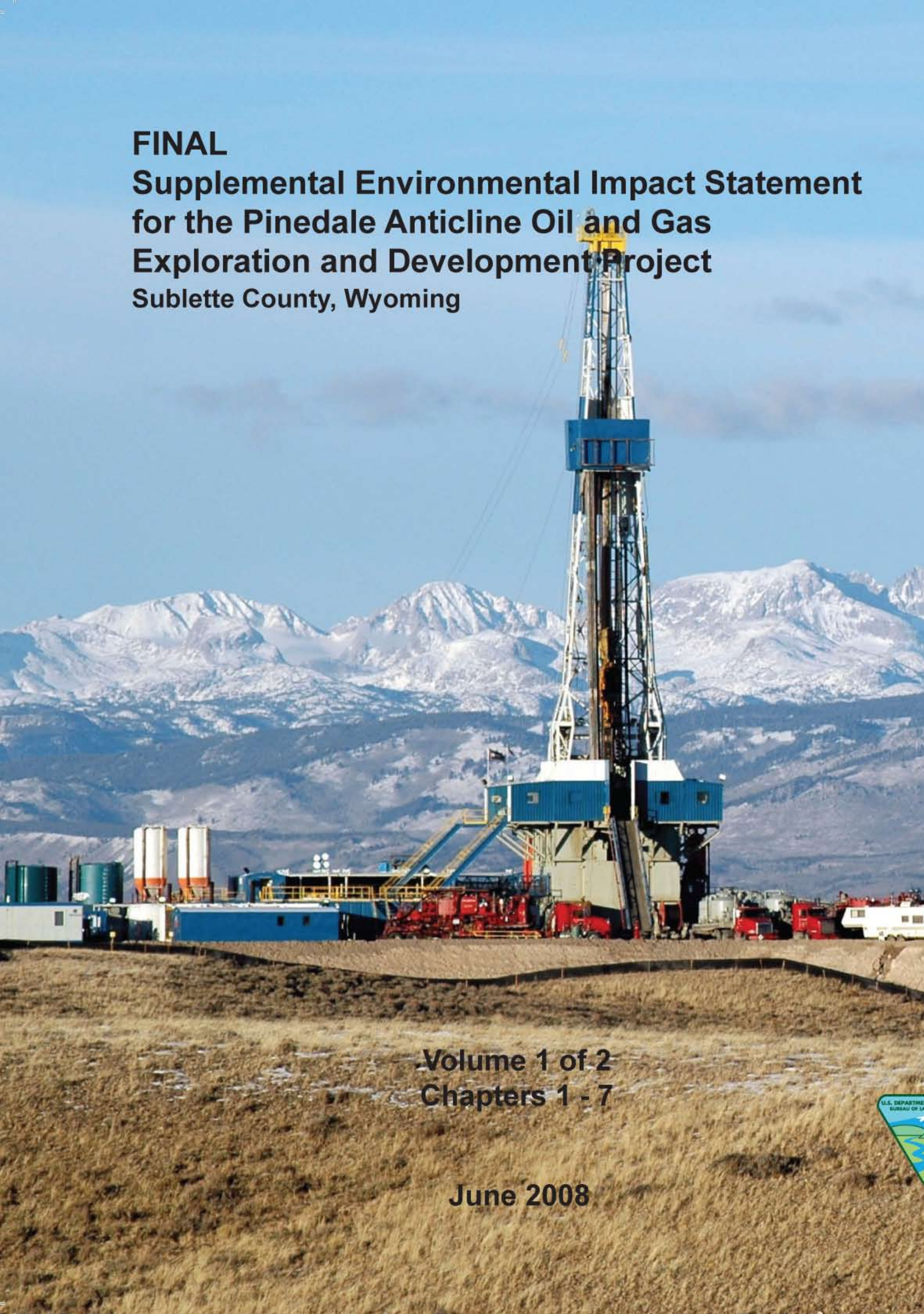
FINAL
Supplemental Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project
Sublette County, Wyoming



Volume 1 of 2
Chapters 1 - 7

June 2008

BLM

Pinedale Field Office

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

MISSION STATEMENT

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FINAL
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
PINEDALE ANTICLINE OIL AND GAS EXPLORATION AND DEVELOPMENT PROJECT
SUBLETTE COUNTY, WYOMING

(Volume 1 of 2)

Bureau of Land Management
Wyoming State Office
Cheyenne, Wyoming

Pinedale Field Office
Pinedale, Wyoming

In Cooperation with

State of Wyoming
Sublette County
Sublette County Conservation District

June 2008

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82003-1828

In Reply Refer To:

1793 (930)
1610

JUNE 27 2008

Dear Reader:

This Final Supplemental Environmental Impact Statement (FSEIS) for the proposed long-term development of natural gas resources in the Pinedale Anticline Project Area (PAPA) is submitted for your review. The FSEIS has been prepared to analyze the potential impacts from drilling and production operations of natural gas wells and associated access roads, pipelines, and production facilities proposed by Ultra Resources, Inc. (Ultra), Shell Exploration & Production Company (Shell), Questar Market Resources including Wexpro Company (Questar), BP America Production Company, Newfield Energy Corporation, Yates Petroleum Corporation, Anshutz Pinedale Corporation and others who agree to participate, collectively referred to as the Proponents. The PAPA is located entirely within Sublette County, Wyoming.

A limited number of hard copies of the FSEIS will be available for review at the Bureau of Land Management (BLM) offices listed below. The FSEIS may be viewed or downloaded from the BLM website at http://www.blm.gov/wy/st/en/info/NEPA/pfodocs/anticline/seis.html.

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

Bureau of Land Management
Pinedale Field Office
1625 West Pine Street
Pinedale, Wyoming 82941

The PAPA includes 198,034 acres, of which approximately 158,000 acres (80 percent) is Federal surface ownership, 9,800 acres (5 percent) is State surface ownership, and 29,800 acres (15 percent) is private surface ownership. Well field development (drilling and construction of well pads, roads, pipelines, and ancillary facilities) in the PAPA was approved in the 2000 Record of Decision (ROD) for the Pinedale Anticline Oil and Gas Exploration and Development Project.

Public scoping was conducted in 2005, and 2006, after the Operators requested increased access to the PAPA in the winter. A Draft SEIS was issued in December 2006, and a Revised Draft was issued in December 2007. Comments on each draft were received by the BLM and are included in the FSEIS.

Five alternatives are analyzed in the FSEIS. Under the No Action alternative (Alternative A), the Operators' proposal for relief from seasonal timing restriction in crucial wildlife habitat

(Alternative B) would be denied. Alternative A does not provide for full oil and gas resource recovery.

The Proposed Action Alternative (Alternative B) includes development of the natural gas resource by drilling up to 4,400 additional wells, achieving a bottom hole (producing zone) spacing of approximately 10 acres per well along the crest of the anticline. Multiple wells would be directionally drilled from a single well pad; as a result, approximately 100 fewer well pads would be necessary to develop the oil and gas resource. Under the Proposed Action Alternative, year-round development would mostly occur in three Concentrated Development Areas within a core area defined by the Operators. This would limit year-round development (including winter drilling within crucial winter ranges) and associated disturbance and impacts to the Concentrated Development Areas. Alternative B includes mitigation to offset impacts to other resources, particularly air quality and wildlife.

Alternative C is similar to the Proposed Action Alternative in that it includes the same project components (number of wells, well pads, and ancillary facilities). However, it is different from the Proposed Action, spatially. That is, rather than only specifying certain areas of development where year-round drilling could occur, Alternative C specifies areas where year-round drilling would not occur. It includes a core area boundary that is different from the core area defined by the Operators in the Proposed Action Alternative. The overall objective of Alternative C is to control spatial disturbance over time, maximizing development in some areas while minimizing development in other areas, especially in portions of big game crucial winter ranges. Alternative C includes additional air mitigation to further reduce impacts to nearby sensitive areas and performance-based objectives to further reduce impacts to other resources.

Alternative D, the BLM preferred alternative, is the result of comments received on the Draft SEIS (12/2006) and the revised Draft SEIS (12/2007). Major components of this alternative are an expanded core area, divided into five development areas and a Potential Development Area (PDA) that surrounds the majority of the core. Similar to Alternative C, this alternative presents a spatially phased development approach, while adding additional operator committed measures, including suspended and no surface occupancy leases outside of the Core Area and PDA, an adaptive management approach, and an operator funded compensatory mitigation fund. Alternative E, also the result of public comment on the Draft SEIS, analyzes the development of the Pinedale Anticline oil and gas resource without considering relaxing seasonal timing restrictions in crucial wildlife habitat. This alternative, if selected, would reflect a development approach similar to that considered in the PAPA ROD (BLM, 2000), while fully analyzing the number of wells and other impacts necessary to effectively recover the energy resource.

Additional information acquired from public input and BLM internal review may result in the selection of an alternative or combination of alternatives to provide the best operational requirements, impact mitigation, and management practices to reduce environmental harm.

The FSEIS will be available for 30 day review starting on the date that the Environmental Protection Agency (EPA) publishes its Notice of Availability (NOA) of the FSEIS in the Federal Register. During this time, no decision on the Proposed Action will be made or recorded.

The FSEIS was prepared pursuant to the National Environmental Policy Act and other regulations and statues to address the environmental and socioeconomic impacts which could result from the project. The FSEIS is not a decision document. Its purpose is to inform the public and interested agencies of impacts associated with implementing the Operators' long-term development proposal and to evaluate alternatives to the proposal. The FSEIS conforms to the current Pinedale Resource Management Plan as well as to the Pinedale Draft Resource Management Plan revision that is currently being prepared.

The FSEIS has been sent to affected Federal, State, and local government agencies, and to individuals who provided substantive comments during the scoping period or during the comment period on either the Draft SEIS (12/2006) or on the Revised Draft SEIS (12/2007).

If you have questions or need additional information, please contact the Pinedale Field Office, address shown above, or by telephone (307) 367-5300.

Sincerely,

for Robert A. Bennett
State Director

ABSTRACT

Final Supplemental Environmental Impact Statement
Pinedale Anticline Oil and Gas Exploration and Development Project
Sublette County, Wyoming

Lead Agency: Bureau of Land Management, Pinedale Field Office, Pinedale, Wyoming

Type of Action: Administrative

Jurisdiction: Within Sublette County

Abstract: The Bureau of Land Management has received a proposal for continued development of the Pinedale Anticline Project Area (PAPA). The proposal emphasizes concentrated development and year-round development (construction, drilling, completion, and production). The PAPA consists of approximately 198,000 acres located in Sublette County, Wyoming, near the Town of Pinedale. There are currently more than 642 producing oil and gas wells in the PAPA on 340 well pads. Natural gas development and reclamation is expected to continue for approximately 60 years. This document supplements the environmental analysis and decisions reached by the BLM in the *Final Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project – Sublette County, Wyoming* and in the *Record of Decision for the Pinedale Anticline Oil and Gas Exploration and Development Project – Sublette County, Wyoming*, which was published in 2000.

Five Alternatives are considered in detail. The No Action Alternative (Alternative A) is the baseline for comparing the other action Alternatives. Based on the current state of reservoir knowledge, Alternative A would not completely recover the natural gas resource. The Proposed Action (Alternative B) includes year-round development within big game crucial winter habitats and seasonal habitats utilized by greater sage-grouse in three Concentrated Development Areas within a Core Area. Alternative C specifies areas where year-round development would not occur. Alternative D is similar to Alternative C, but includes additional mitigation, federal suspended and term NSO leases where no additional activity would occur for at least 5 years and an area surrounding the Alternative D Core Area where year-round development may occur (Potential Development Area, PDA). Alternative E is similar to Alternative A, but includes additional wells and a longer development period to completely recover the natural gas resource. These Alternatives are fully described in Chapter 2 of the Final Supplemental Environmental Impact Statement (Final SEIS). The various impacts that would be expected from implementing each of the Alternatives are disclosed in Chapter 4.

Further information regarding the Final SEIS can be obtained from the Pinedale Field Office (1625 Pine Street, Pinedale, Wyoming, 307-367-5300). The Final SEIS will be available for a 30-day review starting on the date that the Environmental Protection Agency publishes its Notice of Availability in the Federal Register. During this time, no decision on the Proposed Action will be made or recorded.

EXECUTIVE SUMMARY

The U.S. Department of Interior (USDI), Bureau of Land Management (BLM), prepared a Draft Supplemental Environmental Impact Statement (SEIS) to evaluate and disclose to the public the direct, indirect, and cumulative environmental impacts associated with a proposed long-term plan for continued exploration and development of natural gas resources in the Pinedale Anticline Project Area (PAPA) in Sublette County, Wyoming (see Map 1.1-1). The BLM solicited and obtained public comment on the Draft SEIS from December 2006 until April 2007. Based upon the public comments, the BLM analyzed two additional Alternatives in a Revised Draft SEIS. The BLM solicited and obtained public comment on the Revised Draft SEIS from December 2007 through February 2008. Responses to comments received on the Draft SEIS and on the Revised Draft SEIS are included as part of this Final SEIS.

Collectively referred to as the Proponents, Ultra Resources, Inc., Shell Exploration & Production Company, Questar Market Resources including Wexpro Company, BP America Production Company, Stone Energy Corporation, Newfield Exploration Company, Yates Petroleum Corporation, and Anschutz Pinedale Corporation have notified the BLM Pinedale Field Office (PFO) that they propose a new long-term development plan that includes year-round development (construction, drilling, completion, and production) of 4,399 additional natural gas wells within their leases in the PAPA. In addition to year-round development proposals by the Proponents, the BLM has identified the need for additional pipeline corridors to transport hydrocarbon products from the PAPA to gas processing plants in southwest Wyoming. Jonah Gas Gathering Company and Rendezvous Gas Services propose gas sales pipelines that would be sited within the new corridors, and Questar Gas Management is proposing an expansion of the Granger Gas Processing Plant in Sweetwater County.

The BLM prepared this Final SEIS because the Proponents' proposed long-term development plan is substantially different from the approach that was analyzed in the *Draft Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project – Sublette County, Wyoming* and approved in the PAPA ROD, published in 2000. Limits on levels of development and analysis thresholds were set forth in the PAPA ROD. Under the current proposal, these limits may be exceeded. Analysis thresholds associated with air quality have already been exceeded. In proposing year-round development (construction, drilling, completion, and production), the Proponents are requesting exception from BLM's seasonal restrictions (Condition of Approval or lease stipulation) within certain areas of the PAPA that coincide with big game (mule deer, pronghorn, and moose) crucial winter habitats and greater sage-grouse seasonal habitats. The BLM has determined that the Proponents' proposal could cause significant impacts to the human and natural environments.

LIMITS BY THE PAPA ROD

Project components approved in Section 2 of the PAPA ROD include:

- 900 initial well pad locations on all lands and minerals within the PAPA;
- 700 producing wells and/or well pads on all lands and minerals within the PAPA;
- 700 production facilities at individual well locations;
- central production facilities;
- 4 compressor facility sites;

- water wells for drilling/completion;
- 1 BP Amoco Field Office;
- ~121.5 miles of sales pipeline corridor for multiple pipelines;
- ~276.0 miles of access road (including collector, local and resource roads); and
- ~280.0 miles of gathering pipeline system.

The PAPA ROD did not limit wells but limited well pads within defined Management Areas (MAs) that were developed to conserve sensitive resources. The PAPA ROD specifies that if any of the authorized limits to development are reached, additional environmental analysis would be required.

EXISTING DEVELOPMENT

Since 2000, most natural gas development in the PAPA has been along the Anticline Crest, which is approximately 2 to 3 miles wide, 25 to 30 miles long, and centered along the length of the PAPA. The Proponents are proposing long-term development within the Anticline Crest as well as continued exploration off the Anticline Crest. As of November 2006, there were approximately 642 producing wells on 340 well pads in the PAPA. Of these, 613 producing wells on 285 well pads were drilled after issuance of the PAPA ROD. There were 26 drilling rigs operating in the PAPA at the end of 2006.

SCOPING

BLM held meetings with participation from various agencies, the Proponents, and the public to encourage early and improved public participation and agency cooperation. The BLM's Notice of Intent (NOI) to prepare a Supplemental EIS inviting the public to comment on the Proponents' proposal for long-term development of the PAPA appeared in the Federal Register on October 21, 2005. BLM mailed a scoping notice to the media, governmental agencies, environmental organizations, industry representatives, individuals, landowners, and livestock grazing permittees. The scoping notice explained the general nature of the project and requested comments. The public scoping comment period ended November 20, 2005. Scoping meetings were held in Jackson and Marbleton on November 7, 2005, and in Pinedale on November 8, 2005. The locations of the proposed transportation corridor/pipeline alignments were not determined at the time of the initial scoping; therefore, an additional scoping notice was issued. The second notice, mailed on April 14, 2006, was sent to the same recipients as the October 2005 scoping notice, as well as individuals and organizations on mailing lists provided by the BLM Rock Springs and Kemmerer field offices. The public comment period for the second scoping notice ended on May 17, 2006. Numerous issues were identified in the scoping process. Comments received during scoping were incorporated into the analysis in the Draft SEIS published in December 2006.

Comment Period on the Draft SEIS

The Draft SEIS was available for public comment in December 2006. BLM hosted an open house on the Draft SEIS on February 13, 2007 in Pinedale. Over 63,000 comments were received on the Draft SEIS. The BLM received substantive comments from business and industry representatives; environmental groups; federal, state, and local agencies; and individuals about the Alternatives and many respondents suggested that additional Alternatives be considered. Based upon these suggestions, the BLM formulated two additional Alternatives and made changes to the Draft SEIS, resulting in the Revised Draft SEIS. BLM's response to substantive comments received on the Draft SEIS is included in this Final SEIS. The major changes to the Draft SEIS resulting in the Revised Draft SEIS were:

- The affected environment has been updated with current baseline data and includes development that occurred in 2006;
- Two additional Alternatives (Alternative D and Alternative E) are analyzed;
- Additional Proponent-offered mitigation is included in Alternative D; and
- Additional discussion of impacts to socioeconomic, air quality, and wildlife resources, based on a range of drilling rigs operating in the PAPA at any one time, is included.

Comment Period on the Revised Draft SEIS

The Revised Draft SEIS was available for public comment in December 2007. BLM hosted two open houses on the Revised Draft SEIS on January 17, 2008 and February 2, 2008. Over 68,000 comments were received on the Revised Draft SEIS. The BLM received substantive comments from business and industry representatives; environmental groups; federal, state, and local agencies; and individuals. Based upon comment received on the Revised Draft SEIS, BLM has prepared this Final SEIS. BLM's response to substantive comments received on the Revised Draft SEIS is included in this Final SEIS.

ALTERNATIVES

Alternative A - No Action Alternative. The No Action Alternative is based on elements authorized by the PAPA ROD in 2000. Development in the PAPA beyond the limits specified in the PAPA ROD would require additional environmental review; however, the limits have not been reached for wellfield components. The PAPA ROD did not specify the type or extent of the additional environmental review that would be required.

The No Action Alternative is required by the National Environmental Policy Act (NEPA) as a baseline against which other action Alternatives can be analyzed. For this project, the No Action Alternative is a continuation of current BLM management practices. Wellfield development could continue on state and private leases and would occur on federal leases as authorized by prior NEPA decisions.

Alternative B - Proposed Action Alternative. The Proposed Action includes year-round development (construction, drilling, completions, and production) of up to 4,399 additional wells and up to 12,885 acres of new surface disturbance, including well pads, roads, pipelines, and other ancillary facilities within the PAPA. Year-round development would be allowed within the Alternative B Core Area centered on the Anticline Crest and would be mostly concentrated within three Concentrated Development Areas at any one time. The Proponents would install a liquids gathering system in the central and southern portions of the PAPA complementing the existing liquids gathering system in the northern portion of the PAPA. Tier 2 equivalent emission controls would be installed on drilling rig engines in 29 out of 48 drilling rigs at peak drilling in 2009. The Proponents have offered 3:1 off-site mitigation for wildlife, if necessary.

Alternative C. Alternative C is similar to Alternative B in that it includes the same project components including up to 4,399 additional wells on up to 12,885 acres of surface disturbance; however, it is spatially different. That is, rather than only specifying certain areas of development where year-round development could occur, Alternative C specifies areas where year-round development would not occur. It includes a core area (Alternative C Core Area) that is different from the Alternative B Core Area. The overall objective of Alternative C is to control spatial disturbance over time, maximizing development in some areas while minimizing development in other areas, especially in portions of big game crucial winter ranges. Alternative C includes five development areas (DAs). Year-round development would be allowed within four of the five DAs (1 through 4). Alternative C includes additional air mitigation to further reduce impacts to nearby sensitive areas.

Alternative D. Alternative D, the BLM Preferred Alternative, is the result of comments received on the Draft SEIS. Alternative D is similar to Alternatives B and C in that it includes the same project components including up to 4,399 additional wells on up to 12,885 acres of disturbance. Major differences in this Alternative are an expanded core area (Alternative D Core Area), divided into five DAs, and a Potential Development Area (PDA) that surrounds the majority of the Alternative D Core Area. This Alternative presents a spatially phased development approach, while adding additional measures, including federal suspended and term NSO (no surface occupancy) leases (where no additional development would occur for at least the first 5 years) in the Flanks, outside of the Alternative D Core Area and PDA. Alternative D includes additional air mitigation to further reduce impacts to nearby sensitive areas. An adaptive management approach and a compensatory mitigation fund are elements of Alternative D.

Alternative E. Alternative E, also the result of comments received on the Draft SEIS, analyzes seasonal restrictions remaining in effect. This Alternative reflects a development approach similar to that considered in the PAPA ROD, while analyzing the impacts of full field development of the natural gas resource. Under this Alternative, a core area (the Alternative E Core Area) is defined which is the same geographic area as the Alternative D Core Area. A Buffer Area which is the same geographic area as the Alternative D PDA has also been defined. This Alternative sets limits on the number of active well pads and acres of surface disturbance within the Alternative E Core Area, the Buffer Area, and the Flanks.

ENVIRONMENTAL IMPACTS

Potential impacts resulting from natural gas development in the PAPA to various resources vary by Alternative and are summarized below.

Socioeconomics. Expanded drilling and production activities under all Alternatives evaluated in this Final SEIS will continue to exert pressure on socioeconomic resources in affected communities. Employment associated with the PAPA would increase. The populations of affected communities are expected to increase, which would lead to further increases in the demand for housing and local services, most notably schools, medical services, fire protection, and law enforcement. Increasing revenues from the PAPA would help local governments meet these demands. Communities are likely to continue to experience growth-related problems. Employment under all Alternatives analyzed in this Final SEIS is strongest during the development phase, while production has a lower impact than development on employment and earnings trends.

Transportation. Each Alternative would require construction of additional roads to support increased wellfield traffic. Traffic levels would increase during winter with year-round development. Increased traffic would increase road maintenance costs and could lead to increased vehicular crash rates. Installation of the liquids gathering system in the central and southern portions of the PAPA in addition to continuation of the liquids gathering system in Questar's leases would eliminate approximately 90 percent of truck traffic (3,820 vehicles per day in the production-only phase) associated with removal of condensate and produced water. The use of computer-assisted operations in Alternatives B, C and D, would further reduce light vehicle traffic.

Land Use and Residential Areas. Wellfield development under any of the Alternatives would have minimal impact to lands zoned as Residential by Sublette County. Under all Alternatives, over two-thirds of the initial surface disturbance within the 0.25-mile residential buffer and Residential Sensitive Resource Management Zone would be on private lands with privately-owned mineral rights where there is no federal jurisdiction. Differences in the amount of surface disturbance by Alternative are inherent to the Alternative and depend upon length of the development phase, allowance of year-round development, degree of concentrated development, degree of interim reclamation, and inclusion of a liquids gathering system. Under all Alternatives, over 90 percent of the initial disturbance is within the Shrub and Brush Rangeland land use/land cover type. The remainder of the initial disturbance under all Alternatives is mostly in Mixed Rangeland and Cropland and Pasture land use/land cover types.

Recreation. Decreased recreational use of off-highway vehicle areas in the PAPA, by additional surface disturbance, is expected for each Alternative. Decreased hunting opportunities are expected in the PAPA with decreased abundance of big game and upland game birds as the density of wellfield development increases. Impacts to Recreation Resources would include increased traffic and human presence in the PAPA, increased noise, and changes to the visual landscape, making it a less desirable place to recreate. Increase in population overall and specifically to the Town of Pinedale make it more difficult for people to visit the PAPA and surrounding areas because motel rooms are full at different times of the year, possibly causing potential visitors to choose other locations for recreation.

Visual Resources. Most disturbance, by any Alternative, would be within land classified as VRM IV. Substantial portions of land in the VRM Class III would be affected by all Alternatives, primarily within the northern end of the PAPA and along the New Fork River. Some development in VRM Class III lands on the west side of U.S. Highway 191 has already occurred in the southern end of the PAPA and additional development is expected under all Alternatives. Wellfield development could disturb about 2,000 acres in VRM Class III on BLM-administered public lands by all action Alternatives. Construction of new well pads and ancillary facilities would be highly visible during winter if snow cover presents highly contrasting visibility conditions.

Cultural and Historic Resources. Destruction and/or unexpected discoveries of archaeological resources are expected consequences of new surface disturbance in the PAPA by each Alternative. Increased surface disturbance is likely in areas with high potential for major finds (sandy bluffs south of the New Fork River, not in Mesa Breaks). There would be no surface disturbance for well pads within a 0.25-mile buffer of the Lander Trail; however, disturbance associated with linear facilities may decrease the visual integrity within the Lander Trail Sensitive Resource Management Zone.

Air Quality. It is expected that there would be no violations to applicable federal and state air quality standards under any of the Alternatives. Air quality impacts to visibility at regional Class I airsheds (e.g., Bridger Wilderness Area) are anticipated under all Alternatives. Some

Alternatives include mitigation to reduced impacts to regional Class I airsheds. A detailed analysis of air quality effects is provided in the *Air Quality Impact Analysis Technical Support Document*.

Noise. Drilling and completion under each Alternative would increase noise from pre-development levels above 10 dBA at noise-sensitive sites (residences and greater sage-grouse leks) up to 2,800 feet away.

Geology and Geologic Hazards. Additional disturbance by each Alternative would increase erosion and slope instability by disturbance to soils on slopes ≥ 15% with high erosion potential. Continued development under all action Alternatives would lead to eventual depletion of the recoverable natural gas resource.

Paleontological Resources. Additional surface disturbance by each Alternative would increase the possibility of unintentional loss, damage, or destruction of fossils in the Blue Rim Area.

Groundwater. Drilling of water supply wells under each Alternative could lead to temporary drawdown of the Wasatch Formation aquifer. Water use from supply wells for drilling a single well in the PAPA is expected to decrease under all Alternatives as produced water is re-used to a greater degree. Potential impacts to groundwater quality could result from accidental spills of petroleum products or other pollutants and cross-aquifer mixing. Lowering of water levels and cross-contamination of shallow aquifers are preventable by sound well construction practices.

Surface Water. Annual sediment yields could be increased substantially above current conditions in six hydrologic sub-watersheds that coincide with the Anticline Crest and surface water quality could be impacted under all Alternatives. The potential impacts would be greatly reduced by the extensive use of Best Management Practices to prevent erosion and timely interim and final reclamation.

Soil Resources. Each Alternative would disturb sensitive soils with high erosion potential and low revegetation capabilities. Disturbances to soils on slopes ≥ 15% with high erosion potential are expected to increase soil erosion and sedimentation in aquatic habitats substantially above current conditions under all Alternatives.

Vegetation Resources. Removal of existing native vegetation would occur under all of the Alternatives. Surface disturbance in native vegetation dominated by shrubs and trees would be converted to herbaceous vegetation. Unsuccessful revegetation with increased presence of noxious weeds (Canada thistle, perennial pepperweed) is expected on unreclaimed bare ground. However, the Alternative D Reclamation Plan (Appendix 8D) would ensure faster and more results-oriented return of vegetation and functional habitat than the other Alternatives, for both interim and final reclamation.

Grazing Resources. Loss of livestock grazing capacity (AUMs) by removal of existing native vegetation in the PAPA is expected within some grazing allotments. Decreased grazing capacity with increased presence of noxious weeds (Canada thistle, perennial pepperweed) is likely on unreclaimed bare ground.

Wetlands, Riparian Resources and Flood Plains. There would be no loss of wetlands and/or wetland function due to surface disturbance in wetlands for well pads. There would be some loss due to linear facilities under each Alternative. Surface disturbance in the Wetland Sensitive

Resource Management Zone with increased sedimentation in aquatic habitats is possible with removal of forest-dominated riparian and shrub vegetation. Surface disturbance associated with linear facilities within the 100-year flood plain may adversely affect flood plain function which includes river channel migration.

Threatened, Endangered Species and Special Status Species. Because all alternatives would cause water depletions within the Colorado River system, BLM will enter into formal consultation with U.S. Fish and Wildlife Service as required under the Endangered Species Act. However, adverse effects to endangered Colorado River fish species are not anticipated to result from those depletions. Likewise, adverse effects to other ESA-listed species (black-footed ferret, Canada lyns, Ute ladies'-tress) are not expected. Though they are no longer listed under ESA, nesting bald eagles may be affected by surface disturbance and associated human presence by each Alternative. The effects are expected to be substantial within 1 mile of the New Fork River riparian zone with potential effects to forested-dominated riparian habitat which is utilized by wintering bald eagles. Direct effects to special status wildlife species that depend on upland habitats (sagebrush steppe, mixed grass prairie, greasewood and desert shrub), forest-dominated riparian forest habitats, and wetland habitats are expected under each Alternative. Special status fish species may be adversely affected by increased sedimentation in aquatic habitats. Direct effects to extant populations of special status plant species are possible with surface disturbance in the Blue Rim Area under each Alternative.

Wildlife and Aquatic Resources. Implementation of any Alternative is likely to create additional barriers to wildlife movements with increased fragmentation by creation of edges and patches within former contiguous habitats. There would be indirect effects to species that depend on upland habitats (sagebrush steppe, mixed grass prairie, greasewood, and desert shrub), forest-dominated riparian habitats, and wetland habitats. Big game would continue to be adversely affected by wellfield development that causes direct loss of crucial winter range, other seasonally-used habitats, and decreased habitat function near roads and well pads due to human activity. Similarly, decreased habitat function is expected at greater sage-grouse leks by surface disturbance and potential human presence within 2 miles of nesting and brood-rearing habitats. Fragmentation and direct loss of native habitats by surface disturbance is expected to adversely affect migratory birds, particularly in habitats used by sagebrush-obligate species. Decreased raptor nesting habitat effectiveness is likely within 1 mile of New Fork River riparian zone. Decreased reproductive success in spring-spawning native salmonid species is possible from increased sedimentation in aquatic habitats and loss of forest-dominated riparian and shrub vegetation by each Alternative.

MITIGATION MEASURES

Each Alternative contains variations on the amount and level of mitigation that would be required. In addition to mitigation measures typically required by the BLM, mitigation measures are also provided within the Alternative itself. Further, additional mitigation opportunities that could be applied to all Alternatives have been identified and included in Chapter 4. All Alternatives that contemplate year-round development contain offers to provide off-site compensatory mitigation.

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Chapter 5 – Consultation and Coordination

Abbreviations and Acronyms

AEM	adaptive environmental management
AJE	annual job equivalents
AM	adaptive management
ANC	acid neutralizing capacity
AO	Authorized Officer
APD	Application for Permit to Drill
AQD	Air Quality Division
Air Quality TSD	Air Quality Impact Analysis Technical Support Document
AQRV	air quality related values
ARPA	Archeological Resources Protection Act
Anschutz	Anschutz Pinedale Corporation
ASU	Anschutz, Shell, and Ultra
AUM	animal unit month
BACT	best available control technology
BART	best available retrofit technology
bbl	barrel
BCC	Bird Canyon Corridor
BBS	Breeding Bird Survey
BFGC	Blacks Fork Granger Corridor
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BO	Biological Opinion
BMP	best management practices
BP	BP America Production Company
BTEX	benzene, toluene, ethylbenzene and xylene
BTNF	Bridger-Teton National Forest
C	degrees centigrade
CAPS	Cooperative Agricultural Pest Survey
CASTNET	Clean Air Status and Trends Network
CDA	concentrated development area
CDP	central delivery point
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGF	central gathering facility
CH_4	methane
CIAA	cumulative impact assessment area
CO	carbon monoxide
CO_2	carbon dioxide
COE	U.S. Army Corps of Engineers
C/OSPF	central off-site production facility
CPF	centralized production facilities
CRBSCF	Colorado River Basin Salinity Control Forum
CVM	contingent valuation methodologies
CX	categorical exclusions
DA	development area
DAT	Deposition Analysis Threshold
dBA	decibel on the A-weighted scale
DEIS	draft environmental impact statement
DNA	Determination of NEPA Adequacy
DO	dissolved oxygen

dv	deciview
EA	environmental assessment
EIS	environmental impact statement
EMS	emergency medical services
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
F	degrees farenheit
FEIS	final environmental impact statement
FLAG	Federal Land Managers' Air Quality Related Values Workgroup
FLPMA	Federal Land Policy Management Act
FMR	federal mineral royalty
FONSI	Finding of No Significant Impact
Forest Service	United States Department of Agriculture Forest Service
g/hp-hr	grams per horsepower-hour
gpm	gallons per minute
GTNP	Grand Teton National Park
HAP	hazardous air pollutant
HDD	horizontal directional drilling
HMA	herd management area
HNO_3	nitric acid
hp	horsepower
HUC	hydrologic unit code
IDLH	immediately dangerous to life or health
ID Team	BLM Interdisciplinary Team
IM	internal memorandum
IMPROVE	Interagency Monitoring of Protected Visual Environments
JGGC	Jonah Gas Gathering Company
JIDPA	Jonah Infill Drilling Project Area
KFO	Kemmerer Field Office
KINIEROS2	Kinematic Runoff and Erosion Model-Version 2
kg/ha-yr	kilograms per hectare-year
km	kilometer
KOP	key observation point
kV	kilovolt
lb/acre/yr	pounds per acre per year
LAC	level of acceptable change
LWCF	Land and Water Conservation Fund
LOC	levels of concern
LOP	life-of-project
MA	management area
MBTA	Migratory Bird Treaty Act
MCL	maximum concentration level
MEI	maximally-exposed-individual
mg/L	milligrams per liter
MGR	Mountain Gas Resources
MLE	most-likely-exposure
MMSCF	million standard cubic feet
MMSCF/D	million standard cubic feet per day
MOU	memorandum of understanding
mph	miles per hour
MSCF	thousand standard cubic feet
N	nitrogen
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NADP	National Acid Deposition Program
NAICS	North American Industry Classification System

ND	non-disclosure
NEPA	National Environmental Policy Act
Newfield	Newfield Exploration Company
NH_4	ammonium
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Safety and Health
NO_x	nitrogen oxide
NO_2	nitrogen dioxide
NO_3	nitrate
NOI	Notice of Intent
NPS	National Parks Service
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NSO	no surface occupancy
NTN	National Trends Network
NWS	National Weather Service
O_3	ozone
OCTA	Oregon-California Trails Association
OHV	off-highway vehicle
OPC	Opal Pioneer Corridor
PA	programmatic agreement
PAPA	Pinedale Anticline Project Area
PAWSA	Pinedale Anticline Wildlife Study Area
PAWG	Pinedale Anticline Working Group
PBC	Paradise Bird Canyon
PCBs	polychlorinated biphenols
PDA	potential development area
PFO	Pinedale Field Office
PFYC	Probable Fossil Yield Classification
PILT	Payment In Lieu of Taxes
$PM_{2.5}$	particulate matter less than 2.5 microns in effective diameter
PM_{10}	particulate matter less than 10 microns in effective diameter
ppm	parts per million
ppb	parts per billion
PRB	Powder River Basin
PRBP	Powder River Basin Oil and Gas Development Project
PSD	Prevention of Significant Deterioration
PVFD	Pinedale Volunteer Fire Department
QGM	Questar Gas Management
Questar	Questar Market Resources
R6	Rendezvous Phase 6
RELs	reference exposure levels
RfCs	reference concentrations for chronic inhalations
RFD	reasonably foreseeable development
RFFA	reasonably foreseeable future actions
RGS	Rendezvous Gas Services
RIP	Recovery and Implementation Program
RMIS	Recreation Management Information System
RMG	Reservoir Management Group
RMP	Resource Management Plan
ROD	Record of Decision
ROW	right-of-way
RP	resource protection
RPO	Regional Planning Organization
RSFO	Rock Springs Field Office
S	sulfur

SAR	sodium adsorption ratio
SCCD	Sublette County Conservation District
SEIS	supplemental environmental impact statement
SEO	State Engineer's Office
Shell	Shell Exploration & Production Company
SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
SO_4	sulfate
SPCC	Spill Prevention, Containment and Countermeasures
SRMA	Special Recreation Management Area
SRMZ	Sensitive Resource Management Zone
Stone	Stone Energy Corporation
SUGMA	Small and Upland Game Management Area
SUV	sport utility vehicle
SVR	standard visual range
SWAT	Soil and Water Assessment Tool
SWPPP	Stormwater Pollution Prevention Plan
TCF	trillion cubic feet
TDS	total dissolved solids
TPH	total petroleum hydrocarbons
tpy	tons per year
TSD	technical support document
TSS	total suspended solids
µeq/l	microequivalents per liter
$\mu g/m^3$	micrograms per cubic meter
Ultra	Ultra Resources, Inc.
URF	unit risk factor
USC	United States Code
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VISTAS	Visibility Improvement State and Tribal Association of the Southeast
VOCs	volatile organic compounds
VRM	visual resource management
WAAQS	Wyoming Ambient Air Quality Standards
WDAI	Wyoming Department of Administration and Information
WDEQ	Wyoming Department of Environmental Quality
WGFD	Wyoming Game and Fish Department
WO	Washington Office
WOGCC	Wyoming Oil and Gas Conservation Commission
WRAP	Western Regional Air Partnership
WSII	Wyoming Stream Invertebrate Index
WDOT	Wyoming Department of Transportation
Yates	Yates Petroleum Corporation
YNP	Yellowstone National Park

Chapter 1
Introduction

1.1 BACKGROUND

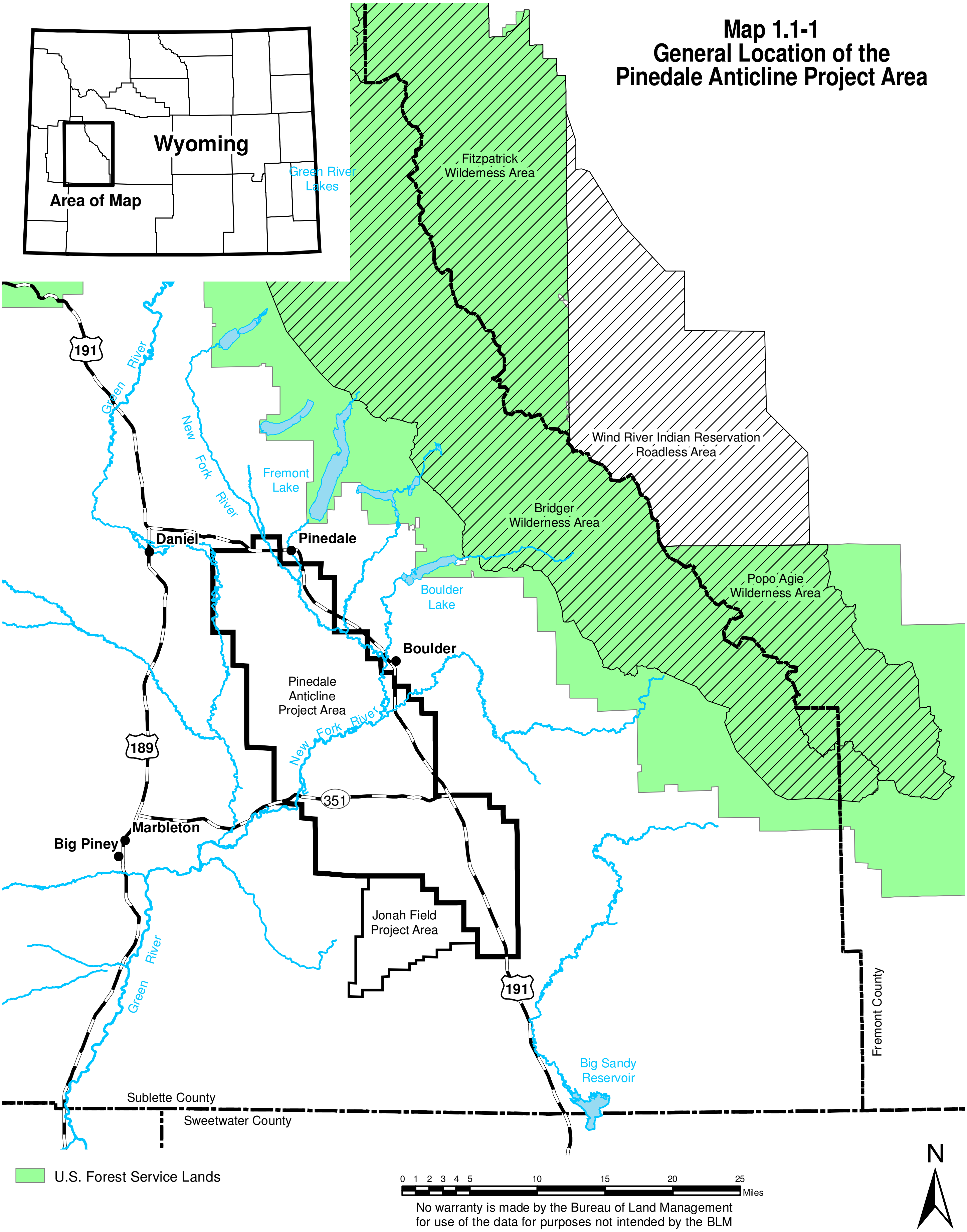
The United States Department of the Interior (USDI), Bureau of Land Management (BLM) has prepared this Final Supplemental Environmental Impact Statement (SEIS) to evaluate and disclose to the public the direct, indirect, and cumulative environmental impacts associated with a proposed long-term plan for continued exploration and development of natural gas resources in the Pinedale Anticline Project Area (PAPA) in Sublette County, Wyoming (see Map 1.1-1). The BLM released a Draft SEIS on December 15, 2006 (BLM, 2006a). The public review and comment period lasted for 114 days and ended on April 6, 2007. The original public review and comment period of 45 days was extended twice; once in response to a request from the public and once due to release of the Ozone Modeling Analysis Supplement. BLM provided public notice for the extensions. Based on comments received, the BLM developed two new Alternatives and completed additional analyses resulting in a Revised Draft SEIS (BLM, 2007a). The Revised Draft SEIS included a description of the original three Alternatives and two new Alternatives and described the potential environmental consequences of each. The BLM released the Revised Draft SEIS on December 28, 2007. The public review and comment period lasted for 45 days and ended on February 11, 2008. Based on comments received on the Revised Draft SEIS, BLM has prepared this Final SEIS. BLM's response to comments received on the Draft SEIS and on the Revised Draft SEIS is included as part of this Final SEIS. All comments received on the Draft SEIS and the Revised Draft SEIS are on file with the BLM.

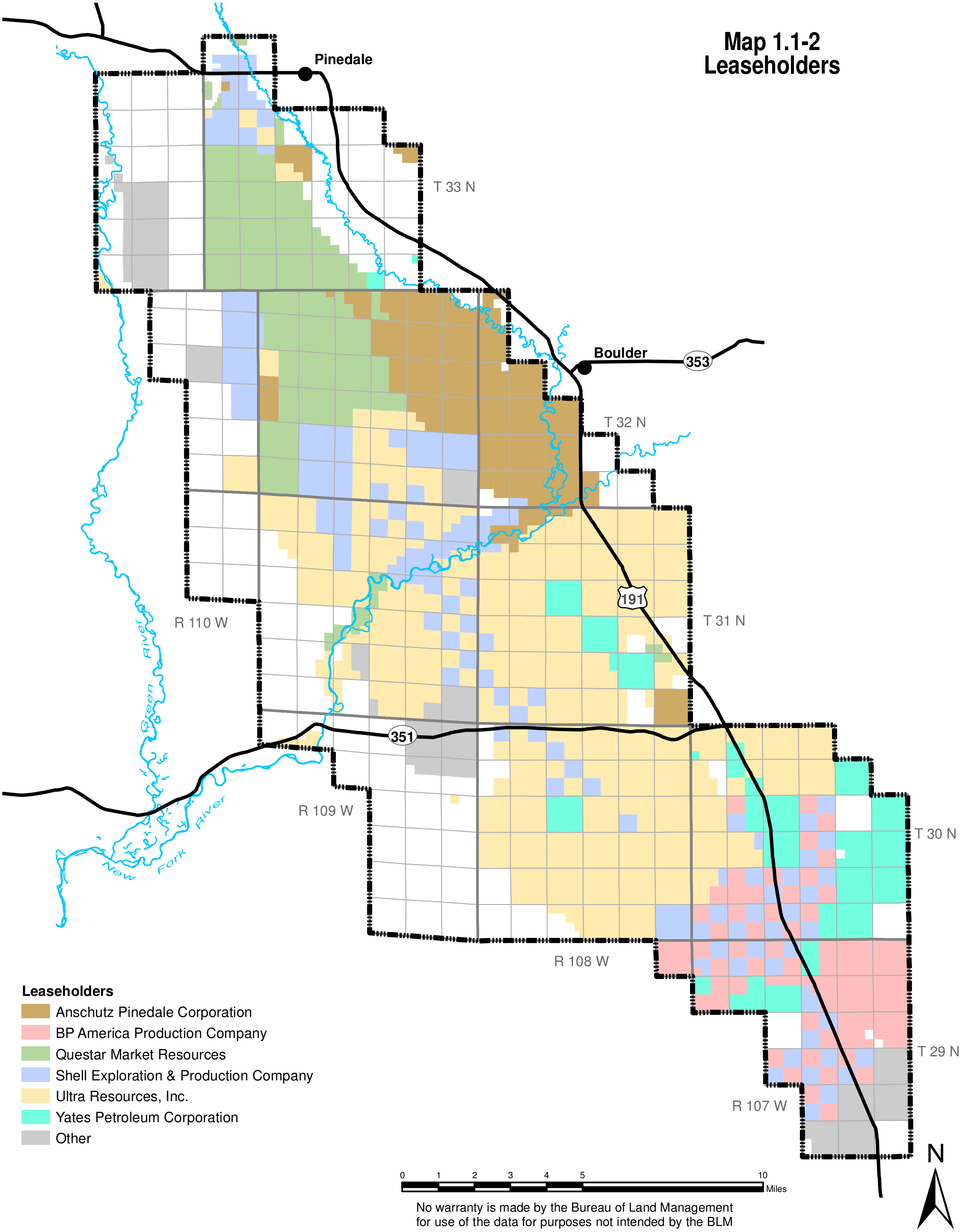
1.2 INTRODUCTION

The BLM administers the federal land and mineral estate that comprises approximately 80 percent of the 380-square mile PAPA addressed by this supplement. The BLM is the lead agency with primary responsibilities for the preparation of this SEIS. There are three cooperating agencies: the State of Wyoming, Sublette County, and Sublette County Conservation District.

Collectively referred to as the Proponents, Ultra Resources, Inc. (Ultra), Shell Exploration & Production Company (Shell), Questar Market Resources (Questar) including Wexpro Company, BP America Production Company (BP), Stone Energy Corporation (Stone), Newfield Exploration Company (Newfield), Yates Petroleum Corporation (Yates), and Anschutz Pinedale Corporation (Anschutz) have submitted to the BLM Pinedale Field Office (PFO) a proposal for a long-term development plan that includes year-round development (construction, drilling, completion, and production) of 4,399 additional natural gas wells within their leases in the PAPA (see Map 1.1-2).

In addition to year-round development proposals by the Proponents, the BLM has identified the need for additional pipeline corridors to transport hydrocarbon products from the PAPA to gas processing plants in southwestern Wyoming. Jonah Gas Gathering Company (JGGC) and Rendezvous Gas Services (RGS) propose gas sales pipelines that would be sited within the new corridors, and Questar Gas Management (QGM) is proposing an expansion of the Granger Gas Processing Plant in Sweetwater County. Analysis of potential impacts associated with the corridors and gas sales pipelines is included in this Final SEIS. Air quality impact analyses associated with the proposed expansion of the Granger Gas Plant are also included in this document.


Map 1.1-1
General Location of the
Pinedale Anticline Project Area
Wyoming
Area of Map
Green River
Lakes
Fitzpatrick
Wilderness Area
Wind River Indian Reservation
Roadless Area
Bridger
Wilderness Area
Popo Agie
Wilderness Area
Fremont
Lake
Boulder
Lake
Green River
New Fork River
191
189
351
Daniel
Pinedale
Boulder
Marbleton
Big Piney
Pinedale
Anticline
Project Area
Jonah Field
Project Area
Big Sandy
Reservoir
Fremont County
Sublette County
Sweetwater County
U.S. Forest Service Lands
0 1 2 3 4 5 10 15 20 25
Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
N



Map 1.1-2
Leaseholders
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Leaseholders
Anschutz Pinedale Corporation
BP America Production Company
Questar Market Resources
Shell Exploration & Production Company
Ultra Resources, Inc.
Yates Petroleum Corporation
Other
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

This document supplements the analysis and decisions reached by the BLM as the lead agency, in cooperation with the U.S. Department of Agriculture Forest Service (USFS), U.S. Army Corps of Engineers (COE), and the State of Wyoming in the *Final Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project, Sublette County, Wyoming* (PAPA FEIS - BLM, 2000a) and in the *Record of Decision for the Pinedale Anticline Oil and Gas Exploration and Development Project, Sublette County, Wyoming* (PAPA ROD - BLM, 2000b).

Regulations promulgated by the Council on Environmental Quality (CEQ, 1978) require federal agencies to prepare supplements to existing documents (40 CFR §1502.9(c)(1)) implementing provisions of the National Environmental Policy Act (NEPA) if:

> "*(i) The agency makes substantial changes that are relevant to environmental concerns; or*
> *(ii) There are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts*."

The BLM provided similar guidance in H-1790-1 National Environmental Policy Act Handbook (BLM, 1988a) with the additional explanation:

> *"if an existing relevant environmental document does not fully cover a proposed action and it is not appropriate to tier, then a determination should be made on whether to supplement or modify the existing document or prepare an entirely new one."*

The BLM prepared this Final SEIS because the Proponents' proposed long-term development plan is substantially different from the approach that was analyzed in the *Draft Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project, Sublette County, Wyoming* (PAPA DEIS - BLM, 1999a) and approved in the PAPA ROD (BLM, 2000b). Limits on levels of development and analysis thresholds were set forth in the PAPA ROD. Under the current proposal, these limits may be exceeded. The analysis threshold for nitrogen oxides (NO_x) has already been exceeded. The Proponents' proposal requests exception from BLM seasonal restrictions for big game (mule deer and pronghorn) and greater sage-grouse, which seasonally restrict development activities within certain habitats. The BLM has determined that the Proponents' proposal could cause significant impacts to the human and natural environments.

The BLM recognizes that additional air quality impact analysis is required for continued development of the PAPA. The PAPA ROD (BLM, 2000b) states:

> *"If activity and corresponding emission assumptions and/or impacts exceed those identified in the Pinedale Anticline EIS (376.59 tons/year of NO_x emission from compressors or 693.50 tons/year NO_x emissions from the combination of construction/drilling, well production, and compression), the BLM, in cooperation and consultation with Wyoming Department of Environmental Quality-Air Quality Division (WDEQ-AQD), EPA Region VIII, USDA-Forest Service, and other affected agencies, will undertake additional cumulative air quality environmental review as required by CEQ regulations 40 CFR §1502.9(c)(1)(ii)."*

The BLM has determined that NO_x emissions from all sources in the PAPA currently exceed the 693.50 tons per year (tpy) analysis threshold specified in the PAPA ROD (BLM, 2000b). This Final SEIS serves as the additional cumulative air quality environmental review referenced above.

1.3 REGIONAL SETTING AND PROJECT AREA DESCRIPTION

The PAPA is located in west-central Wyoming in Sublette County (see Map 1.1-1). The PAPA contains 198,037 acres of predominately federal lands with federal mineral rights but also contains private and state lands and minerals. The Town of Pinedale is situated on the northern end of the PAPA. Pinedale is located approximately 80 miles south of Jackson and 100 miles north of Rock Springs. Other communities/settlements in the general vicinity of the PAPA include Cora, Daniel, Boulder, Bargerville, Marbleton, and Big Piney.

The PAPA lies between U.S. Highway 191 and the Green River. U.S. Highway 191 runs along the eastern and northern edges of the PAPA and is the primary route to the PAPA as well as the primary route for tourist travel to Yellowstone and Grand Teton National Parks. U.S. Highway 189, also a primary tourist travel route, runs west of the PAPA, and State Highway 351 crosses through the southern portion of the PAPA (see Map 1.1-1).

No National Forest System lands are located in the PAPA; however, the Bridger-Teton National Forest (BTNF) is located west, north, and east of the PAPA. The northern boundary of the PAPA comes within 2.3 miles of the administrative boundary of the BTNF.

Sagebrush communities dominate the PAPA with shrub-steppe vegetation blending into riparian areas and wetland areas of the New Fork River and Green River flood plains. The higher elevation area between these rivers in the northern half of the PAPA is known locally as the "Mesa."

1.4 PAPA EIS AND ROD

As documented in the PAPA ROD (BLM, 2000b), the BLM's State Director selected the *Resource Protection Alternative on Federal Lands and Minerals,* with modifications. A summary of natural gas development levels as approved by the PAPA ROD is included to provide background information and historical perspective and to establish the context within which this supplement was developed. This SEIS incorporates by reference and tiers to the environmental documents prepared for the PAPA EIS. Collectively, the DEIS and the FEIS are referred to as the "PAPA EIS."

The PAPA EIS realized uncertainty in the projected impacts (e.g., see PAPA DEIS, page 1-2). Potential development evaluated in the PAPA EIS was a maximum of 900 initial well pads and 700 producing well pads over 10 to 15 years, which some participants considered optimistic (PAPA DEIS, page 2-2). The BLM asserted, "*it is possible that development within the PAPA could go beyond the levels of development considered in this EIS, although few would consider such a level of development as reasonably foreseeable*" (PAPA DEIS, page 2-2).

The PAPA ROD (BLM, 2000b) required that if any approved level of development as analyzed in the PAPA EIS were to be exceeded, the BLM would prepare a supplement. The components approved by the PAPA ROD in Section 2 include:

- 900 initial well pad locations on all lands and minerals within the PAPA,
- 700 producing wells and/or well pads on all lands and minerals within the PAPA,
- 700 production facilities at individual well locations,
- central production facilities,
- 4 compressor facility sites,
- water wells for drilling/completion,

- 1 BP Amoco Field Office,
- ~121.5 miles of sales pipeline corridor for multiple pipelines,
- ~276.0 miles of access road (including collector, local, and resource roads), and
- ~280.0 miles of gathering pipeline system.

Section 2 also states, "*This ROD authorizes the construction and drilling of up to 900 wells and the completion, testing, and production of up to 700 producing natural gas well pads within the PAPA.*"

In addition to expressing "*uncertainty,*" the PAPA ROD is ambiguous. In Section 2 alone it is evident that, from the bulleted list and the statement above, it is not clear whether the PAPA ROD is authorizing "700 wells" or "700 producing well pads," and "900 wells" or "900 well pad locations." Furthermore, in Section 1 - Introduction of the PAPA ROD, the following statements occur:

- "*BLM approves the Pinedale Anticline Operators proposal for 700 producing well pads;*"
- "*The ROD recognized that in order to develop 700 productive well pads in the PAPA, as many as 900 well pads may need to be constructed;" and*
- "*Monitoring for project consistency with the scope of EIS analysis will be based on the total of 700 producing well pads.*"

When the PAPA ROD (BLM, 2000b) was issued in July 2000, the extent to which directional drilling would be implemented in the PAPA was uncertain. Although there was allowance in the PAPA ROD for multi-well pads, it was generally assumed that most well pads would contain a single well. It was not the intent of the PAPA ROD to limit wells but rather to limit well pads within defined Management Areas (MAs) based on sensitive resources. MAs are defined in the PAPA EIS. The air quality impact assessment for the PAPA EIS assumed that there would be 700 producing wells in the PAPA; hence, the ambiguous interchange between wells and well pads.

Multiple requirements for managing development-related impacts to specific resources are defined in Section 3 and various appendices to the PAPA ROD (BLM, 2000b). These requirements are summarized in Table 1 of Appendix 1 as:

- requirements of federal statute and/or agency policy,
- required plan for development or for implementing another action,
- required multi-party memorandum of understanding (MOU), programmatic agreement (PA), or less formal agreement,
- required Adaptive Environmental Management (AEM) with monitoring and/or reporting,
- required implementation of relevant practices and guidelines, and
- implementation of required or suggested mitigation.

The BLM's Preferred Alternative in the PAPA EIS was to be implemented with restrictions to exploration and development within each of nine defined MAs. Some of the MAs represent various combinations of sensitive resource management zones (SRMZs) as defined and analyzed in the PAPA DEIS (BLM, 1999a). While the extent of development within the entire PAPA was limited by BLM's Approved Project Components (BLM, 2000b - Section 2) and Administrative Requirements and Conditions of Approval (BLM, 2000b - Section 3), Section 4 of the PAPA ROD (BLM, 2000b) provided specific limits of development within each of the nine MAs based on numbers of producing well pads.

In each MA, the average and maximum numbers of producing well pads per square mile were based on analyses of various assumptions and limits in the PAPA EIS. According to the PAPA ROD, should development in a MA reach the limit of producing well pads, BLM approval of additional well pads would halt until additional environmental analyses are completed or until wells on a pad are no longer producing gas, have been plugged, and the pad area reclaimed for one full growing season. The reclaimed pad would be credited back to the MA and a new well pad could be developed as long as the limit is not exceeded. Descriptions of each MA, objectives for managing the MA, and allowable levels of development are summarized in Table 2 of Appendix 1 in this Final SEIS.

Uncertainties associated with levels of exploration and development and geographic distribution of development in each MA are reflected in the allowable levels of development in Table 2 (Appendix 1). To ensure that specific MA objectives were met, the BLM mandated a comprehensive monitoring program using an Adaptive Management (AM) process that depends on participation by cooperating agencies and the public. CEQ regulations require monitoring (40 CFR §1505.2(c) and §1505.3). In August 2004, the Secretary of the Interior chartered the Pinedale Anticline Working Group (PAWG) under the Federal Advisory Committee Act. The primary responsibility of the PAWG is to provide recommendations to the BLM on monitoring and mitigation.

1.5 EXCEPTIONS AND SUBSEQUENT NEPA DOCUMENTS TIERED TO THE PAPA EIS

The PAPA ROD (BLM, 2000b) allows exceptions (Appendix A-6 in the PAPA ROD) to *Administrative Requirements and Conditions of Approval* (Section 3) to some lease stipulations and conditions of approval. In the years since the PAPA ROD was issued, the most frequently requested exception is one where the operator/leaseholder seeks to continue working past the onset of big game timing restrictions. These exceptions are provided for in the Pinedale Resource Management Plan - RMP (BLM, 1988b) and administered by the BLM's Authorized Officer (AO).

In addition to exceptions to lease stipulations, BLM (2003a) noted, *"waivers, exceptions, and modifications are viable and effective means of adapting oil and gas lease stipulations to meet changing circumstances. Circumstances for granting a waiver, exception, or modification are documented in most existing land use plans and are a requirement of all future land use plans,"* and provided the following application of the terms:

- Lease stipulation waiver is a permanent exemption to a lease stipulation;
- Lease stipulation exception is a one-time exemption to a lease stipulation and exceptions are determined on a case-by-case basis; and
- Lease stipulation modification is a change to the provisions of a lease stipulation, either temporarily or for the term of the lease.

Since 2000, the BLM AO has considered requests for exceptions to big game, greater sage-grouse, and raptor seasonal stipulations or restrictions. Exceptions to these restrictions have been granted, partially granted, or denied for a variety of activities including drilling, completions, equipment removal, pipeline installation, surveying, seismic and geophysical surveys, wildlife research studies, and various other wellfield activities.

Prior to making decisions regarding exceptions, the BLM coordinates a review with the Wyoming Game and Fish Department (WGFD). For exception requests to big game crucial winter range seasonal restrictions, a consultation is held with WGFD biologists to assess animal presence or absence, animal condition, weather severity, habitat condition and availability, specific site location, and requested action. Exception requests and subsequent decisions made by the BLM AO from 2001 through 2007 are summarized in Table 3 of Appendix 1 of this document.

After the approval of the PAPA ROD (BLM, 2000b), the BLM evaluated five requests for approval of development strategies related to year-round drilling in subsequent Environmental Assessments (EAs). The Decision Records for each of the EAs are included in Table 4 in Appendix 1 and summarized below:

- Questar Year-Round Drilling Proposal – EA Number WY-100-EA05-034, November 2004. Questar proposed installation of a gathering system for condensate and produced water in the PAPA, construction of a pipeline to transport crude petroleum from the PAPA, and utilization of Tier 2 compliant drilling rig engines or alternate fuels with emissions equivalent to Tier 2 engines by 2007. In November 2004, the BLM issued a Decision Record (BLM, 2004a) approving the proposal and allowing Questar to utilize up to six drilling rigs (two rigs per pad for up to three pads between November 15 and April 30 for 9 years beginning November 15, 2005).

- Questar Year-Round Drilling Proposal - Condensate Pipeline Modification (QYDP-CPM) - EA Number WY-100-EA05-283, July 2005. In July 2005, the BLM issued a Decision Record (BLM, 2005a) for modification of the condensate (crude petroleum) pipeline route. Approval of drilling operations between November 15, 2005 and April 30, 2006 would be contingent upon the liquids gathering system being operational by November 15, 2005. The Decision Record required Questar to utilize Tier 2 compliant drilling rig engines (or equivalent, or better) on all year-round drilling rigs by January 1, 2008.

- ASU Year-Round Drilling Demonstration Project - EA Number WY-100-EA05-254, September 2005. Anschutz, Shell, and Ultra submitted a proposal to the BLM for a year-round drilling demonstration project. In September 2005, the BLM issued a Decision Record (BLM, 2005b) that approved drilling operations between November 15, 2005 and July 31, 2006 within big game crucial winter ranges, sage-grouse nesting and brood-rearing habitat, and sage-grouse winter concentration areas. It allowed completion operations beginning May 1, 2006. The Decision Record allowed up to two drilling rigs on each of three well pads between November 15, 2005 and July 31, 2006.

- Questar Year-Round Drilling Proposal, Addendum - EA Number WY-100-EA06-043, November 2005. The BLM issued a Decision Record (BLM, 2005c) that allowed for accelerated winter development on the Mesa, including well completions and the addition of a third drilling rig on the Mesa 3-20 winter drilling pad, and allowed a total of seven drilling rigs during winter 2005-2006.

- Ultra 2006-2007 Big Game/Sage Grouse Exception for the Mesa 10D-33 Deep Well - EA Number WY-100-EA07-006, November 2006. The BLM issued a Decision Record (BLM, 2006b) that allowed for drilling operations between November 15, 2005 through May 17, 2007 within big game crucial winter range and greater sage-grouse brood-rearing and nesting habitat at the Mesa 10D-33 well location. The Decision Record required monitoring of traffic volumes, dead carcasses, and emissions tracking of three natural gas fired turbines which were to be used to drill the well. The Decision Record was valid only for the 2006-2007 season.

1.6 EXISTING DEVELOPMENT IN THE PAPA

Since 2000, most natural gas development in the PAPA has been along the Anticline Crest, which is approximately 2 to 3 miles wide, 25 to 30 miles long, and centered along the length of the PAPA. The Proponents are proposing long-term development within the Anticline Crest as well as continued exploration off the Anticline Crest. As of November 2006, there were approximately 642 producing wells on 340 well pads in the PAPA. Of these, 613 producing wells on 285 well pads were drilled after issuance of the PAPA ROD (BLM, 2000b). There were 26 drilling rigs operating in the PAPA at the end of 2006.

1.7 PROPOSED ACTION

The Proponents have proposed a long-term plan for continued development of the PAPA. Their proposal includes up to 4,399 new producing wells that would be drilled from 250 new well pads and from expansion of existing well pads. There would be no more than 600 total well pads in the PAPA. In proposing concentrated and year-round development (construction, drilling, completion, and production), the Proponents are requesting exception from BLM's seasonal restrictions (condition of approval or lease stipulation) within certain areas of the PAPA that coincide with big game (mule deer and pronghorn) crucial winter habitats and greater sage-grouse seasonal habitats.

The Proponents estimate that surface disturbance would continue through 2023, and would consist of 12,885 acres of initial disturbance with a life-of-project (LOP) disturbance of 4,012 acres. This disturbance would be in addition to the current existing wellfield disturbance in the PAPA of 4,835 acres. Project components consist of new well pads, expansion of existing well pads, production equipment, gas gathering pipelines, access roads, and other ancillary facilities. Some of the Proponents are proposing to install additional liquids gathering systems, resulting in most of the producing wells in the PAPA being connected to a liquids gathering system. This would result in a reduction of truck traffic required to haul condensate and produced water. Some of the Proponents are proposing emission reductions, thereby reducing impacts to air quality and air quality related values (AQRVs) in nearby wilderness areas. Two gas sales pipelines are proposed that would transport natural gas from the PAPA to gas processing plants in southwest Wyoming. The BLM has identified three new pipeline corridors that would contain the gas sales pipelines. An expansion of the Granger Gas Plant is also proposed and air quality impacts associated with the expansion are analyzed in this document.

1.8 PURPOSE AND NEED

The purpose and need of the BLM is to act upon the Proponents' proposal to revise the PAPA ROD to expand the level of development by drilling 4,399 new producing wells and to relax seasonal restrictions in certain areas. This would be done with compensating protections for wildlife through limitation of activity in other areas and additional mitigation measures in and outside of the PAPA. It is also to consider appropriate well spacing in light of determinations of well spacing made by the Wyoming Oil and Gas Conservation Commission (WOGCC).

The proposal would allow for the development of additional gas resources from the highly productive PAPA while protecting resources, including big game (pronghorn and mule deer) and greater sage-grouse with less impact from production traffic levels and the stability of the drilling rig fleet and associated workforce than caused by current seasonal restrictions.

1.9 RELATIONSHIP TO NEPA AND BLM POLICY

The PAPA EIS process was completed in 2000 in compliance with CEQ Regulations for Implementing the Procedural Provisions of NEPA (CEQ, 1978). CEQ described several situations in which federal agencies would prepare supplements to either a DEIS or FEIS (40 CFR §1502.9(c)) if "*the agency makes substantial changes that are relevant to environmental concerns or there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts*." In other situations, agencies may prepare supplements to existing documents if they determine that the purposes of NEPA would be furthered by doing so.

To the extent possible and appropriate, the BLM supports the use of existing environmental analyses to address impacts of a proposed action as described in Handbook H-1790-1 (BLM, 1988a). Supplements to existing NEPA documents are prepared when additional environmental analyses are needed. The Handbook specifically advises that the *"relationship between the supplement and the existing EIS is lateral, i.e., the proposed action and alternatives are analyzed to the same level of specificity and detail*."

The guidance referenced above cannot be applied to this document because the Alternatives analyzed in the PAPA EIS were projections of various development possibilities with incomplete information available regarding 1) the extent of the mineral resource, 2) the pace of development over time, 3) the geographic extent and intensity of development, and 4) environmental impact to multiple resources. The BLM now has substantial documentation for each of these four issues associated with natural gas development in the PAPA.

Information now available (which was uncertain in nature during preparation of the PAPA EIS) is used in this document to describe the Affected Environment (Chapter 3) and to analyze the Environmental Consequences (Chapter 4) of the Proponents' Proposed Action and other Alternatives. The current level of natural gas development in the PAPA has been inventoried and is described in Chapter 2. The inventory provides the foundation for understanding the current status of each resource included in Chapter 3 and is the basis for evaluating the impacts of each Alternative in Chapter 4. The current inventory of development and associated impact, coupled with the specificity of the Proponents' proposal, allows for the environmental analysis in this document to be more specific and detailed than the environmental analysis in the PAPA EIS.

1.10 CONFORMANCE WITH BLM'S EXISTING RESOURCE MANAGEMENT PLANS

Policies for development and land use decisions within the PAPA are contained in the draft and final Pinedale Resource Area (now referred to as the PFO) RMP (BLM, 1988b), the Green River Resource Area (now referred to as the Rock Springs Field Office - RSFO) RMP (BLM, 1997), and the Kemmerer Resource Area (now referred to as the Kemmerer Field Office - KFO) RMP (BLM, 1986). These three RMPs allocate which lands and/or minerals are appropriate for leasing and provide development guidelines. The RODs indicate which federal minerals will be made available for orderly and efficient development, and that all minerals actions will comply with goals, objectives, and resource restrictions (mitigations) required to protect other resource values. The components selected and approved for the PAPA must be in conformance with the RMPs.

PFO RMP. The PFO RMP states that Preferred Alternatives would be considered in conformance if they: 1) are specifically provided for in the plan, 2) are consistent with the provisions, guidelines, and objectives of the plan, or 3) are not specifically prohibited or are not inconsistent with the objectives and other actions that are provided for in the plan. A Preferred Alternative must meet at least one of these requirements in all aspects of its implementation to be in conformance with the PFO RMP. The PFO RMP allows for exceptions to restrictions, including big game and greater sage-grouse restrictions. Applications for rights-of-way and other land use authorizations will be considered on a case-by-case basis. They will be processed consistent with the objectives of the PFO RMP and will include any necessary mitigation requirements, offset retrogression, or displacement of natural resource and economic values.

The wildlife management objective of the PFO RMP is to maintain sufficient habitat to support wildlife populations at the 1987 WGFD planning objective levels, as updated in 2004 to reflect more recently available data. However, well spacing authorized prior to 2004 has resulted in adverse impacts to some species. To mitigate the additional impacts of infill drilling, the Proponents have proposed off-site mitigation aimed at habitat enhancement linked to various levels of authorized surface disturbance. Three of the five Alternatives presented in Chapter 2 (Alternative B, Alternative C, and Alternative D) include extensive provisions for off-site mitigation. BLM has determined that the Alternatives analyzed in this Final SEIS are consistent with the guidelines and objectives of the PFO RMP.

RSFO RMP. The RSFO RMP simply states that “All public land and resource uses in the planning area must conform with the decisions, terms, and conditions of use” described in the RMP. Concerning rights-of-way, the RSFO RMP states that public lands will be made available throughout the planning area for rights-of-way, permits, and leases. The planning area, with the exception of defined exclusion and avoidance areas, will be open to the consideration of granting rights-of-way. BLM has determined that all Alternatives analyzed in this Final SEIS comply with the applicable decisions, terms, and conditions of use in the RSFO RMP.

KFO RMP. The KFO RMP states that all public lands within the resource area have been reviewed and have been determined to be suitable for oil and gas leasing and development subject to certain stipulations. Resource management and protection stipulations will be developed and implemented on an "as needed" basis to prevent undue adverse impacts to other resource values. Further, rights-of-way will be issued incorporating surface reclamation stipulations (and other mitigating measures). Restrictions and mitigating measures may be modified on a case-by-case basis. BLM has determined that the Alternatives analyzed in this Final SEIS are in conformance with the KFO RMP objectives.

1.11 AUTHORIZING ACTIONS, RELATIONSHIPS TO STATUTES AND REGULATIONS

BLM is not the only agency that must issue approvals for the Proponents’ proposal. A list of permits, approvals, and authorizing actions necessary to construct, operate, maintain, and abandon project-related facilities is provided in Table 1.11-1. The PAPA EIS contains complete descriptions of the regulatory programs listed in Table 1.11-1, as well as their applicability to oil and gas activities in the PAPA. For additional information regarding these regulatory programs, please refer to the PAPA EIS.

Table 1.11-1
Permits, Approvals, and Authorizing Actions Necessary for Construction, Operation, Maintenance, and Abandonment of the Proposed Action and Alternatives[1]

Issuing Agency/Permit Name	Nature of Permit/Approval	Authority
Bureau of Land Management Permit to Drill, Deepen or Plug Back (APD/Sundry process)	Controls drilling for oil and gas on federal onshore lands	Mineral Leasing Act of 1920 (30 U.S.C. 181 *et seq*.); 43 CFR §3162
Rights-of-way Grants and Temporary Use Permits	Rights-of-way grants on federal lands	Mineral Leasing Act of 1920 as amended (30 U.S.C. 185); 43 CFR §2880
Rights-of-way Grants and Temporary Use Permits	Rights-of-way grants on federal lands	Federal Land Policy and Management Act of 1976 (43 U.S.C. 1761 - 1771); 43 CFR §2800
Antiquities, Cultural, and Historic Resource Permits	Issue antiquities and cultural resources use permits to inventory, excavate or remove cultural or historic resources from federal lands	Antiquities Act of 1906 (16 U.S.C. 431-433); Archaeological Resources Public Protection Act of 1979 (16 U.S.C. 470aa - 47011); 43 CFR §3; Section 106 of the National Historic Preservation Act
Approval to Dispose of Produced Water	Controls disposal of produced water from federal leases	Mineral Leasing Act of 1920 (30 U.S.C. 181 *et seq*.); 43 CFR §3164; Onshore Oil and Gas Order No. 7
U.S. Army Corps of Engineers Section 404 Permit (Nationwide and Individual)	Controls discharge of dredged or fill materials into waters of the United States	Section 404 of the Clean Water Act of 1972 (33 U.S.C. 1344)
U.S. Fish and Wildlife Service Consultation Process, Threatened and Endangered Species	Biological Assessment	Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. et seq.)
Wyoming Department of Environmental Quality Water Quality Division Notice of Intent - Storm Water Discharge Permit Temporary Discharge Permits	Controls off-site storm water runoff from construction activities resulting in 1 acre or more of disturbance	Wyoming Environmental Quality Act; Section 405 of the Clean Water Act (40 CFR §122, 123, and 124); WDEQ Water Quality Rules and Regulations, Chapters 1, 2, and18
Air Quality Division Permits to construct and operate Notice of Installation	Regulates emissions from project components Notification of potential emissions from production equipment	Wyoming Air Quality Standards and Regulations Oil & Gas Production Facilities Chapter 6, Section 2 Permitting Guidance
Wyoming Department of Transportation Oversize and Overlength Load Permits	Permits for oversize, overlength, and overweight loads	Chapters 17 and 20 of the Wyoming Department of Transportation Rules and Regulations
Utility Permit	Highway pipeline crossing	Title 12: Code of Civil Procedures, Chapter 26: Eminent Domain
Access Permit	Highway access construction	Rules and Regulations for Access Driveways as Approved by the Wyoming Highway Commission

Issuing Agency/Permit Name	Nature of Permit/Approval	Authority
Wyoming Oil and Gas Conservation Commission Permit to Drill, Deepen or Plug Back (APD process)	Regulates drilling of all oil and gas wells in the state	WOGCC Regulations Chapter 3, Section 8. W.S. 30-5-104 (d)(i)(C). W.S. 30-5-115
Well location (part of the APD process)	Regulates downhole well location of all oil and gas wells by reservoir or pool	WOGCC Rule: Chapter 3 Section 2, W.S. 30-5-109
Protection of surface waters and productive formations (part of APD process)	Provides general drilling, casing, and cementing rules for oil and gas wells	WOGCC Rule: Chapter 3, Section 22
Well control (part of APD process)	Provides requirements for blowout preventers	WOGCC Rule: Chapter 3, Section 23
Authorization approving drilling and spacing units	Regulates well spacing and pooling of interests by reservoir or pool	W.S. 30-5-104(d)(ii)(F)(iv). W.S. 30-5-109(a),(b),(c) and (f)
Permit to drill to a nonstandard location	Provides for well relocation while maintaining existing well spacing	WOGCC Rule: Chapter 3, Section 3, W.S. 30-5-109
Permit to directionally drill	Provides the notification requirements for controlled directional drilling	WOGCC Rule: Chapter 3, Section 25
Plugging and abandonment of a well (applies to non-federal lands)	Provides procedures and regulates the plugging and abandonment of oil and gas wells	WOGCC Rule: Chapter 3, Section 18, Chapter 4, Section 2. W.S. 30-5-104 (d)(vi)(B)
Measurement of oil and gas production	Regulates the measurement and reporting of oil and gas production	WOGCC Rule: Chapter 3, Section 30 and 31, W.S. 30-5-104 (d)(vi)(B)
Permit to complete a well in multiple zones or pools (commingling)	Regulates the production of oil and gas from more than one pool in one well	WOGCC Rule: Chapter 3, Section 35
Authorization to flare or vent gas	Regulates the safe venting or flaring of gas to prevent waste	WOGCC Rule: Chapter 3, Section 40
Permit to use an earthen pit (applies to nonfederal lands)	Regulates construction, use and closure of noncommercial reserve, production and emergency pits on drilling and producing locations	WOGCC Rule: Chapter 4, Section 1, W.S. 30-5-104 (d)(vi)(A)
Spills and fires	Requires notification, with a prevention and cleanup plan, of accidental deaths, fires, or releases of 10 or more barrels of non-potable fluids that enter or threaten the waters of the State	WOGCC Rule: Chapter 4, Section 3
Workmanlike operations	Regulates the safety and environmental protection of well production facilities	WOGCC Chapter 4, Section 4
Permit underground disposal of water	Regulates the noncommercial underground disposal of non-potable water and oil field wastes	WOGCC Chapter 4, Section 5, W.S. 30-5-104 (d)(vi)(B)
Permit to close a natural gas processing facility	Regulates closure of infield gas gathering and processing facilities	WOGCC Rule: Chapter 4, Section 13 (b)

Issuing Agency/Permit Name	Nature of Permit/Approval	Authority
Wyoming Department of Employment Workers Safety and Compensation Division	Provides the rules and regulations governing the health and safety of employees and employers of oil and gas drilling and servicing, includes equipment spacing, lighting requirements, hours of operation and other items pertinent to pad size and design	W.S. 27-11-105
Wyoming State Engineer's Office Water Well Permit Temporary Industrial Use of Unappropriated Water S.W.1	Grant permit to appropriate groundwater Surface water withdrawal for hydrostatic testing	Wyoming State Statutes Section 41-3-938
Wyoming State Historic Preservation Office	Cultural resource protection	Section 106 of National Historic Preservation Act and Advisory Council Regulations (36 CFR §800)
Wyoming State Lands and Investments	Rights-of-way and easements on state lands	W.S. 36-9-118
Sublette County Planning and Zoning	Energy Pipeline Permit	
Planning and Zoning	Driveway Permit	Zoning and Development Regulations of Sublette County Section 7. Wyoming State Statutes Section 18-5-207
Planning and Zoning	Building Permits	

[1] This list is intended to provide an overview of key regulatory requirements that would govern project implementation under any Alternative. Additional approvals, permits, and authorizing actions could be necessary.

1.12 DECISIONS TO BE MADE BASED ON THIS NEPA ANALYSIS

This document supplements the existing PAPA DEIS (BLM, 1999a) through analysis and evaluation of the potential impacts of the approval of additional natural gas development in the PAPA. The BLM must decide whether or not to approve the Proponents' proposal. The BLM will base the decision, and the conditions of that decision, on the analyses and information contained in the SEIS and on information and comments provided to the BLM. After completing the SEIS process, a new ROD will be prepared and released that will supersede the PAPA ROD (BLM, 2000b). Although the ROD may approve modification of the Operators' development program, the BLM must analyze and approve each component of the project that involves disturbance of federal lands on a site-specific basis. The methods used to evaluate each surface-disturbing activity are the Application for Permit to Drill (APD) or rights-of-way grants/temporary use permits, which would be required before any construction could occur.

Chapter 2
Public Participation, Existing Development and Alternatives

2.1 INTRODUCTION

The purpose of this chapter is to provide an overview of the public participation process, to describe the existing wellfield development in the PAPA, and to present Alternatives for continued exploration, development, and production of natural gas resources in the PAPA. The project components associated with Alternative A (No Action Alternative), Alternative B (Proposed Action Alternative), and Alternatives C, D, and E are summarized in this chapter. Other project Alternatives considered, but not analyzed in detail, are also discussed in this chapter. This chapter describes the expansion of transportation corridors and proposed gas sales pipelines from the PAPA to gas processing plants in southwest Wyoming.

2.2 PUBLIC PARTICIPATION

2.2.1 Scoping, Consultation and Coordination

NEPA regulations (40 CFR §1500 -1508) require that the BLM use a scoping process to identify potential significant issues in preparation for impact analysis. The principal goals of scoping are to allow public participation to identify issues, concerns, and potential impacts that require detailed analysis. Scoping was the primary mechanism used by the BLM to initially identify issues regarding proposed development in the PAPA.

BLM held meetings with participation from various agencies, the Proponents, and the public to encourage early and improved public participation and agency cooperation. The BLM's Notice of Intent (NOI) to prepare a Supplemental EIS inviting the public to comment on the Proponents' proposal for long-term development of the PAPA appeared in the *Federal Register* on October 21, 2005. BLM mailed a scoping notice to the media, governmental agencies, environmental organizations, industry representatives, individuals, landowners, and livestock grazing permittees. The scoping notice explained the general nature of the proposal and requested comments. The public scoping comment period ended November 20, 2005. Scoping meetings were held in Jackson and Marbleton on November 7, 2005, and in Pinedale on November 8, 2005.

The locations of the proposed transportation corridor/pipeline alignments were not determined at the time of the initial scoping; therefore, an additional scoping notice was issued. The second notice, mailed on April 14, 2006, was sent to the same recipients as the October 2005 scoping notice, as well as to individuals and organizations on mailing lists provided by BLM's RSFO and KFO. The public comment period for the second scoping notice ended on May 17, 2006.

Numerous issues were identified in the scoping process. Comments received during scoping were incorporated into the analysis in the Draft SEIS published in December 2006 (BLM, 2006a). Scoping comments are available for inspection in BLM's PFO, RSFO, and KFO. The agencies and government entities that were contacted during the scoping process include the U.S. Fish and Wildlife Service (USFWS), USFS, National Park Service (NPS), U.S. Environmental Protection Agency (EPA), State of Wyoming (including WGFD and WDEQ), Sublette County, and the BLM Interdisciplinary Team (ID Team). The scoping issues identified are summarized in Section 2.2.2 and detailed in Appendix 2.

The ID Team considered all comments received during the scoping process (see Appendix 2). From the breadth of key environmental issues submitted by agencies and the public, the ID Team developed the Alternatives that were described and analyzed.

2.2.2 Summary of Issues

Following the November 2005 scoping, BLM received a total of 63 written comments, nine of which were from government agencies (two federal, five state, and two county), four from industry representatives, five from environmental organizations, and 45 from private individuals. Following the April 2006 scoping of the proposed transportation corridor/pipeline alignments, BLM received a total of 10 written comments. Of the comments received, five were from government agencies (three federal, one state, and one county) and five were from private individuals.

Issues introduced by the public, industry, interested groups, and other agencies are summarized below:

- The pace of development in the PAPA is too fast and BLM has not fully evaluated the environmental consequences of winter drilling, operators' mitigation, compliance with all regulatory standards, and application of Adaptive Management.
- The BLM should analyze an alternative that emphasizes conservation and wildlife in the PAPA.
- The impact to wildlife by current development has been a major concern. Although monitoring must continue, new approaches to mitigation should be developed and monitored.
- The effects on livestock operators and private landowners by wildlife displaced due to development in the PAPA should be evaluated both on- and off-site, and mitigation should be proposed.
- Winter drilling will increase winter traffic and increase safety risks.
- The effect of winter drilling on the long-term economic stability of Sublette County should be evaluated.
- Development on public and private lands has become a single resource use of land, not multiple use.
- Hunting is impacted by declining wildlife populations.
- Wellfield development is impacting surface water and groundwater.
- Air quality in the region should be fully evaluated with respect to sensitive airsheds and local air quality, and mitigation measures should be proposed, where necessary.

2.2.3 Comment Period on the Draft SEIS

The Draft SEIS (BLM, 2006a) was available for public comment in December 2006. The public comment period initially ran for 60 days from December 15, 2006 through February 13, 2007. A Supplemental Ozone Analysis was released in early February 2007, and the public comment period was extended to April 6, 2007. BLM hosted an open house on the Draft SEIS on February 13, 2007 in Pinedale.

Over 63,000 comment letters were received on the Draft SEIS (BLM, 2006a) citing various rationales either in support of or in opposition to various Alternatives. The BLM received substantive comments from business and industry representatives; environmental groups; federal, state, and local agencies; and individuals about the Alternatives including many suggestions that additional Alternatives be considered. Based upon these suggestions, the BLM formulated two additional Alternatives and made changes to the Draft SEIS resulting in the Revised Draft SEIS. The major changes were:

- The affected environment has been updated to include more recent baseline data and to include wellfield development that occurred in 2006;
- Two additional Alternatives (Alternative D and Alternative E) are analyzed;
- Additional Proponent-committed mitigation is included in Alternative D; and
- Additional discussion of impacts to socioeconomic, air quality, and wildlife resources based on a range of drilling rigs operating in the PAPA at any one time is included (Appendix 3).

2.2.4 Comment Period on the Revised Draft SEIS

The Revised Draft SEIS was available for public comment in December 2007. BLM received over 68,000 comment letters on the Revised Draft SEIS (BLM, 2007a). The public comment period lasted for 45 days and ended on February 11, 2008. BLM hosted public meetings on the Revised Draft SEIS in Pinedale on January 17, 2008 and February 7, 2008. This Final SEIS is the result of revisions based on comments on the Revised Draft SEIS. Reponses to substantive comments during the comment periods are included in the Final SEIS.

2.3 EXISTING DEVELOPMENT IN THE PAPA

Many of the written responses to scoping as well as comments received on the Draft SEIS (BLM, 2006a) and Revised Draft SEIS (BLM, 2007a) referred to issues about existing development in the PAPA. The extent of existing development in the PAPA, combined with the allowed components in the PAPA ROD (BLM, 2000b) provides the baseline for evaluating each Alternative described in Section 2.4. The analyses and discussions that follow provide an inventory of natural gas development in the PAPA since the PAPA ROD was issued.

In addition to the extent of development, scoping, Draft SEIS (BLM, 2006a) and Revised Draft SEIS (BLM, 2007a) comments focused on the pace of development in the PAPA. For this analysis, the number of wells drilled and completed during any given year has been defined to be the pace of development.

There were 38 producing wells at the end of 2001, the first full year after the PAPA ROD was issued. At the end of 2006, there were approximately 642 producing wells (613 since the PAPA ROD). Natural gas production in 2006 was approximately 27 times greater than production in 2000 (Table 2.3-1 and Figure 2.3-1). Condensate and water production have also increased by similar proportions each year.

Table 2.3-1
Total Annual Production of Natural Gas, Condensate, and Produced Water in the PAPA since 2000[1]

Year	Natural Gas (MCF)	Condensate (Bbls)	Produced Water (Bbls)
2000	10,587,252	100,405	175,912
2001	21,701,861	210,127	336,447
2002	61,747,523	550,857	809,927
2003	109,864,089	881,926	1,950,380
2004	180,398,607	1,424,753	3,712,832
2005	237,909,623	1,869,043	5,069,538
2006	284,789,614	2,201,685	6,384,655

[1] Source: WOGCC, 2007.

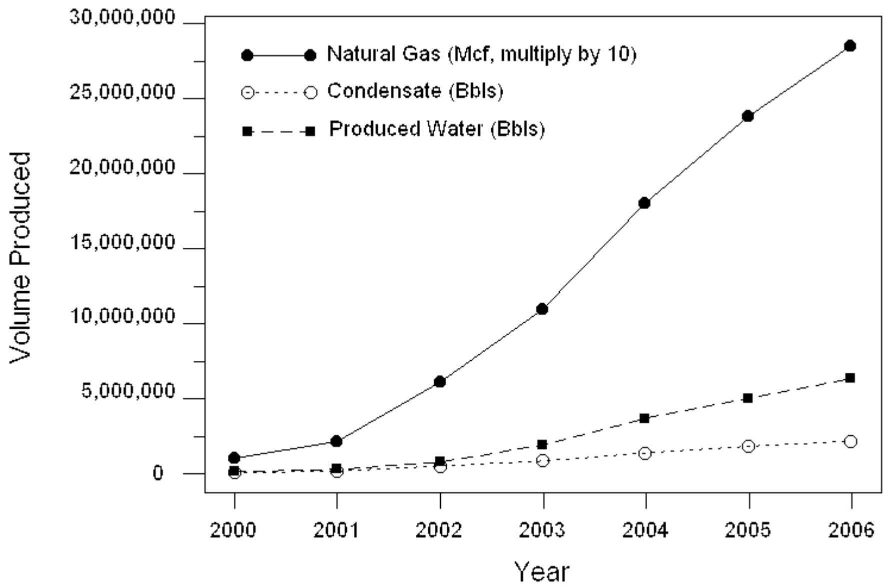


Figure 2.3-1
Total Annual Production of Natural Gas,
Condensate, and Produced Water in the PAPA since 2000
(Source: WOGCC, 2007)

Since approval of the PAPA ROD (BLM, 2000b), better definition of the resource places the Pinedale Anticline Field as the third largest natural gas field in the nation (WOGCC, 2007).

2.3.1 Limitations in the PAPA ROD

2.3.1.1 Project Components

The PAPA ROD (BLM, 2000b) allowed project components on BLM-administered public lands in the PAPA (see Table 2.3-2) and stated that development beyond the specified limits would require additional supplemental environmental impact analysis. Wellfield components allowed by the PAPA ROD, and summarized in Table 2.3-2, had not reached the limits on development by November 2006.

Table 2.3-2
PAPA ROD Allowed Components Compared to
Development since the PAPA ROD through November 2006[1]

PAPA ROD Allowed Component	Number	Development (July 2000 through November 2006)
Initial well pad locations on all lands and minerals with the PAPA	900 well pads	285 well pads
Producing wells and/or well pads on all lands and minerals with the PAPA	700 wells or well pads[2]	613 wells
Production facilities at individual well locations	700	Less than 613
Central off-site production facilities	None specified	None
Compressor facility sites	4	3
BP Amoco Field Office	1	1
Miles of sales pipeline corridor for multiple pipelines	121.5	14.5 (in the PAPA)
Miles of access road (including collector, local, and resource roads)	276.0	179.2
Miles of gas gathering pipeline system	280.0	115.9

[1] Totals do not include 55 well pads constructed and 29 producing wells drilled before July 2000.
[2] See Section 1.4 in Chapter 1 for discussion on ambiguity of PAPA ROD regarding wells and well pads.

2.3.1.2 Management Area Well Pad Limits

The BLM's Preferred Alternative (*Resource Protection Alternative on Federal Lands and Minerals*), developed in the PAPA DEIS (BLM, 1999a) and authorized by the PAPA ROD (BLM, 2000b), was implemented through restrictions on exploration and development in each of nine MAs. Section 4 of the PAPA ROD provided specific limits of development in each MA based on the number of producing well pads. The PAPA ROD specifies that additional environmental analysis would be required if a MA reaches its well pad density limit. Management objectives for each MA were developed in the PAPA DEIS and were approved in the PAPA ROD.

Well pad construction since issuance of the PAPA ROD (BLM, 2000b) has been most extensive in MA 5 - *Big Game Winter Range and Sage Grouse Strutting and Nesting Habitat* (Table 2.3-3), with an estimated 123 well pads constructed at the end of 2006.

The highest density of well pads is in MA 9 - *Non-Federal Lands* in Section 16, T. 32 N., R. 109 W., a state-owned section surrounded by federal lands in MA 5. Although these lands are surrounded by big game crucial winter range, they are not subject to seasonal restrictions as they would be on federal lands.

Table 2.3-3
Management Area Limitations and Current Status of Well Pads

Management Area Limitations for Resource Protection in the PAPA ROD	Estimated Current Status of Well Pad Limitation July 2000 through November 2006
MA 1 - Lander Trail	
0 total producing well pads	0 total producing well pads
MA 2 - Mesa Breaks	
0 total producing well pads	0 total producing well pads
MA 3 - Unleased Federal Minerals	
0 total producing well pads	0 total producing well pads
MA 4 - Sensitive Viewshed	
28 total producing well pads	6 total producing well pads
MA 5 - Big Game Winter Range and Sage Grouse Strutting and Nesting Habitat	
212 total producing well pads	123 total producing well pads
MA 6 – Sage Grouse Strutting and Nesting Habitat	
183 total producing well pads	44 total producing well pads
MA 7 – Ross Butte/Blue Rim	
68 total producing well pads	25 total producing well pads
MA 8 - Minimal Conflict Area	
168 total producing well pads	32 total producing well pads
MA 9 - Non federal Lands[1]	
200 total producing well pads	55 total producing well pads
[1] BLM does not have jurisdiction on non-federal lands.	

As of November, 2006, none of the limits for well pads in an individual MA had been reached. *Big Game Winter Range and Sage Grouse Strutting and Nesting Habitat* (MA 5) and *Ross Butte/Blue Rim* (MA 7) are the most developed with approximately half of the allowable well pads constructed.

2.3.1.3 Air Quality Analysis Threshold

Since the PAPA ROD (BLM, 2000b) was issued, natural gas development in the PAPA has occurred at a faster pace than was analyzed in the PAPA DEIS (BLM, 1999a). The PAPA ROD specified an analysis threshold for emissions of 376.59 tpy of NO_x from compression and 693.50 tpy of NO_x from all sources in the field. The PAPA ROD states that if these analysis thresholds are exceeded, additional analysis would be conducted. The air quality impact assessment modeling for the PAPA DEIS assumed 900 initial wells drilled, with 700 producing wells and up to eight drilling rigs operating in the PAPA at any one time. Subsequent NEPA analysis (BLM, 2004a) disclosed that NO_x emissions from all sources in the PAPA exceed the 693.50 tpy analysis threshold specified in the PAPA ROD, mostly due to the increased number of drilling rigs.

2.3.2 Surface Disturbance by Wellfield Component

Total surface disturbance by wellfield component, through November 2006, was determined from digitized QuickBird Satellite Imagery (resolution of 0.6 meter, digitized at a scale of 1:2,000) and concurrent aerial photography. Well pads with a variety of features (wellheads, pits, tank batteries) were clearly visible on the imagery as were roads and pipelines. An accurate status of revegetation on disturbed sites could not be determined from the imagery. Therefore, for this analysis, all portions of well pads, roads, and pipelines are assumed to be disturbed and not reclaimed. Map 2.3-1 shows the existing wellfield surface disturbance in the PAPA as of November 2006, including surface disturbance that occurred before issuance of the PAPA ROD (BLM, 2000b).

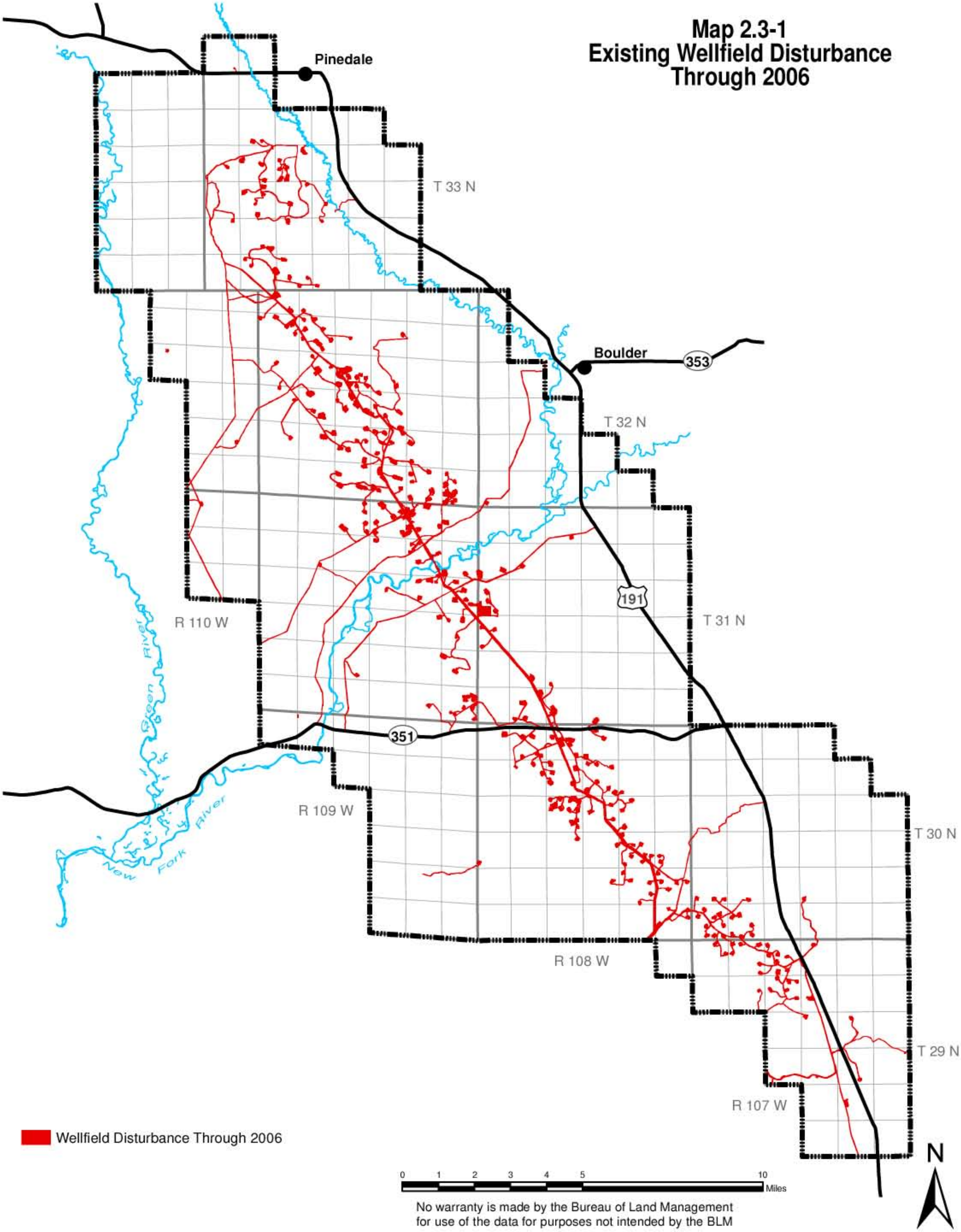
Table 2.3-4 provides the total estimated disturbance in the PAPA as a result of natural gas development through November 2006 (4,834.6 acres). Disturbance that occurred since issuance of the PAPA ROD in July 2000 is 4,393.3 acres. Although the PAPA ROD did not place limits on total surface disturbance from wellfield activity, it did place limits on surface disturbance associated with roads and gas gathering pipelines in terms of lineal dimensions (miles) rather than area disturbed (acres). Most surface disturbance is concentrated along the Anticline Crest (see Map 2.3-1).

Table 2.3-4
Total Estimated Surface Disturbance in the PAPA as a Result of Natural Gas Development through November 2006

	Pre-ROD		Post-ROD		Total	
Approved Component	Number or miles	Total Area Disturbed (acres)	Number or miles	Total Area Disturbed (acres)	Number or miles	Total Area Disturbed (acres)
Well Pads	55	320.4	285	2,018.8	340	2,339.2
Roads	6.4	60.7	179.2	932.0	185.5	992.7
Gas Gathering Pipelines	12.2	60.2	115.9	827.6	128.1	887.8
Gas Sales Pipelines	--	--	14.5	437.9	14.5	437.9
Compressor Stations	--	--	3	29.4	3	29.4
Stabilizer Facility	--	--	1	5.7	1	5.7
Anticline Disposal	--	--	1	76.6	1	76.6
Storage Yards	--	--	6	54.0	6	54.0
BP Amoco Field Office	--	--	1	11.3	1	11.3
Total		**441.3**		**4,393.3**		**4,834.6**

2.3.2.1 Well Pads

As of November 2006, there were 340 well pads in the PAPA, 55 of which were constructed before issuance of the PAPA ROD (BLM, 2000b). Since July 2000, 285 well pads have been constructed (Table 2.3-4) and are subject to the limit of 700 producing well pads in the PAPA ROD. Therefore, the limit for total well pads allowed in the PAPA ROD had not been reached by November 2006.


Map 2.3-1
Existing Wellfield Disturbance
Through 2006
Pinedale
Boulder
353
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
191
351
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

2.3.2.2 Roads and Gas Gathering Pipelines

Before issuance of the PAPA ROD (BLM, 2000b), there were 6.4 miles of roads associated with natural gas development in the PAPA. The PAPA ROD allowed additional construction and/or upgrade of access roads on federal lands, including collector, local, and resource roads, totaling approximately 276 miles. The roads in the PAPA are classified as follows:

- Arterial roads with high traffic volumes that pass through the PAPA, such as state highways or county roads (not subject to limitations in the PAPA ROD);
- Two-lane collector roads that provide primary access to large blocks of land and connect with or extend the public road system;
- One or two-lane local roads that connect to collector roads but normally serve a smaller area and convey less traffic than collector roads; and
- Single lane resource roads from local or collector roads to individual well pads.

Map 2.3-2 shows the existing road network in the PAPA. Approximately 185.5 miles of local and resource roads have been constructed and/or improved since the PAPA ROD (BLM, 2000b) was issued. These roads are subject to the 276-mile limit in the PAPA ROD. This includes the upgrading of roads on federal lands that were present before issuance of the PAPA ROD. The limit allowed for roads in the PAPA ROD had not been reached by November of 2006.

The PAPA ROD (BLM, 2000b) approved an additional 280 miles of gas gathering pipelines to carry natural gas from individual well pads to a central location where the gas would be compressed into a sales pipeline. The approval included construction and operation of 3- to 16-inch diameter gathering pipelines. Approximately 128.1 miles of gas gathering pipelines were constructed between July 2000 and November 2006, which is below the limit allowed by the PAPA ROD.

In 2005, Questar installed a condensate and produced water gathering system (liquids gathering system) within their leaseholds in the northern portion of the PAPA. Potential environmental impacts associated with construction of the liquids gathering system were evaluated by BLM (2004a). The PAPA EIS did not consider installation and operation of a liquids gathering system or transportation of produced liquids from the PAPA to sales and disposal facilities. Therefore, the liquids gathering system is not considered part of the gathering pipeline limit set forth in the PAPA ROD.

2.3.2.3 Gas Sales Pipelines

The PAPA DEIS (BLM, 1999a) analyzed a gas sales pipeline route, including two alternative alignments, with a 200-foot wide right-of-way to accommodate multiple gas sales pipelines. Depending on alternatives, the route ranged from 119.6 to 121.7 miles. The PAPA ROD (BLM, 2000b) allowed a 121.5-mile route. Currently, a portion of the constructed gas sales pipeline extends for 14.5 miles inside the PAPA boundary with an estimated disturbance of 437.9 acres.

2.3.2.4 Compressor Stations

The PAPA ROD (BLM, 2000b) allowed four compressor station sites in the PAPA. There are currently three compressor station sites in the PAPA. They include the Pinedale/Gobblers Knob Compressor Station operated by QGM (Section 2, T. 31 N., R. 109 W.); the Paradise Compressor Station (Section 2, T. 31 N., R. 109 W.); and the Falcon Compressor Station (Section 36, T. 30 N., R. 108 W), both operated by JGGC. Total compression for the three stations is 58,948 horsepower (hp) for the compressor engines, with an additional 7,690 hp associated with generators and vapor recovery units for a total of 66,638 hp (see Table 2.3-5).

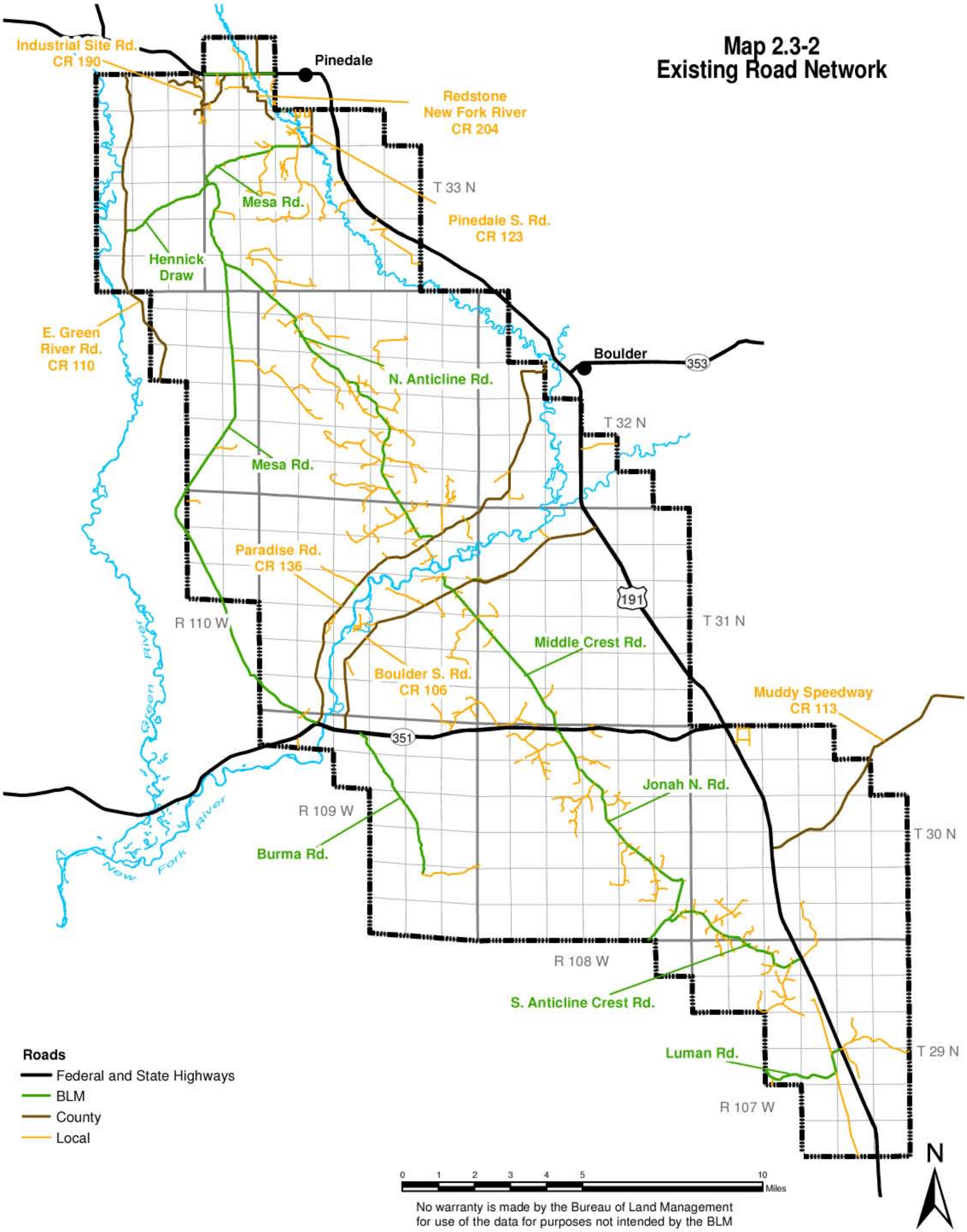

Map 2.3-2
Existing Road Network
Pinedale
Industrial Site Rd.
CR 190
Redstone
New Fork River
CR 204
T 33 N
Mesa Rd.
Pinedale S. Rd.
CR 123
Hennick
Draw
E. Green
River Rd.
CR 110
Boulder
353
N. Anticline Rd.
T 32 N
Mesa Rd.
Paradise Rd.
CR 136
191
T 31 N
R 110 W
Middle Crest Rd.
Boulder S. Rd.
CR 106
Muddy Speedway
CR 113
351
Green River
Jonah N. Rd.
R 109 W
New Fork River
T 30 N
Burma Rd.
R 108 W
S. Anticline Crest Rd.
Roads
Federal and State Highways
BLM
County
Local
Luman Rd.
T 29 N
R 107 W
N
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

Table 2.3-5
Horsepower and NO_x Emissions at Existing Compressor Stations in the PAPA through 2006

Compressor Station	Existing Compression (hp)	Existing Generation (hp)	Existing VRU (hp)	Total Compression (hp)	NO_x Emission (tpy)
Pinedale/Gobblers Knob	18,600	0	0	18,600	125.7
Paradise	18,340	3,600	245	22,185	161.2
Falcon	22,008	3,600	245	25,853	185.3
Total	**58,948**	**7,200**	**490**	**66,638**	**472.2**

As of November 2006, total disturbance associated with the three facilities covered 29.4 acres. The total NO_x emission for all compression in the PAPA as of November 2006 was estimated to be 472.2 tpy.

The PAPA ROD (BLM, 2000b) allowed for varying levels of compression, depending upon the compressor emissions rating, the level of construction and drilling activity, and the number of producing wells. The current level of 66,638 hp is within the amount of compression analyzed in the PAPA DEIS (26,000 to 96,000 hp with compressor emission ratings of 1.5 to 0.7 g/hp-hr, respectively); however, the total estimated NO_x emission of 472.2 tpy is over the 376.59 tpy NO_x analysis threshold specified in the PAPA ROD. This document provides the additional air quality impact analysis that is required by the PAPA ROD.

2.3.2.5 Stabilizer Facility

Disturbance associated with expansion of the Pinedale/Gobblers Knob Compressor Station for a stabilizer facility was analyzed under NEPA (BLM, 2004a) and included an additional 5.7 acres. The purpose of the condensate stabilizer is to make a “stable” product that can be metered and pumped to the crude petroleum pipeline for transport off the PAPA. A Documentation of Land Use Plan Conformance and Determination of NEPA Adequacy, or DNA, was issued by BLM in 2005. It allowed installation of an underground 25 kilovolt (kV) three-phase power distribution line to connect the condensate stabilizer to the Pinedale/Gobblers Knob Compressor Station.

2.3.2.6 Anticline Disposal Facility

The Anticline Disposal Facility, which disposes of produced water by evaporation and surface discharge (proposed to begin in 2007), is located in Section 18, T. 31 N., R. 108 W. and Section 13, T. 31 N., R. 109 W. The 76.6-acre site is located entirely on private land. BLM has issued rights-of-way for pipelines and roads to and from the facility.

2.3.2.7 Storage Yards

There are seven storage yards located in the PAPA that are located within various Operator leaseholds. The total surface disturbance for the storage yards is 54.0 acres.

2.3.2.8 BP Amoco Field Office

The PAPA ROD allowed construction of a BP Amoco Field Office. It was constructed in Section 26, T. 29 N., R. 107 W.

2.3.3 Drilling Rigs

Restriction on the number of drilling rigs present at any one time in the PAPA was not carried forward from the PAPA EIS to the PAPA ROD (BLM, 2000b). BLM concluded that limiting the number of drilling rigs (on federal and non-federal lands and minerals, combined) would be difficult to manage. Furthermore, BLM noted that seasonal restrictions to protect wildlife under the Preferred Alternative (*Resource Protection Alternative on Federal Lands and Minerals*) would impose limits on the number of drilling rigs within specific MAs and would control the number of drilling rigs operating in the PAPA at any one time. Other factors including, but not limited to, the availability of drilling rigs and workers, market price of natural gas, and budgetary constraints, would limit drilling rigs.

The number of drilling rigs operating in the PAPA has increased since issuance of the PAPA ROD (BLM, 2000b). In each year, the fewest rigs have been present between November and April, which corresponds with BLM's seasonal restrictions for surface-disturbing activities in big game crucial winter ranges. There has been an increase in wells drilled and drilling rigs present each month during winter beginning in 2003-2004, due to the exceptions granted by BLM and the Decision Records for several limited winter drilling proposals (BLM, 2004a, 2005a, 2005b, 2005c, and 2006b).

Based on available data, drilling rigs averaged 62 days to drill wells to depths averaging 13,600 feet. There is considerable variation in the average amount of drilling time and bottom-hole depth, regardless of which geologic formation is targeted. Efficiency has improved as more wells have been drilled, and the Proponents estimate that most wells could be drilled within 50 days. The deepest producing wells in the PAPA are under 14,600 feet total vertical depth and there are approximately 92 of them in the range of 14,000 to 14,600 feet.

2.3.4 Other Allowed Components

Production Facilities. The PAPA ROD (BLM, 2000b) allowed up to 700 production facilities on individual well pad locations. Production facilities include tanks, separators, dehydration units, remote telemetry for computed assisted operations, and other equipment. Most of the well pads with producing wells have dedicated production facilities, although some production facilities are shared.

Central/off-site production facilities (C/OSPFs) were envisioned in the PAPA ROD (BLM, 2000b) for efficient operation of wells and/or to avoid or minimize disturbance to sensitive resources (wildlife, sensitive viewsheds, etc.) in areas with 80- and 40-acre well spacing. The PAPA ROD allowed C/OSPFs on a case-by-case basis. Directionally drilling one or more wells from a single pad was envisioned and could be authorized on a case-by-case basis. Currently, there are no C/OSPFs in the PAPA, although there has been extensive directional drilling since July 2000.

Water Wells. The PAPA ROD (BLM, 2000b) allowed for water supply wells drilled on natural gas well pads as water sources for drilling, completions, pipeline hydrostatic testing, and dust abatement. There were no limits placed on the number of water supply wells in the PAPA ROD because they are permitted through the Wyoming State Engineer's Office (SEO) appropriation process. To date, approximately 100 Operator-drilled water wells are being monitored in the PAPA. Well depths range from 300 to 1,000 feet. Most of the Operator-drilled water wells are on the same pad as natural gas wells.

Central Delivery Points. In 2005, QGM constructed three Central Delivery Point (CDP) facilities within Questar's leaseholds, all of which were constructed on existing pads within existing disturbance. The purpose of the CDPs is to receive condensate, produced water, and natural gas from producing wells. The three CDPs were located on the Mesa 15-06, Stewart Point 16-18, and Mesa 14-16 well pads. Impacts associated with construction and operation of the CDPs on federal lands were analyzed under NEPA, and Categorical Exclusions (CXs) were issued. The CDP located on the Mesa 14-16 well pad is on state lands. Impacts associated with an underground 25 kV three-phase power distribution line to the Stewart Point 16-18 CDP was analyzed by BLM and the power distribution line was installed in 2005.

Water Handling Facility. QGM proposed to install a water storage facility near Highway 351. Impacts associated with the emergency tank storage facility were analyzed under NEPA by BLM, and an EA was issued; however, the facility was not constructed.

2.4 ALTERNATIVES

This section briefly discusses the Alternatives analyzed in detail in the PAPA DEIS (BLM, 1999a), introduces the Alternatives analyzed in detail in this Final SEIS, and presents Alternatives considered, but not analyzed in detail.

2.4.1 Alternatives Analyzed in the PAPA DEIS

The PAPA DEIS (BLM, 1999a) analyzed three action Alternatives; the *Standard Stipulation Alternative*, the *Resource Protection Alternative on Federal Lands and Minerals*, and the *Resource Protection Alternative on All Lands and Minerals*.

2.4.1.1 Standard Stipulation Alternative

This Alternative assumed that either 500 or 700 producing well pads would be developed entirely under BLM's Standard Mitigation Guidelines (Appendix A of the PAPA DEIS – BLM, 1999a), with lease stipulations on development issued at the time of leasing. Impact analysis was based on an average of up to eight drilling rigs operating in the PAPA year-round. Unless required by lease stipulations, the *Standard Stipulations Alternative* generally did not limit the density of development (the number of potential well pad locations per section) within any of the SRMZs. In most cases, the Alternative addressed anticipated impacts from locating up to 16 well pads per section in each of the SRMZs.

2.4.1.2 Resource Protection Alternative on Federal Lands and Minerals

This Alternative analyzed the impacts of implementing the *Resource Protection Alternative* on only federal lands and minerals. This Alternative assumed that either 500 or 700 well pads would be developed using BLM's Standard Mitigation Guidelines and lease stipulations. It disclosed the types of impacts that would remain even if BLM implemented additional controls to reduce impacts. It evaluated the impacts of slower paced development by limiting the number of drilling rigs operating at any one time in the PAPA to five. This Alternative considered pad drilling as an option for reducing surface disturbance and human presence in the PAPA. The term "pad drilling" refers to multiple wells with different bottom-hole locations directionally drilled from a single surface well pad. Use of centralized production facilities was advanced in this Alternative to eliminate storage of condensate and produced water on each well pad, collecting them at central locations. This Alternative, as modified in the PAPA ROD (BLM, 2000b), was implemented by BLM.

2.4.1.3 Resource Protection Alternative on All Lands and Minerals

This Alternative analyzed the impacts of implementing the *Resource Protection Alternative* throughout the PAPA (on all lands and minerals). This Alternative assumed that either 500 or 700 well pads would be developed using BLM's Standard Mitigation Guidelines and lease stipulations. The implementation of mitigation measures (pad drilling and centralized production facilities) on all lands in the PAPA was evaluated.

2.4.2 Alternatives Analyzed in Detail

In this Final SEIS, five Alternatives are analyzed in detail. Supporting information for each Alternative is provided in appendices which are detailed in Table 2.4-1. Some appendices are common to all Alternatives and others are unique to one Alternative or another.

Table 2.4-1
Summary of Appendices in Relation to each Alternative

Appendix		Alternative				
No.	**Title**	**A**	**B**	**C**	**D**	**E**
1	Authorizations in the PAPA ROD	X	--	--	--	--
2	Scoping Comments	X	X	X	X	X
3	Review of Impacts to Socioeconomics, Air Quality, and Wildlife Based Upon Various Levels of Drilling Rigs	--	X	X	X	--
4	BLM's Practices and Restrictions for the Pinedale Anticline Project Area	X	X	X	X	X
5	Transportation Plans					
5A	Alternative A – Transportation Plan	X	--	--	--	--
5B	Alternative B – Transportation Plan	--	X		--	--
5C	Alternative C – Transportation Plan	--	--	X	--	--
5D	Alternative D – Transportation Plan	--	--	--	X	--
5E	Alternative E – Transportation Plan	--	--	--	--	X
6	Pipeline Design and Construction Procedures	X	X	X	X	X
7	Development Procedures for Wellfield Activities	X	X	X	X	X
8	Reclamation Plans					
8A	Alternative A – Reclamation Plan	X	--	--	--	--
8B	Alternative B – Reclamation Plan	--	X	--	--	--
8C	Alternative C – Reclamation Plan	--	--	X	--	--
8D	Alternatives D and E – Reclamation Plan	--	--		X	X
9	Wildlife and Habitat Mitigation Plans					
9A	Alternative B – Wildlife and Habitat Mitigation Plan	--	X		--	--
9B	Alternative C – Wildlife and Habitat Mitigation Plan	--	--	X	--	--
9C	Alternative D – Wildlife and Habitat Mitigation Plan	--	--	--	X	--
10	Wildlife Monitoring and Mitigation Matrix	--	--	--	X	--
11	Alternative D Mitigation	---	--	--	X	--
12	Hazardous Materials Summary	X	X	X	X	X
13	Individual Management Area Objectives and Restrictions/Limitations for Alternative E	--	--	--	--	X
14	Wyoming Protocol Agreement	X	X	X	X	X
15	Programmatic Agreement Shell/Ultra	X	X	X	X	X
16	Air Quality Impact Tables 2005	X	X	X	X	X
17	Wildlife Technical Report	X	X	X	X	X
18	Air Quality Impact Tables Project Alternative Modeling	X	X	X	X	X
19	Models of Potential Impacts to Groundwater	X	X	X	X	X

Differences in the Alternatives focus on areas where year-round development (construction, drilling, completion, and production) would be allowed, with exceptions to seasonal restrictions for big game (pronghorn and mule deer) and greater sage-grouse seasonal habitats. Alternatives A and E include only limited year-round development through 2013-2014 as authorized in BLM's 2004 Decision Record (BLM, 2004a) in Questar's leaseholds. Alternatives B, C, and D include year-round development in certain areas within big game and greater sage-grouse seasonal habitats. Guidelines relating to protection of raptor nesting and wintering habitats would apply under all Alternatives as outlined in Appendix 4. All Alternatives include provisions for Adaptive Management and varying levels of Proponent-committed mitigation, as well as mitigation required and suggested by the BLM.

The PAPA ROD (BLM, 2000b) established seasonal restrictions in the form of guidelines for the protection of big game and greater sage-grouse in seasonal habitats. These restrictions as stated in Appendix A of the PAPA ROD are:

Big Game – to protect important big game winter habitat, activities or surface use will not be allowed from November 15 through April 30 within certain areas encompassed by the authorization. The same criteria apply to defined big game birthing areas from May 1 through

June 30. The BLM can and does grant exceptions to seasonal restrictions if the wildlife biologist, in consultation with the WGFD, feels that granting an exception will not jeopardize the population being protected. Wildlife biologists use a set of criteria when considering a request for an exception.

Sage Grouse – Operators will comply with the following guidelines for avoidance of sage-grouse leks and nesting areas:

Surface disturbance within 0.25 mile of a sage grouse lek will be avoided. Linear disturbances such as pipelines, seismic activity, etc., could be granted exceptions since they do not have long-term, continuous activity associated with them that could impact breeding success.

- Permanent (life of the project), high profile structures such as buildings and storage tanks will not be constructed within 0.25 mile of a lek.
- During the sage grouse mating season, from March 1 through May 15, surface uses and activities will not be allowed between the hours of midnight and 9:00 a.m., within a 0.5-mile radius of active leks (i.e., leks occupied by mating birds).
- Operators will restrict construction activities from March 1 through July 31 within a 2.0-miles radius of active sage grouse leks in suitable sage grouse nesting habitat as determined during on-site reviews of proposed development areas. If an active nest is located, an appropriate buffer area will be established on a case-by-case basis to prevent direct loss of the nest or indirect impacts from human-related disturbance. The appropriate buffer distance will vary, depending on topography, type of activity proposed, and duration of disturbance.
- If active sage grouse strutting or nesting is identified in an area proposed for disturbance which is outside the dates of March 1 through July 31, surface-disturbing activities will be delayed in the area until strutting or nesting is completed.
- If existing information is not current, field evaluations for sage grouse leks and/or nests will be conducted by a qualified biologist prior to the start of activities in potential sage grouse habitat. These field evaluations for leks and/or nests will be conducted if project activities are planned in potential sage grouse habitat from February 1 through July 31. BLM wildlife biologists will ensure that such surveys are conducted using proper survey methods.

Subsequent to the PAPA ROD (BLM, 2000b), BLM issued guidance for the protection of greater sage-grouse habitat in Instruction Memorandum (IM) WY2004-057 (BLM, 2004b), which set the current temporal and spatial restrictions for greater sage-grouse habitat. These restrictions are:

- Sage-grouse leks: 1) Avoid surface disturbance or occupancy within 0.25 mile of the perimeter of occupied sage-grouse leks. 2) Avoid human activity between 8 p.m. and 8 a.m. from March 1 - May 15 within 0.25 miles of the perimeter of occupied sage-grouse leks.
- Sage-grouse nesting/early brood-rearing habitat: Avoid surface disturbing and disruptive activities in suitable sage-grouse nesting and early brood-rearing habitat within two miles of an occupied lek, or in identified sage-grouse nesting and early brood-rearing habitat outside the 2-mile buffer from March 15 - July 15.
- Sage-grouse winter habitat: Avoid disturbance and disruptive activities in sage-grouse winter habitat from November 15 - March 14.

These restrictions are currently being utilized by the BLM. It is important to note the change in terminology. The PAPA ROD requires: “During the sage grouse mating season, from March 1 through May 15, surface uses and activities will not be allowed between the hours of midnight and 9:00 a.m., within a 0.5-mile radius of active leks (i.e., leks occupied by mating birds), while the IM requires: “Avoid surface disturbance or occupancy within 0.25 mile of the perimeter of occupied sage-grouse leks.”

An active lek is defined (BLM, 2004b) as “Any lek that has been attended by male sage-grouse during the strutting season. Presence can be documented by observation of birds using the site or by signs of strutting activity.” An occupied lek is defined as “A lek that has been active during at least one strutting season within the last 10 years.” Management protection has been afforded to occupied leks.

The reason for the seasonal restriction on drilling and other surface disturbing activities is to inform the land user that if activities are to be conducted during the seasonally restricted period, it would be necessary to assess the impacts of the proposal on the resource being protected by the restriction. If the proposal would offer the same level of protection, or a higher level of protection than the seasonal restriction, it is reasonable for BLM to approve the proposal. One of the purposes of the analysis in this Final SEIS is to determine if one or more of the Alternatives would result in better protection for big game and greater sage-grouse populations than what is currently afforded by the seasonal restrictions set forth in the PAPA ROD.

Alternative A (the No Action Alternative) includes development through 2011 under current management practices in the PAPA, which would be managed as allowed in the PAPA ROD (BLM, 2000b). Alternatives B, C, and D are similar in that they include year-round development through 2025 with 4,399 additional wells on 250 additional well pads. Alternatives B, C, and D are different in that they have different core areas, Alternatives C and D have additional development areas (DAs) and Alternative D includes a Potential Development Area (PDA). Alternative E includes an additional 4,399 wells but implementation would require a slower pace of development with construction of 415 additional well pads. Development under Alternative E would occur through 2033. Alternative E includes MAs similar to Alternative A but the MAs have been revised to reflect current lease status so that expired leases within other MAs have been re-assigned to MA 3 – *Unleased Federal Minerals*. The Alternative E Core Area is the same as the Alternative D Core Area. Under Alternative E, the Alternative D PDA is defined as the Buffer Area. The area outside of the PDA under Alternative D and the Buffer Area under Alternative E are defined as the Flanks.

Year-round development under Alternatives A and E would be limited to that allowed in BLM’s 2004 Decision Record (BLM, 2004a) in Questar’s leases in the northern portion of the PAPA through winter 2013-2014. Alternatives B, C, and D include year-round development by exception in otherwise seasonally restricted seasonal habitats for big game and greater sage-grouse. “Where” development would ultimately occur is dictated by the location of the resource. Core areas have been defined to delineate “how” and “when” year-round development would be allowed under Alternatives B, C, and D. A comparison of the elements of each of the five Alternatives is provided in Table 2.4-2.

Table 2.4-2
Comparison of Alternatives Analyzed in Detail

Alternative Elements	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Development Period	2011	2025	2025	2025	2033
Production Only Period	2051	2065	2065	2065	2073
Resource Recovery (TCF)	9	20 to 25	20 to 25	20 to 25	20 to 25
Number of Additional Wells	1,139	4,399	4,399	4,399	4,399
Number of New Pads	249	250	250	250	415
Proposed Total Pads in PAPA	534	not to exceed 600 total	not to exceed 600 total	not to exceed 600 total	700
Number of Pads in PAPA[1]	589	590	590	590	755
Initial Disturbance (acres)	4,123.1	12,885.6	12,885.6	12,885.6	10,427.0
LOP Disturbance (acres)	1,622.5	4,012.5	4,012.5	4,012.5	4,185.6
New Roads (miles)	99.6	100	100	100	166
New Gas Gathering Pipelines (miles)	99.6	100	100	100	166
Liquids Gathering Pipelines (miles)	10.5	471	471	471	31.5
Development Management	By MA Objectives- in MAs 1 through 9	By CDAs in Core Area of 43,624 acres Three CDAs of up to 8 square miles each not to exceed 19 square miles total	By DAs in Core Area of 39,678 acres DA-1 12,644 acres DA-2 8,903 acres DA-3 7,127 acres DA-4 7,964 acres DA-5 3,040 acres	By DAs in Core Area of 45,415 acres – also by PDA of 24,875 acres DA-1 14,872 acres DA-2 9,222 acres DA-3 7,127 acres DA-4 7,964 acres DA-5 6,230 acres PDA-1 5,370 acres PDA-2 3,845 acres PDA-3 3,625 acres PDA-4 4,532 acres PDA-5 7,503 acres	By MAs Objectives and Limitations in MAs 1 through 9 in Core Area (45,415 acres), Buffer Area (24,875 acres), and Flanks
Year-Round Development	Allowed according to BLM's 2004 Decision Record in Questar's leaseholds through 2013-2014[2] Allowed within seasonally restricted areas by exception	Allowed within Core Area CDAs Allowed within seasonally restricted areas by exception	Allowed within DAs 1-4 Allowed within seasonally restricted areas by exception	Allowed within Core Area, possibly within PDA Allowed within seasonally restricted areas by exception	Allowed according to BLM's 2004 Decision Record in Questar's leaseholds through 2013-2014[2] Allowed within seasonally restricted areas by exception

Alternative Elements	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Delineation	Allowed anywhere within seasonal timing stipulations Allowed within seasonally restricted areas by exception	Allowed within the Core Area – estimated completion within 5 years Allowed within seasonally restricted areas by exception	Allowed anywhere within seasonal timing stipulations Allowed within seasonally restricted areas by exception	Allowed within the Core Area, possibly in PDA Allowed within seasonally restricted areas by exception except on federal suspended and term NSO leases for at least 5 years	Allowed anywhere within seasonal timing stipulations Allowed within seasonally restricted areas by exception
Concentrated Development (simultaneous construction, drilling, completion, production)	Limited – similar to current management practices	Yes	Yes	Yes	Limited – similar to current management practices
Drilling Rig Movement	Moves to accommodate seasonal restrictions resulting in more rig moves	Rigs stay on pad until pad completed to extent practicable resulting in less rig moves	Rigs stay on pad until pad is completed and never come back resulting in less rig moves	Rigs stay on pad until pad completed to extent practicable resulting in less rig moves	Moves to accommodate seasonal restrictions resulting in more rig moves
Interim Pad Reclamation	Limited	Yes	Yes	Yes	Limited
Big Game (pronghorn and mule deer) Seasonal Timing Restrictions	Applies in restricted areas except for as allowed according to BLM's 2004 Decision Record in Questar's leaseholds through 2013-2014[2]	Apply in all seasonally restricted areas except for the CDAs	Applies in all seasonally restricted areas outside of the Alternative C Core Area	Applies in all seasonally restricted areas outside of the Alternative D Core Area and possibly the PDA	Applies in restricted areas except for as allowed according to BLM's 2004 Decision Record in Questar's leaseholds through 2013-2014[2]
Greater Sage-Grouse 0.25 mile NSO	Applies across entire PAPA	Applies across entire PAPA	Applies across entire PAPA	Applies across entire PAPA	Applies across entire PAPA
Greater Sage-Grouse Seasonal Timing Restrictions	Applies in restricted areas except for as allowed according to BLM's 2004 Decision Record in Questar's leaseholds through 2013-2014[2]	Apply in all seasonally restricted areas except for the CDAs and as allowed according to BLM's 2004 Decision Record in Questar's leaseholds through 2013-2014[2]	Applies in all seasonally restricted areas outside of the Alternative C Core Area	Applies in all seasonally restricted areas outside of the Alternative D Core Area and possibly the PDA	Applies in restricted areas except for as allowed according to BLM's 2004 Decision Record in Questar's leaseholds through 2013-2014[2]

Alternative Elements	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Lander Trail 0.25 mile NSO	No Surface Occupancy within 0.25 mile of the Lander Trail	No Surface Occupancy within 0.25 mile of the Lander Trail	No Surface Occupancy within 0.25 mile of the Lander Trail	No Surface Occupancy within 0.25 mile of the Lander Trail	No Surface Occupancy within 0.25 mile of the Lander Trail
Adaptive Management	Yes	Yes	Yes	Yes	Yes
BLM's Practices and Restrictions for the Pinedale Anticline Project Area	Apply Appendix 4 on a case-by-case basis	Apply Appendix 4 on a case-by-case basis	Apply Appendix 4 on a case-by-case basis	Apply Appendix 4 on a case-by-case basis	Apply Appendix 4 on a case-by-case basis
Transportation Plan	Yes Appendix 5A	Yes Appendix 5B	Yes Appendix 5C	Yes Appendix 5D	Yes Appendix 5E
Reclamation Plan	Appendix 8A	Appendix 8B	Appendix 8C	Appendix 8D	Appendix 8D
Wildlife and Habitat Mitigation Plan	No	Yes Appendix 9A	Yes Appendix 9B	Yes Appendix 9 C	No
Wildlife Monitoring and Mitigation Matrix	No	No	No	Yes Appendix 10	No
Liquids Gathering System	Continued according to BLM's 2004 Decision Record[2]	Continued according to BLM's 2004 Decision Record[2] New in Shell and Ultra's leases in central and southern portions of the PAPA	Continued according to BLM's 2004 Decision Record[2] New in Shell and Ultra's leases in central and southern portions of the PAPA	Continued according to BLM's 2004 Decision Record[2] New in Shell and Ultra's leases in central and southern portions of the PAPA	Continued according to BLM's 2004 Decision Record[2]
Computer-Assisted Operations	Limited	Yes	Yes	Yes	Limited
Federal Suspended and Term NSO Leases	No	No	No	Yes 49,903 acres	No
Compensatory Mitigation	No	3:1 if Offsite, if necessary	3:1 if Offsite, if necessary	Monitoring and Mitigation Fund	No
Emissions Reductions	None	Tier 2 equivalent reductions for NO_x on selected rigs and according to BLM's 2004 Decision Record[2]	Reduction to 2005 NO_x levels within 1 year and 80 percent additional within 5 years	Reduction to 2005 NO_x levels within 1 year and 80 percent additional within 42 months	None

[1] Includes 55 pads constructed prior to issuance of the PAPA ROD.
[2] Source: BLM, 2004a.

2.4.2.1 Components Common to All Alternatives

Project components that are common to all Alternatives are discussed below.

Leasing Decisions. Leasing decisions would not be made within the PAPA until completion of the RMP revision. Leasing decisions would then be made in conformance with the new RMP. The Wind River Front Moratorium as described on page 34 of the PAPA ROD (BLM, 2000b) would be continued.

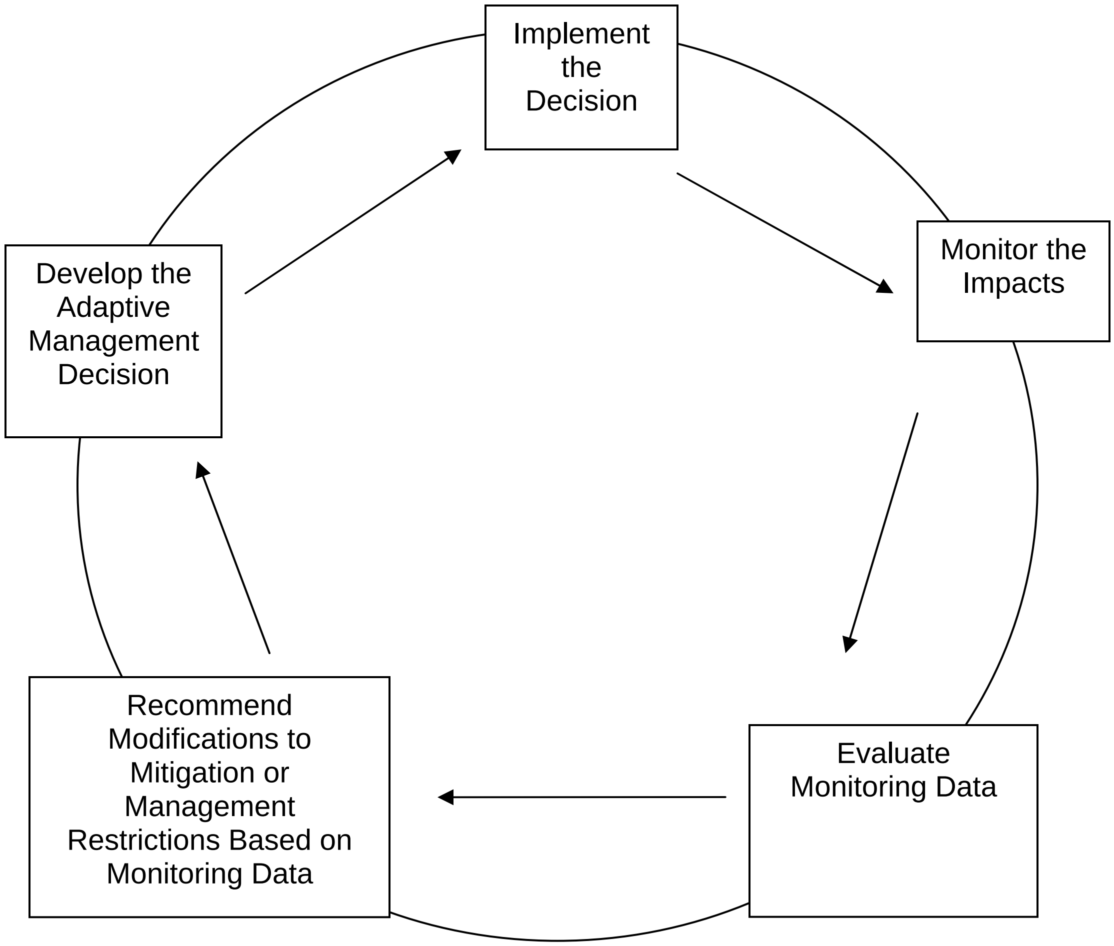
Performance-Based Management. Performance-based objectives have been adopted to provide BLM greater flexibility in protection of physical, environmental, and cultural resources. Successful application of performance- or outcome-based resource management objectives require implementation of Adaptive Management principles, specifically requiring implementation of monitoring and subsequent evaluation to determine whether or not the requirements and/or standards (or use of new techniques and/or practices) have been applied and whether the desired objective has been achieved in a timely and efficient manner.

Adaptive Management. All Alternatives analyzed in this Final SEIS include elements of Adaptive Management. Alternative A includes Adaptive Management as described in the PAPA ROD (BLM, 2000b), which includes continuation of the PAWG. Adaptive Management under Alternatives B, C, and D would be based on Annual Planning Meetings attended by the BLM and other federal, state, and local agencies (the Review Team). Presentations by the Operators would provide information on existing development and results of monitoring studies. Recommendations would be made to the Review Team for future delineation and development. The Operators Annual and 10-year plans for development and delineation would be reviewed. The need for monitoring and mitigation as well as reclamation to offset impacts would be determined.

The decision to adapt management in order to meet resource objectives would be made and implemented by the BLM AO, see Figure 2.4-1. Only Alternative D includes a Wildlife Monitoring and Mitigation Matrix (Appendix 10) that would trigger specific Adaptive Management responses based upon monitoring information. For all Alternatives, in addition to the Annual Planning Meeting, the PAWG would continue to be an advisory group to the BLM.

Planning Process. The objectives and operating standards would be presented, reviewed, and implemented in the following steps:

- **Pre-application Consultation.** The Operators would present preliminary plans to the BLM each year for activities that would occur during the following field season. During the pre-application consultation, the Operators would be informed of BLM procedures and acceptable operating standards applicable to the proposed activities. The Operators would be required to have met all necessary federal, state, and local permit requirements prior to the beginning of field work. The BLM, the Operators, and other affected parties may visit the proposed site to identify issues and discuss alternatives during the pre-application consultation.
- **Evaluate Application.** BLM would review the proposal to:
  - Determine if the proposal complies with all applicable Outcomes and Operating Standards; this may be accomplished by adhering to the recommended requirements/standards or by the use of new techniques/practices that meet the objective(s).
  - Additional environmental analysis (e.g., EA or EIS), may be required by the BLM prior to approving new mitigation that may be proposed to address issues identified throughout the consultation and planning process.
  - Identify appropriate monitoring levels to determine the effectiveness of the mitigation, applicable operating standards, or proposed new operating techniques and methods.



Adaptive Management Framework

Figure 2.4-1
Adaptive Management Framework

- **Review Written Application for Completeness.** Operators and the BLM would meet again to finalize plans for implementation. After initial review of the written application, the application may be rejected or accepted or additional information may be requested.
- **Issue Authorization**. BLM would issue authorizations with appropriate terms and conditions of approval identified or attached.

Mitigation Requirements. The BLM would incorporate environmental Best Management Practices (BMPs) into the APD Surface Use Plan of Operations by the Operator under all Alternatives. BMPs are provided in *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development Fourth edition, 2007* – a joint effort by USDI-BLM and USDA-USFS (2007), also known as the Gold Book. Proponent committed mitigation varies by Alternative.

Environmental Protection Measures. BLM's Practices and Restrictions for the Pinedale Anticline Project Area (Appendix 4) would apply to all Alternatives. The 0.25-mile buffer surrounding the Lander Trail would continue to be no surface occupancy (NSO). A NSO would also be maintained within the 0.25-mile buffer surrounding greater sage-grouse leks. These measures could be utilized on a case-by-case basis.

Transportation Requirements. The number of vehicles in and out of the PAPA on a daily basis varies seasonally. During the development period (while construction, drilling and completion are occurring), traffic would be greater in summer than in winter, due to traffic required for construction of roads, well pads, and pipelines which generally does not occur in the winter due to frozen soil conditions. Workers, material, and equipment would be transported to the PAPA over U.S. Highways 191 and 189, State Highway 351, and county and BLM roads located in the PAPA. During the production period, traffic under each Alternative is expected to be consistent through all seasons though decreasing over time as gas production declines. A comparison of traffic requirements for each of the Alternatives for 2009 (the year with the greatest development) is provided in Table 2.4-3 below. Transportation Plans for the various Alternatives are provided in Appendix 5.

Table 2.4-3
Comparison of Traffic (vehicles per day)
During Development for all Alternatives in 2009

	Alternatives A andE[1]			Alternatives B, C and D		
	Light	Heavy	Total	Light	Heavy	Total
Summer	1,917	1,061	2,978	622	600	1,222
Winter	1,547	692	2,239	521	448	969

[1] Shell/Ultra liquids gathering system is not included in Alternatives A and E.

Workforce Requirements. The estimated workforce requirements provided by the Proponents to develop a single well in the PAPA are provided in Table 2.4-4. The Proponents also provided estimates for operating and maintaining a producing well in the PAPA (see Table 2.4-5).

Table 2.4-4
Workforce Requirements Necessary to
Develop a Single Well under all Alternatives

Category	Average Number of Workers	Average Number of Days
Well Pad and Access Road Construction	15	5
Rig Up/Down	15	5
Drilling	25	50
Testing and Completion	20	12

Table 2.4-5
Workforce Requirements Necessary to Operate and Maintain a Single Well[1, 2]

Development Scenario	Average Number of Workers
With liquids gathering system	0.076
Without liquids gathering system	0.120

[1] Estimates include field and office employees and contractors.
[2] Assumes 4,800 producing wells (existing and projected).

Pipeline Corridors. The BLM proposes the designation of three pipeline corridors to support construction and operation of future pipelines for transport of natural gas-related production (natural gas, crude petroleum, and produced water) from the PAPA (see Map 2.4-1). The corridors would mostly parallel, and be located adjacent to, existing pipeline corridors connecting the PAPA with natural gas processing plants in southwest Wyoming. The BLM has determined the need for such corridors based on:

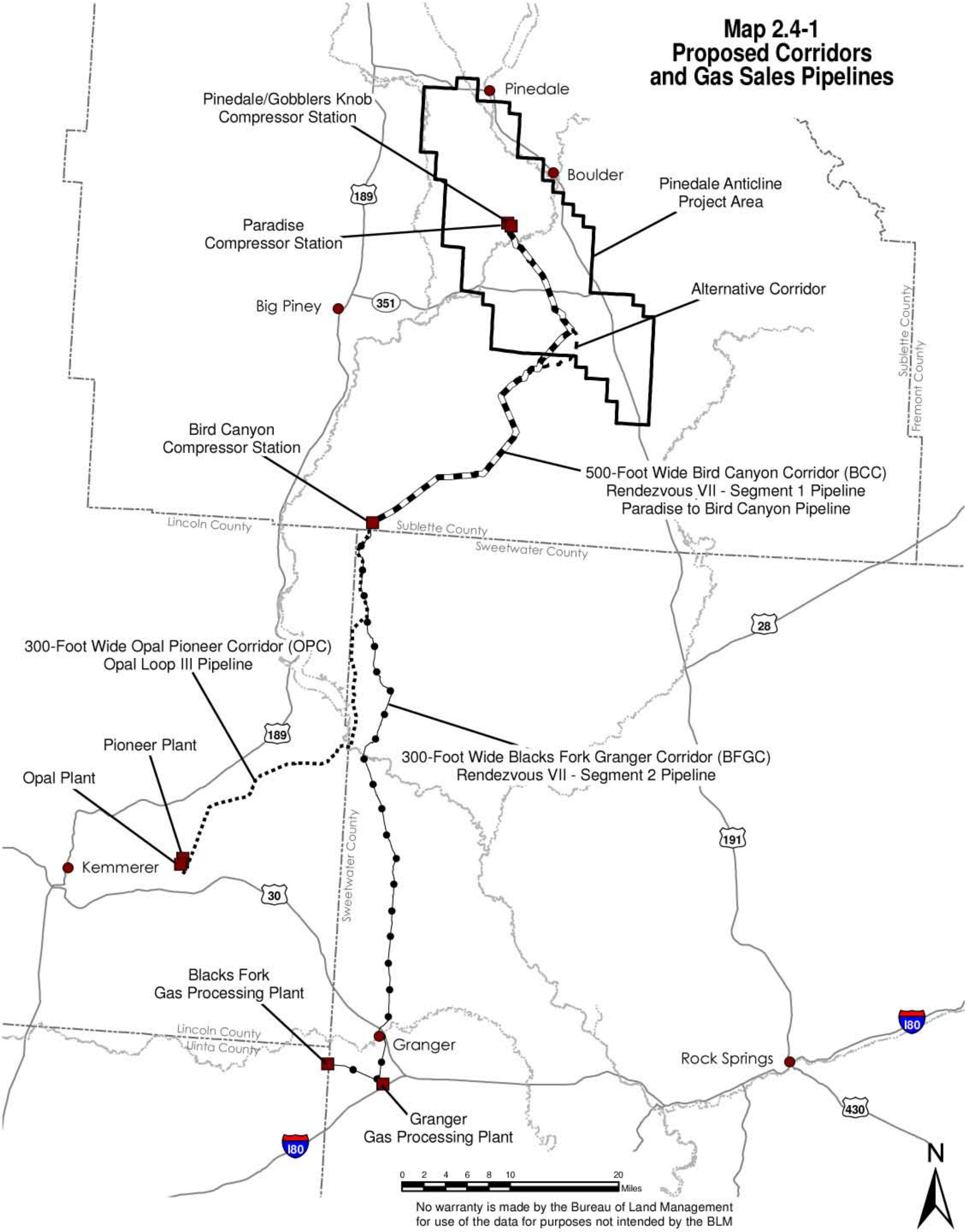
- Continued success in the development of natural gas resources in the PAPA;
- Indications, initial plans, and actual proposals by industry for the construction and operation of additional pipeline capacity to transport the increasing volumes of natural gas and other hydrocarbon products from the PAPA and Jonah Field Project Area to market;
- An agency determination that the existing pipeline corridors are full; and
- Provisions of the 2005 Energy Policy Act encouraging location of pipelines in common corridors and providing for expedited NEPA approvals.

The proposed pipeline corridors are discussed below:

1. The 500-foot wide, 41.5-mile long Bird Canyon Corridor (BCC) would mostly parallel and be adjacent to the existing 200-foot wide pipeline corridor between the PAPA (Pinedale/Gobblers Knob and Paradise compressor stations, Section 2, T. 31 N., R. 109 W.) and the Bird Canyon Compressor Station (Section 34, T. 27 N., R. 111 W.)
2. The 300-foot wide, 62.1-mile long Blacks Fork Granger Corridor (BFGC) would mostly parallel and be adjacent to the existing 200-foot wide pipeline corridor between the Bird Canyon Compressor Station and the Blacks Fork Gas Processing Plant (Section 10, T. 18 N., R. 112 W.) with an intermediate connection into the Granger Gas Processing Plant (Section 16, T. 18 N., R. 111 W.).
3. The 300-foot wide, 45.5-mile long Opal Pioneer Corridor (OPC) would mostly parallel and be adjacent to the existing 200-foot wide pipeline corridor between the Bird Canyon Compressor Station and the Opal Gas Processing Plant (Section 27, T. 21 N., R. 114 W.) with an intermediate connection into the Pioneer Gas Processing Plant (Section 22, T. 21 N., R. 114 W.).

Of the 41.5 miles of proposed BCC between the adjacent Pinedale/Gobblers Knob and Paradise compressor stations and the Bird Canyon Compressor Station, approximately 20.2 miles would be located away from the boundary of the existing pipeline corridor. Approximately 18.8 miles of the 20.2 miles would be located on BLM-administered public lands.

Approximately 1.8 miles (0.8 mile of federal lands) of the proposed 300-foot wide, 62.1-mile long BFGC between Bird Canyon Compressor Station and the Blacks Fork Gas Plant would be located away from the boundary of the existing pipeline corridor. The location of the proposed 300-foot wide, 45.5-mile long OPC between the Bird Canyon Compressor Station and the Opal Gas Processing Plant would be adjacent to an existing corridor for its entire length.


Map 2.4-1
Proposed Corridors
and Gas Sales Pipelines
Pinedale
Pinedale/Gobblers Knob
Compressor Station
Boulder
Pinedale Anticline
Project Area
189
Paradise
Compressor Station
Alternative Corridor
Big Piney
351
Sublette County
Fremont County
Bird Canyon
Compressor Station
500-Foot Wide Bird Canyon Corridor (BCC)
Rendezvous VII - Segment 1 Pipeline
Paradise to Bird Canyon Pipeline
Lincoln County
Sublette County
Sweetwater County
28
300-Foot Wide Opal Pioneer Corridor (OPC)
Opal Loop III Pipeline
Pioneer Plant
189
Opal Plant
300-Foot Wide Blacks Fork Granger Corridor (BFGC)
Rendezvous VII - Segment 2 Pipeline
191
Kemmerer
30
Sweetwater County
Blacks Fork
Gas Processing Plant
Lincoln County
Uinta County
Granger
Rock Springs
I80
430
Granger
Gas Processing Plant
I80
0 2 4 6 8 10 20
Miles
N
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Gas Sales Pipelines. RGS proposes to construct a 103.6-mile long, 30-inch diameter, natural gas pipeline (Rendezvous Phase VII or RVII Pipeline) within the proposed BCC and BFGC to transport natural gas produced in the PAPA to gas processing plants. Segment 1 of the proposed RVII Pipeline (41.5 miles) would be located in the BCC, beginning at the Pinedale/Gobblers Knob Compressor Station and ending at the Bird Canyon Compressor Station (see description of the BCC above). Segment 2 of the proposed RVII Pipeline (62.1 miles) would begin at the Bird Canyon Compressor Station and end at the Blacks Fork Processing Plant (see description of the BFGC above). It is anticipated that the RVII Pipeline would be constructed after 2008.

JGGC proposes to construct a 41.5-mile long, 36-inch natural gas pipeline (Paradise to Bird Canyon or PBC Pipeline) and a connecting 45.5-mile long, 30-inch pipeline (Opal Loop III Pipeline) to transport natural gas from the PAPA to gas processing plants (see Map 2.4-1). The PBC Pipeline would be located in the BCC and would parallel Segment 1 of the RVII Pipeline. The Opal Loop III Pipeline would be located in the OPC and would parallel the Bridger Pipeline that was constructed in 2006. It is anticipated that the PBC and Opal Loop III pipelines would be constructed after 2008.

The proposed RVII Pipeline (segments 1 and 2) and the PBC and Opal Loop III pipeline projects would include construction of ancillary facilities (valves, pigging equipment, side taps, and metering equipment). Table 2.4-6 shows the initial disturbance and the LOP disturbance for the pipelines. Each pipeline project would require a permanent right-of-way of 50 feet for operation and maintenance. The entire construction right-of-way and permanent right-of-way would be revegetated. It is assumed that approximately 1.0 acre would be required for each pipeline for permanent ancillary aboveground facilities. Construction procedures for the proposed pipelines are included in Appendix 6.

Table 2.4-6
Estimated Initial and Life-of-Project Disturbance
for Gas Sales Pipelines and Granger Gas Processing Plant

Component	Number or Miles	Total Disturbance (acres)	Life-of-Project Disturbance (acres)
30-inch RVII Pipeline[1]	103.6 miles	1,506.9	1.0
RVII temporary extra work areas[2]	168 sites	23.3	0.0
RVII6 temporary extra work areas – HDDs[3]	4 sites	8.3	0.0
Subtotal		**1,538.5**	**1.0**
36-inch PBC Pipeline[1]	41.5 miles	603.6	1.0
PBC temporary extra work areas[2]		9.4	0.0
PBC temporary extra work areas – HDDs[3]	2 sites	4.2	0.0
Subtotal		**617.2**	**1.0**
30-inch Opal Loop III Pipeline[1]	45.5 miles	661.8	10
Opal Loop III temporary extra work areas[2]		10.5	0.0
Subtotal		**672.3**	**1.0**
Granger Gas Processing Plant[4]	1 site	86.4	86.4
Total Sales Pipelines/Gas Plant	**1 site**	**2,914.4**	**89.40**

[1] Disturbance based on 120 foot construction right of way width.
[2] Temporary extra work areas are required for road, foreign line, historic trail, and waterbody crossings.
[3] Horizontal directional drills.
[4] Granger Gas Processing Plant analyzed for air quality impacts only.

Gas Processing Plant Expansion. RGS proposes to expand the existing 33.6-acre Granger Gas Processing Plant by 86.4 acres, for a total of 120 acres on BLM-administered public lands in Section 16, T. 18 N., R. 111 W. The purpose of the proposed expansion is to construct and operate additional natural gas processing facilities to sufficiently increase processing capacity for an anticipated increased input of 600 million standard cubic feet per day (MMSCF/D) of natural gas and crude petroleum. The current Granger Gas Processing Plant capacity is 600 MMSCF/D. The expansion would represent a 100 percent increase in treatment capacity. RGS and Mountain Gas Resources (MGR) anticipate constructing and operating new facilities, including compressors, gas processing equipment, liquids handling equipment, and supporting facilities, such as office space, parking, and fencing.

Specific facility requirements, engineering, and designs are currently under development; however, maximum emissions have been estimated, and these values have been included in the air quality impact analysis for this Final SEIS. RGS and MGR have assumed a maximum emissions scenario based on emissions from the current Granger Gas Processing Plant with a 600 MMSCF/D treatment configuration. Potential impacts to air quality associated with construction and operation of the Granger Gas Processing Plant have been analyzed in this document. Construction of the Granger Gas Processing Plant would require further NEPA analysis for impacts to other resources.

Trunk Pipelines. QGM is proposing to install two 15.3-mile long, 30- to 42-inch gas pipelines from the Stewart Point Area to the Pinedale Gobblers Knob Compressor Station along existing rights-of-way. Initial disturbance requires 370.9 acres (200-foot construction right-of-way) adjacent to, or within, existing rights-of-way for most of the route. QGM is also proposing to install an 18-mile long, 8-inch water line from the Stewart Point area to Highway 351. This requires an initial disturbance of 109.1 acres (50-foot construction right-of-way) adjacent to, or within, existing rights-of-way for most of the route.

Ancillary Facilities. Expansion of existing and construction of new ancillary facilities, including compressor stations, central gathering facilities (CGFs), stabilizer sites, and water truck unloading facilities, that are components common to all Alternatives are described below. Construction of additional ancillary facilities that are not common to all Alternatives are described within each Alternative in which they are included.

<u>Compressor Stations.</u> QGM and JGGC propose expansion of three compressor stations in the PAPA and one compressor station outside of the PAPA (Bird Canyon Compressor Station) before 2011 (see Table 2.4-7). The expansions include an additional 267,038 hp of compression, with additional LOP disturbance of 90 acres within the PAPA.

<u>Central Gathering Facilities.</u> QGM is proposing six additional CGFs (formerly known as central delivery points) to support their existing liquids gathering system. Each CGF would require an additional 2 acres of disturbance for a LOP disturbance of 12 acres.

<u>Stabilizer Facilities.</u> QGM is proposing to expand the stabilizer site near the Pinedale/Gobblers Knob Compressor Station in support of their existing liquids gathering system. This expansion would require an additional LOP disturbance of 5 acres.

<u>Water Truck Unloading Facilities.</u> QGM is proposing to install truck unloading facilities near Highway 351 in the PAPA in support of their existing liquids gathering system. QGM's water trucking facility would require a LOP disturbance of 7 acres. QGM is proposing an additional truck unloading facility at the Falcon Compressor Station that would require an additional LOP disturbance of 15 acres.

Table 2.4-7
Compressor Station Expansion Common to all Alternatives

Compressor Station Name	Field	Owner	Location	Additional Compression (hp)	Additional Disturbance (acres)
Pinedale/Gobblers Knob	PAPA	QGM	Section 2, T. 31 N., R. 109 W.	31,000 (2009)	20
Paradise	PAPA	JGCC	Section 2, T. 31 N., R. 109 W.	59,000 (2011) 125,000 (2015)	40
Falcon	PAPA	JGCC	Section 36, T. 30 N., R. 108 W.	7,366 (2011) 30,000 (2015)	30
Bird Canyon	SE of Jonah	JGCC	Section 34 T. 27 N., R. 111 W.	14,672 (2011)	0
Total				**267,038**	**90**

2.4.2.2 Alternative A (No Action Alternative)

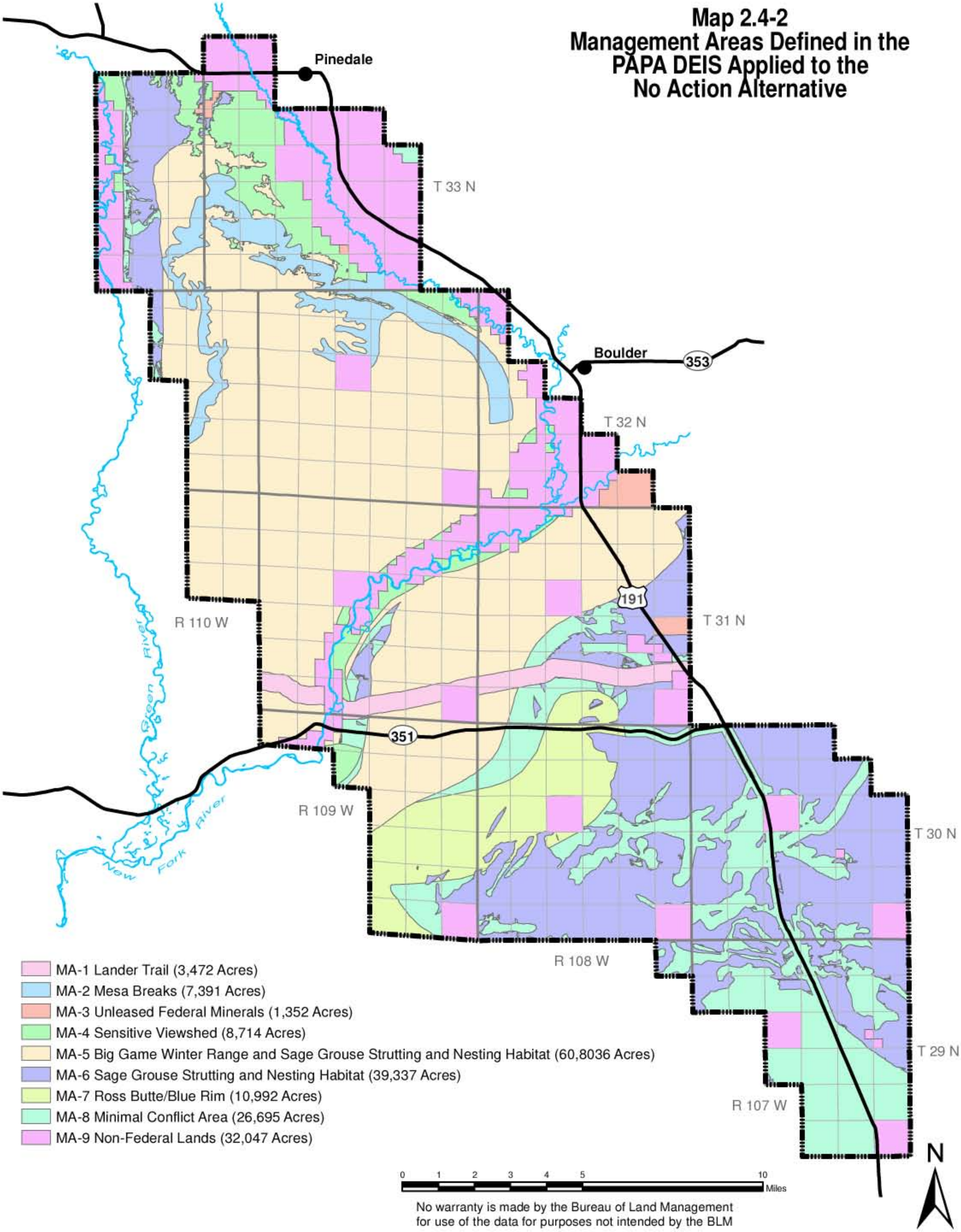
In many instances, the No Action Alternative means “no project” when a new project is proposed. The No Action Alternative can also mean “no change,” in this case, from BLM’s current management in the PAPA. In this Final SEIS, the No Action Alternative has elements of both meanings: the Operators’ Proposed Action would not occur and BLM would continue to manage natural gas development in the PAPA, based on all provisions of the PAPA ROD (BLM, 2000b) and subsequent Decision Records (BLM, 2004a, 2005a, 2005b, 2005c, and 2006b). Both meanings are consistent with the USDI’s (2004) NEPA Revised Implementing Procedures. Mitigation under the No Action Alternative would be the measures set forth in the PAPA ROD.

Continued Management Practices. The No Action Alternative is based on elements allowed by the PAPA ROD (BLM, 2000b) and subsequent BLM Decision Records (BLM, 2004a, 2005a, 2005b, 2005c, and 2006b) including:

- Allowed Project Components (PAPA ROD Section 2);
- Administrative Requirements and Conditions of Approval (PAPA ROD Section 3);
- Management Area Exploration and Development Restrictions and Limitations for Resource Protection (PAPA ROD Section 4); and
- Allowed project components in subsequent Decision Records (Appendix 1).

Development in the PAPA beyond the limits and analysis thresholds specified in the PAPA ROD would require additional environmental review. The limits and analysis thresholds are still in place in the No Action Alternative. The PAPA ROD did not specify the type or extent of the additional environmental review that would be required.

The PAPA ROD (BLM, 2000b) established limits on the number of producing well pads specified for each of nine MAs (see Map 2.4-2). There are timing and geographic restrictions on surface development in some MAs that would be carried through the No Action Alternative. For example, in MA 5 - *Big Game Winter Range and Sage Grouse Strutting and Nesting Habitat*, the PAPA ROD stipulated that drilling was not allowed on federal lands and minerals between November 15 and April 30, although BLM may grant exceptions to the restriction in consultation with WGFD (Section 1.3). Similarly, in MA 5 and MA 6 - *Sage Grouse Strutting and Nesting Habitat*, additional seasonal restrictions were stipulated to protect greater sage-grouse


Map 2.4-2
Management Areas Defined in the
PAPA DEIS Applied to the
No Action Alternative
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
MA-1 Lander Trail (3,472 Acres)
MA-2 Mesa Breaks (7,391 Acres)
MA-3 Unleased Federal Minerals (1,352 Acres)
MA-4 Sensitive Viewshed (8,714 Acres)
MA-5 Big Game Winter Range and Sage Grouse Strutting and Nesting Habitat (60,8036 Acres)
MA-6 Sage Grouse Strutting and Nesting Habitat (39,337 Acres)
MA-7 Ross Butte/Blue Rim (10,992 Acres)
MA-8 Minimal Conflict Area (26,695 Acres)
MA-9 Non-Federal Lands (32,047 Acres)
0 1 2 3 4 5 10
Miles
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seasonal habitats, applicable on a site-specific basis, but which could limit drilling activities between March 1 and July 31.

The Proponents provided information on how they would further develop the PAPA under the No Action Alternative (current management practices) while adhering to seasonal restrictions for wildlife. Using their projections, limitations to wellfield development as set forth in the PAPA ROD (BLM, 2000b) would be reached as follows:

- 212 well pad limit in MA 5 would be reached in 2009,
- Approximately 276.0 miles of road would be reached in 2011,
- 68 well pad limit in MA 7 would be reached in 2011,
- 28 well pad limit in MA 4 would be reached in 2013, and
- 700 well pad limit in the entire PAPA would be reached in 2014.

The air quality impact analysis conducted for the PAPA DEIS (BLM, 1999a) included 700 producing well locations, 900 wells drilled, and up to eight drilling rigs operating in the PAPA. It further assumed approximately 1,000 hp per drilling rig. The PAPA ROD (BLM, 2000b, page 16) states:

> *"If activity and corresponding emission assumptions and/or impacts exceed those identified in the Pinedale Anticline EIS (376.59 tons/year of NO_x emission from compressors or 693.5 tons/year NO_x emissions from the combination of construction/drilling, well production, and compression), the BLM, in cooperation and consultation with Wyoming Department of Environmental Quality-Air Quality Division (WDEQ-AQD), EPA Region VIII, USDA-Forest Service, and other affected agencies, will undertake additional cumulative air quality environmental review as required by CEQ regulations 40 CFR §1502.9(c)(1)(ii)."*

Since the PAPA ROD (BLM, 2000b) was issued, natural gas development in the PAPA has occurred at a pace greater than was analyzed in the PAPA EIS. Assumptions of drill rig emissions and NO_x emissions from the combination of construction, drilling, completion, production and compression have been exceeded. The air quality impact analysis conducted for this Final SEIS serves as the additional environmental review referenced above and analyzes the current proposal.

In the No Action Alternative, air quality impacts were modeled for the Year-2007 to show the increase in impacts beyond that predicted in the PAPA DEIS (BLM, 1999a). The 2007 air quality impact analysis discloses impacts for current allowable development in the PAPA under the No Action Alternative. The 2007 air quality impact analysis assumed approximately 900 producing wells, 43 drilling rigs operating in the summer, and 30 drilling rigs operating in the winter, with approximately 3,875 hp for each drilling rig.

Even though the limit of 212 producing well pads in MA 5 - *Big Game Winter Range and Sage Grouse Strutting and Nesting Habitat* allowed in the PAPA ROD would be attained in 2009, development would continue on pads in other MAs and on expanded pads in MA 5. It is reasonable to expect that additional analysis would be conducted after 2009. In 2011, the producing well pad limit of 68 would be reached in MA 7 - *Ross Butte/Blue Rim*. The No Action Alternative, through 2011, includes an additional 1,139 producing wells.

Project Components. The project components in the No Action Alternative include well pads, roads, and gathering (gas and liquids) pipelines. Transportation corridors, gas sales pipelines, trunk pipelines, and some ancillary facilities are also included in the No Action Alternative. These components are required for continued transport of natural gas and liquids from the PAPA as development carries forward under the PAPA ROD (BLM, 2000b), and are detailed in Section 2.4.2.1 – Components Common to All Alternatives. Projected disturbance was determined from responses provided by the Proponents regarding how they would continue to develop natural gas resources under the PAPA ROD and subsequent Decision Records (BLM, 2004a, 2005a, 2005b, 2005c, and 2006b).

The proposed project components and estimated disturbance for the No Action Alternative through 2011 (assuming continued well pad construction in all MAs in which limits in the PAPA ROD have not been reached) are provided in Table 2.4-8. Initial disturbance is defined as the amount of acreage that is disturbed at the time of construction. Initial disturbance for the No Action Alternative for well pads, roads, and gathering pipelines is 4,123.1 acres. LOP disturbance for the same components is expected to be 1,622.0 acres. LOP disturbance is defined as the amount of disturbance remaining once reclamation has occurred. For example, it is assumed that 60 percent of the initial disturbance would be reclaimed when all development activities have been completed. Likewise, it is assumed that 20 percent of the initial disturbance for roads would be reclaimed while 80 percent of the disturbance would remain to support continued operations.

Nearly all initial disturbance for pipelines would be reclaimed, leaving almost no LOP disturbance. In contrast, for other ancillary facilities such as compressor station expansion, central gathering facilities, etc., the LOP disturbance would be the same as the initial disturbance, i.e., none of the disturbance would be reclaimed until the facility is no longer in use.

Table 2.4-8
Estimated Initial and Life-of-Project
Disturbance under the No Action Alternative through 2011

Component	Number or Miles	Initial Disturbance (acres)	Life-of-Project Disturbance (acres)
Well Pads, Roads and Gathering Pipelines			
Well Pads[1]	249 new pads	2,560.0	1,024.0
Local and Resource Roads[2]	99.6 miles	603.7	483.0
Gas Gathering Pipelines[3]	99.6 miles	301.8	0.0
Liquids gathering pipelines – QGM[4]	10.5 miles	63.6	0.0
Subtotal		**3,529.1**	**1,507.0**
Trunk Pipelines and Ancillary Facilities			
30- to 42-inch Mesa Loop Lines[5]	15.3 miles	370.9	1.0
8-inch water line[6]	18.0 miles	109.1	0.5
Compressor Sites (expansion)	3 sites	90.0	90.0
Central Gathering Facilities	6 sites	12.0	12.0
Water Trucking Facility	1 site	7.0	7.0
Expand Stabilizer Site	1 site	5.0	5.0
Subtotal		**594.0**	**115.5**
Total Wellfield Components		**4,123.1**	**1,622.5**

[1] Disturbance includes new well pads and expansion of existing well pads. LOP disturbance assumes 60 percent reclamation of well pads.
[2] Assumes no new collector roads would be built within the PAPA, assumes 0.4 mile of road per new well pad with a construction right-of-way of 50 feet. LOP disturbance assumes 20 percent reclamation of roads.
[3] Assumes 0.4 mile of gas gathering pipeline per new well pad with a construction right-of-way of 25 feet.
[4] Estimate is based on number of new well pads for Questar only. Assumes 50-foot construction right-of-way.
[5] Disturbance is based on 200-foot construction right-of-way width. Includes two co-located 30- to 42-inch gas pipelines from Stewart Point to Pinedale/Gobblers Knob Compressor Station. Includes 30.6 miles of pipeline but because they are co-located, 200-foot construction right-of-way is 15.3 miles. The two pipelines will be built at separate times.
[6] Disturbance is based on 50-foot construction right-of-way width from Stewart Point area to Highway 351.

Wells and Drilling Rigs. The estimated number of wells, new well pads, and drilling rigs under the No Action Alternative by year is provided in Table 2.4-9. More drilling rigs would be operating in the summer than in the winter under the No Action Alternative because seasonal restrictions would apply in big game (pronghorn and mule deer) and greater sage-grouse seasonal habitats.

Table 2.4-9
Estimated Wells, New Well Pads, and
Drilling Rigs by Year under the No Action Alternative

Year	Wells	Well Pads	Drilling Rigs	
			Summer	Winter
2007	231	92	43	30
2008	235	53	43	30
2009	236	54	43	30
2010	217	27[1]	40	27
2011	220	23[1]	40	27
Total	**1,139**	**249**		

[1] Well pads in MA 5 have been reduced from Proponent's projections because the PAPA ROD well pad limit of 212 pads in MA 5 would be reached in 2009.

Well Pads. The Proponents have proposed additional well pads within each MA. The additional well pads have been added to the current number of well pads in the PAPA (Table 2.4-10). From the progression in Table 2.4-10, it is evident that the threshold of 212 pads in MA 5 would be reached in 2009. Likewise, the threshold of 68 pads in MA 7 would be reached in 2011, assuming all well pads support producing wells.

Table 2.4-10
Total Number of Well Pads Within each Management Area that
have been Proposed by the Proponents under the No Action Alternative

Year	Total Well Pads in Year – No Action Alternative											
	MA 4 Limit 28		MA 5 Limit 212		MA 6 Limit 183		MA 7 Limit 68		MA 8 Limit 168		MA 9 Limit 200	
	No.	Total	No.	Total	No.	Total	No.	Total	No.	Total	No.	Total
Existing 2006	--	6	--	123	--	44	--	25	--	32	--	55
2007	4	10	44	167	10	54	16	41	13	45	5	60
2008	4	14	22	189	9	63	6	47	8	53	4	64
2009	4	18	23	212	9	72	6	53	8	61	4	68
2010	4	22	0	212	8	80	6	63	7	68	2	70
2011	3	25	0	212	8	88	5	68	7	75	0	70

Under the No Action Alternative, when the limit for producing well pads is reached in a specific MA, additional development would be halted in the MA until additional environmental analyses are complete or until a well on a pad is no longer producing gas, is plugged, and the pad area is reclaimed for one full growing season. The reclaimed pad would be credited back to the MA and a new well pad could be developed, as long as the limit is not exceeded.

Initial disturbance estimates for 249 new well pads by 2011 is 2,560.0 acres, with a LOP estimated disturbance of 1,024.0 acres (Table 2.4-8). Reclamation of well pads would be similar to current reclamation practices.

Roads and Gathering Pipelines. Under the No Action Alternative, it is assumed that there would be no additional construction of collector roads in the PAPA. There would be an estimated 99.6 miles of local and resource roads constructed in the PAPA by 2011, for an initial disturbance of 603.7 acres and a LOP disturbance of 483.0 acres, assuming that 20 percent of the initial road disturbance is reclaimed after construction (see Table 2.4-8). It is estimated that there would be 99.6 miles of gas gathering pipelines and 10.5 miles of liquids gathering pipelines (continuation of existing liquids gathering system in leaseholds currently held by

Questar), for an initial disturbance of 301.8 and 63.6 acres, respectively. There is no LOP disturbance associated with construction of gathering pipelines because the entire disturbance is reclaimed after construction.

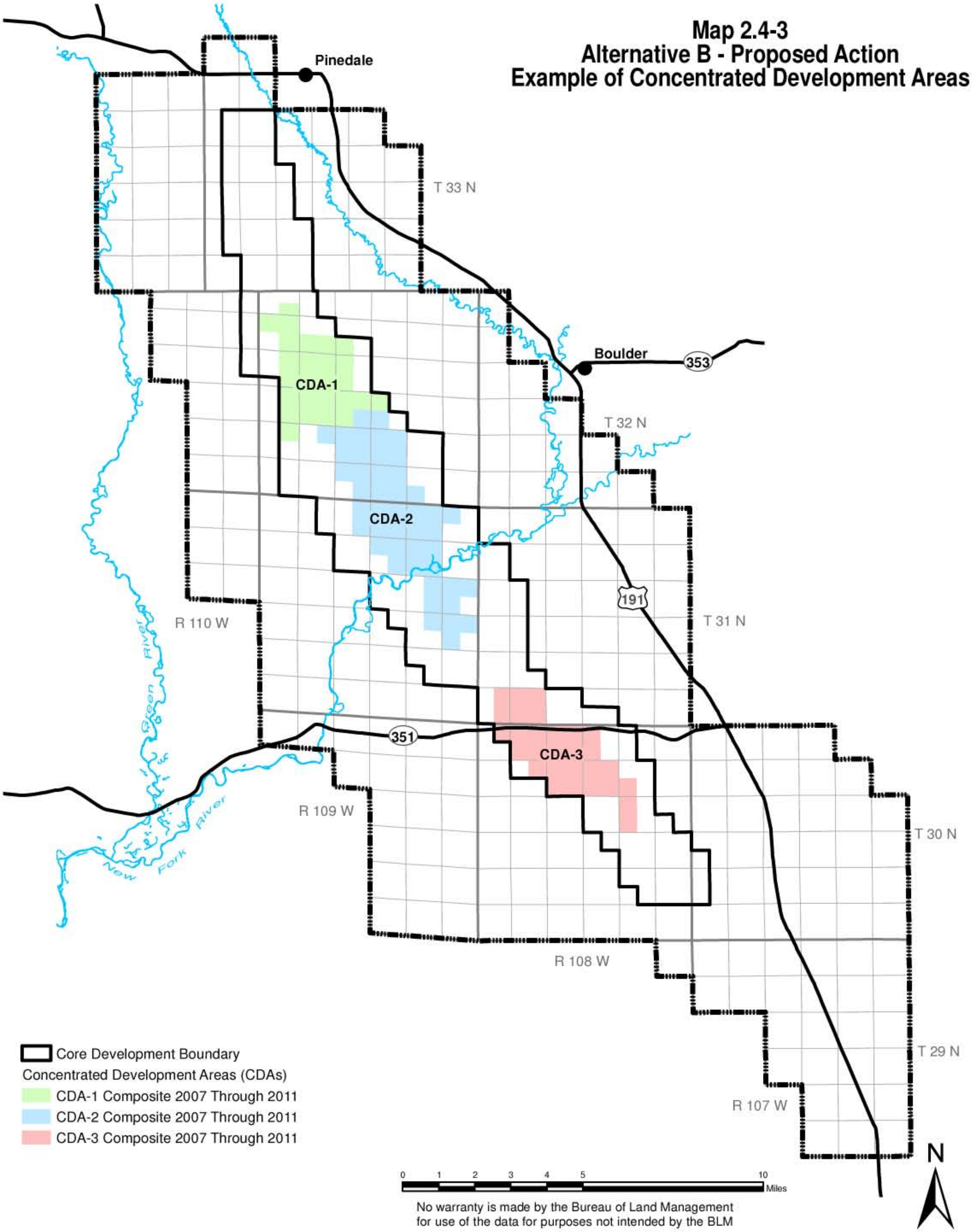
Year-Round Development. Under the No Action Alternative, year-round development would not be allowed in big game (pronghorn and mule deer) and greater sage-grouse seasonal habitats except as allowed by BLM's 2004 Decision Record (BLM, 2004a). The decision provided for limited year-round development within Questar's leaseholds through winter 2013-2014. Approved components in the Decision Record are provided in Appendix 1.

2.4.2.3 Alternative B

The Proponents have proposed a long-term development plan for the PAPA and are requesting exception to seasonal restrictions for big game (pronghorn and mule deer) and greater sage-grouse in seasonal habitats during the seasonally restricted periods. The long-term plan is referred to as "Concentrated Development" and would recover the estimated 20 to 25 trillion cubic feet (TCF) of natural gas in the PAPA. Under Alternative B, construction of new well pads, expansion of existing pads, and construction of new roads and pipelines would take place through 2023 and drilling would continue through 2025. It is estimated that wells would have a 40 year production life continuing through 2065. To provide more predictability during the development phase, the Proponents are proposing to develop a 10-year rolling forecast or development plan working with the BLM and WGFD. Each year, the Proponents would review these plans with the BLM and WGFD to seek improvements to the development plan in an attempt to further reduce impacts. Specific plans pertaining only to Alternative B include a Transportation Plan (Appendix 5B), Reclamation Plan (Appendix 8B), and Wildlife and Habitat Mitigation Plan (Appendix 9A).

The Proponents defined a "core area" (Alternative B Core Area) in the PAPA, mostly along the Anticline Crest, where the majority of development would occur (see Map 2.4-3). The Alternative B Core Area encompasses 43,624 acres (68.1 square miles), or 22 percent of the PAPA. Within the Alternative B Core Area, the Proponents have defined three Concentrated Development Areas (CDAs) that would move as pads are drilled out. Each of the three individual CDAs would not exceed 8 square miles; however, they would be tightly grouped and the combined area of the three would not exceed 19 square miles. The CDAs and their movement would leave large, contiguous blocks of land and corridors available for wildlife without active natural gas development activities. The Proponents provided examples of CDAs and how they could move from 2007 through 2011. Map 2.4-3 shows a composite of the three CDAs for 2007 through 2011. In other words, the three CDAs would most likely be somewhere in these three areas over the first 5 years, while adhering to the size restrictions stated above. The Proponents would attempt to fully develop each multi-well pad to the approved bottom-hole spacing before moving drilling rigs off of well pads. It is estimated that drilling rigs would move to a new pad an average of once per year. Pad reclamation would proceed as soon as practical when the last well on the pad is completed, reducing net disturbance as development proceeds. Interim reclamation would occur on well pads not scheduled for development activity within 2 years.

The northern-most portion of the PAPA contains mostly contiguous leases (currently held by Questar), unlike the central and southern portion, where many of the leases are in a checkerboard ownership pattern. CDA-1 (see Map 2.4-3) would be located in the northern portion of the PAPA in the Alternative B Core Area. Under Alternative B, CDA-1 would begin at the southern end of the leasehold currently held by Questar and would move north.


Map 2.4-3
Alternative B - Proposed Action
Example of Concentrated Development Areas
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
CDA-1
CDA-2
CDA-3
Green River
New Fork River
Core Development Boundary
Concentrated Development Areas (CDAs)
CDA-1 Composite 2007 Through 2011
CDA-2 Composite 2007 Through 2011
CDA-3 Composite 2007 Through 2011
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
N

The middle and southern portions of the PAPA contain leases that are held primarily by Shell and Ultra and are in a checkerboard ownership pattern in the Alternative B Core Area. Under Alternative B, Shell and Ultra propose to work together to develop their leases within CDA-2 and CDA-3. CDA-2 would initially be located at the southern boundary of CDA-1, essentially further concentrating the development. As leases are drilled out, CDA-2 would slowly move to the south. Shell and Ultra would work together to develop CDA-3 in the southern portion of the PAPA (see Map 2.4-3). CDA-3 would move to the south at approximately the same pace as CDA-2.

Delineation wells are proposed for the first 5 years (approximate) to assess production capabilities and ultimate well density required to develop their leases, both within and outside of the Alternative B Core Area. A portion of the delineation wells would be drilled on well pads with existing producing wells. Where possible, the delineation wells would be drilled in accordance with all seasonal restrictions for big game (pronghorn and mule deer) and greater sage-grouse. There may be some instances in the first 5 years where delineation wells must be drilled outside of the CDAs and outside of the Alternative B Core Area during the seasonally restricted periods. This would require an exception from BLM for development in big game (pronghorn and mule deer) and greater sage-grouse seasonal habitats during the seasonally restricted period. Once the estimated 5-year delineation period is over, all drilling in all seasons would be within the three CDAs. The well pads would be reclaimed to the size required for safe production operations.

All development drilling would be on consolidated well pads from which multiple wells would be drilled. Some delineation wells are planned to be drilled on new pads with one to three wells on the pad while other delineation wells would be drilled from existing producing pads. If commercially successful, small delineation pads would be expanded to accommodate additional wells (when they become part of a CDA), or the pads would be reclaimed if the wells are not commercially successful. Expansion of existing producing pads by up to 21 acres would be necessary to accommodate additional drilling.

Construction of ancillary facilities (compressor station expansions, CGFs, and gathering and sales pipelines) would take place both within and outside of the CDAs. Topsoil removal for well pads, roads, or other facility construction would not be conducted during frozen soil conditions. Development procedures for wellfield activities are provided in Appendix 7.

Production initiatives are proposed that are intended to result in better protection for big game and greater sage-grouse populations than what is currently afforded by the seasonal restrictions set forth in the PAPA ROD by lowering the amount and frequency of human presence year-round and throughout the production phase. One of these initiatives is the installation of a liquids gathering system in the central and southern portions of the PAPA, which would nearly eliminate trucking of produced water and condensate (see Appendix 7 for further description of the liquids gathering system). It would also allow for removal of some storage tanks on well pads that currently store condensate and produced water. Under Alternative B, the use of computer-assisted operations on multi-well pads would be expanded to reduce the number of daily visits by production personnel. New production from leases that have existing liquids gathering systems would be joined to the existing system. Shell and Ultra are proposing to install additional liquids gathering systems to transport condensate and produced water from their leases to CGFs. Production from delineation wells would be joined to the liquids gathering system, where possible, and placed within existing rights-of-way.

As part of Alternative B, the Proponents plan to implement Tier 2 equivalent emissions technology on all of their new drilling rig engines within 2 years after issuance of the ROD. Some drilling rig engines would continue to have higher emissions (i.e., Tier 0 and Tier 1);

however, these drilling rigs would be phased out after 2010. Of the 48 drilling rigs proposed by the end of 2009, 29 would have Tier 2 equivalent emission levels, 15 would have Tier 1 equivalent emission levels, and 4 would have Tier 0 equivalent emission levels.

Project Components. Estimated disturbance for each component under Alternative B is provided in Table 2.4-11. Estimates are provided for initial disturbance and LOP disturbance for each project component. Initial disturbance is defined as the amount of acreage that is disturbed at the time of construction and LOP disturbance is defined as the amount of disturbance remaining once reclamation has occurred.

Table 2.4-11
Estimated Initial and Life-of-Project Disturbance under Alternative B

Component	Number or Miles	Initial Disturbance (acres)	Life-of-Project Disturbance (acres)
Well Pads, Roads and Gas Gathering Pipelines			
Well Pads[1]	250 pads	8,113.0	3,245.2
Local and Resource Roads[2]	100 miles	606.0	484.8
Gas Gathering Pipelines[3]	100 miles	303.0	0.0
Liquids Gathering Pipelines[4]	471 miles	2,854.7	0.0
Subtotal		**11,876.7**	**3,730.0**
Trunk Pipelines and Ancillary Facilities			
30- to 42-inch Mesa Loop Lines[5]	15.3 miles	370.9	1.0
8-inch water line[6]	18.0 miles	109.1	0.5
12-inch liquids pipelines[7]	7.8 miles	47.3	0.5
Trunk lines – liquids gathering[8]	18 miles	163.6	0.5
Water Redistribution[4]	6 miles	36.0	0.5
Pipeline Interconnection	0.5 mile	3.0	0.5
Compressor Sites (expansion)	3 sites	110.0	110.0
Central Gathering Facilities	9 sites	90.0	90.0
Central Gathering Facilities	6 sites	12.0	12.0
Falcon Stabilizer Facility	1 site	20.0	20.0
Water Trucking Facility	1 site	20.0	20.0
Water Trucking Facility	1 site	7.0	7.0
Falcon Truck Unloading	1 site	15.0	15.0
Expand Stabilizer Site	1 site	5.0	5.0
Subtotal		**1,008.9**	**282.5**
Total Wellfield Components		**12,885.6**	**4,012.5**

[1] Disturbance includes new well pads and expansion of existing well pads. LOP disturbance assumes 60 percent reclamation of well pads.
[2] Assumes no new collector roads would be built within the PAPA, assumes 0.4 mile of road per new pad with a construction right-of-way of 50 feet. LOP disturbance assumes 20 percent reclamation of roads.
[3] Assumes 0.4 mile of gas gathering pipeline per new well pad with a construction right-of-way of 25 feet.
[4] Estimate for miles of proposed liquids gathering pipelines is based on data provided by the Proponents.
[5] Disturbance is based on 200-foot construction right-of-way width. Includes two co-located 30- to 42-inch gas pipelines from Stewart Point to Pinedale/Gobblers Knob Compressor Station. Includes 30.6 miles of pipeline but because they are co-located, 200-foot construction right-of-way is 15.3 miles. The two pipelines would be built at separate times.
[6] Disturbance is based on 50-foot construction right-of-way width from Stewart Point area to Highway 351.
[7] Disturbance is based 50-foot construction right-of-way width. Includes one 12-inch crude petroleum pipeline and one water pipeline from 4-way area to Paradise Compressor Station.
[8] Disturbance is based on 75-foot construction right-of-way width.

In their long-term development plan, the Proponents provided estimates for the number of new and expanded pads by year, and the estimated disturbance associated with well pad construction through 2023. Estimates for disturbance associated with roads and gas gathering pipelines were determined using factors for existing gas gathering pipelines and roads per well pad. Disturbance estimates for expansion of the existing liquids gathering system, construction of the proposed liquids gathering system, and for construction of trunk pipelines and ancillary facilities were either provided by the Proponents or were factored based on the proposed disturbance. The initial and LOP surface disturbance under Alternative B is 12,885.6 acres and 4,012.5 acres, respectively (see Table 2.4-11).

Wells and Drilling Rigs. The Proponents estimate that all surface disturbance (roads, gathering pipelines, and well pad construction) would be complete by 2023, with drilling continuing through 2025. Table 2.4-12 shows the estimated number of wells drilled, new well pads, and drilling rigs under Alternative B by year. At the end of 2025, there would be approximately 4,399 additional wells drilled in the PAPA under Alternative B. Table 2.4-12 shows that there is an initial increase in estimated drilling rigs (from 26 in November 2006) in the PAPA, peaking in 2009 with 48 rigs. The estimated rig number stabilizes at 45 before it begins to decline as Operators have drilled out their leases. The Proponents are proposing that the most wells drilled in any one year would be about 305. The number of wells drilled per year also begins to decline as leases are drilled out. The number of proposed wells is an estimate based on proposed drilling rigs and current drilling.

Table 2.4-12
Estimated Wells, New Well Pads,
and Drilling Rigs by Year for Alternative B

Year	Wells	New Well Pads	Drilling Rigs
2007	268	44	35
2008	299	36	45
2009	305	37	48
2010	291	29	45
2011	290	33	45
2012	289	13	45
2013	288	15	45
2014	287	11	45
2015	287	12	45
2016	286	12	45
2017	282	8	44
2018	279	0	43
2019	213	0	35
2020	187	0	28
2021	177	0	26
2022	143	0	21
2023	112	0	19
2024	107	0	16
2025	9	0	3
Total	**4,399**	**250**	

Well Pads. Alternative B includes development that utilizes consolidated well pads on a wide-scale throughout the PAPA. Therefore, the sequence described in the PAPA DEIS (BLM, 1999a) is no longer applicable. The majority of the new wells would be drilled from existing well pads that may require expansion by up to 21 acres, but no new access roads, gas gathering pipelines, or water wells would be required for the existing well pads. Some wells would be drilled from new well pads that may become expansion pads. The new well pads would require a new access road, gas gathering pipelines, and a water supply well if the wells are successful.

Alternative B includes up to 4,399 additional wells in the PAPA between 2007 and 2025. It is estimated that to drill these wells, 250 new well pads would be required. In all, the total number of well pads in the PAPA in 2023 is expected to be 590, the sum of 340 existing pads in 2005 and 250 new well pads under Alternative B.

By 2023, the initial disturbance estimate for 250 well pads is 8,113.0 acres, with a LOP disturbance estimate of 3,245.2 acres (Table 2.4-11). The Proponents have prepared a Reclamation Plan which is provided as Appendix 8B. Under the Plan, initial disturbance associated with well pads would be reclaimed to a LOP disturbance of 40 percent (i.e., only 40 percent of the initial disturbance on a pad would remain, once development is complete).

Roads and Gathering Pipelines. Under Alternative B, it is assumed that there would be no additional construction of collector roads in the PAPA. Assuming 0.4 mile of local or resource road per new well pad (based on the current level of development), there would be 100.0 miles of local and resource roads constructed in the PAPA by 2023, for an initial disturbance of 606.0 acres. The LOP disturbance would be 484.8 acres, assuming that 20 percent of the initial road disturbance would be reclaimed within one growing season after construction (see Table 2.4-11). Using a similar assumption for gas gathering pipelines, there would be 100.0 miles of gas gathering pipelines by 2023 for an initial disturbance of 303.0 acres. There is no LOP disturbance associated with construction of gas gathering pipelines because the entire disturbance is reclaimed after construction.

Currently, condensate and produced water are trucked from the central and southern portions of the PAPA. The Proponents are proposing to install an additional 471 miles of liquids gathering pipelines by 2023. The liquids gathering system would disturb 2,854.7 acres and would include continuation of the liquids gathering system in leases currently held by Questar and a new liquids gathering system in leases currently held by Shell and Ultra. The liquids gathering system would most likely be connected to the pipeline that delivers crude petroleum to the processing facilities. Produced water would be collected at truck unloading facilities and transported to various commercial water disposal locations.

Trunk Pipelines. In addition to the trunk pipelines described in Section 2.4.2.1 (Components Common to All Alternatives), JGGC is proposing to install two 7.8-mile long, 12-inch liquids pipelines from the 4-way area to the Paradise Compressor Station, with an initial disturbance of 47.3 acres (assuming a 50-foot construction right-of-way). This disturbance would occur adjacent to or within existing rights-of-way for most of the route.

JGGC is also proposing to install an 18-mile long liquids trunk line (163.6 acres), 6 miles of water redistribution pipelines (36.0 acres), and a 0.5-mile pipeline interconnection (3.0 acres) in support of the new liquids gathering system.

Ancillary Facilities. Several ancillary facilities, including expansion of existing facilities, are proposed.

Compressor Stations. In addition to the compression and new disturbance included in Section 2.4.2.1 (Components Common to All Alternatives), QGM is proposing to install an additional 15,500 hp of compression which would require an additional 20 acres of disturbance at the Pinedale/Gobblers Knob Compressor Station in 2015. Combined, Alternative B includes 282,538 hp of new compression and 110 acres of disturbance, all to be located at existing compressor stations.

Central Gathering Facilities. In addition to the CGFs included in Section 2.4.2.1 (Components Common to All Alternatives), JGGC is proposing to construct nine CGFs in support of the liquids gathering system within leases currently held by Shell and Ultra. The CGFs require 10 acres each, for a total initial and LOP disturbance of 90 acres.

Stabilizer Facilities. In support of the new liquids gathering system, JGGC is proposing to build a stabilizer facility at the Falcon Compressor Station that would require an additional 20 acres of initial and LOP disturbance. The purpose of the stabilizer is to make a “stable” product (crude petroleum) that can be metered, and it then would be sent to the pipeline for transport off the PAPA.

Water Truck Unloading Facilities. In addition to facilities described in Section 2.4.2.1 (Components Common to All Alternatives) and in support of the new liquids gathering system, JGGC is proposing to install truck unloading facilities near Highway 351. This would require an initial and LOP disturbance of 20 acres.

Options to eventually pipe, rather than truck, the produced water collected at the truck unloading facilities are in the preliminary investigation phases. One option would be to build pipeline spurs from the truck unloading facility to the nearby evaporation facilities operated by Anticline Disposal. Another option would be to construct a water disposal pipeline running from the truck unloading facility to produced water injection wells in the PAPA or to the Big Piney Water Disposal Facility located approximately 35 miles southwest of the PAPA.

2.4.2.4 Alternative C

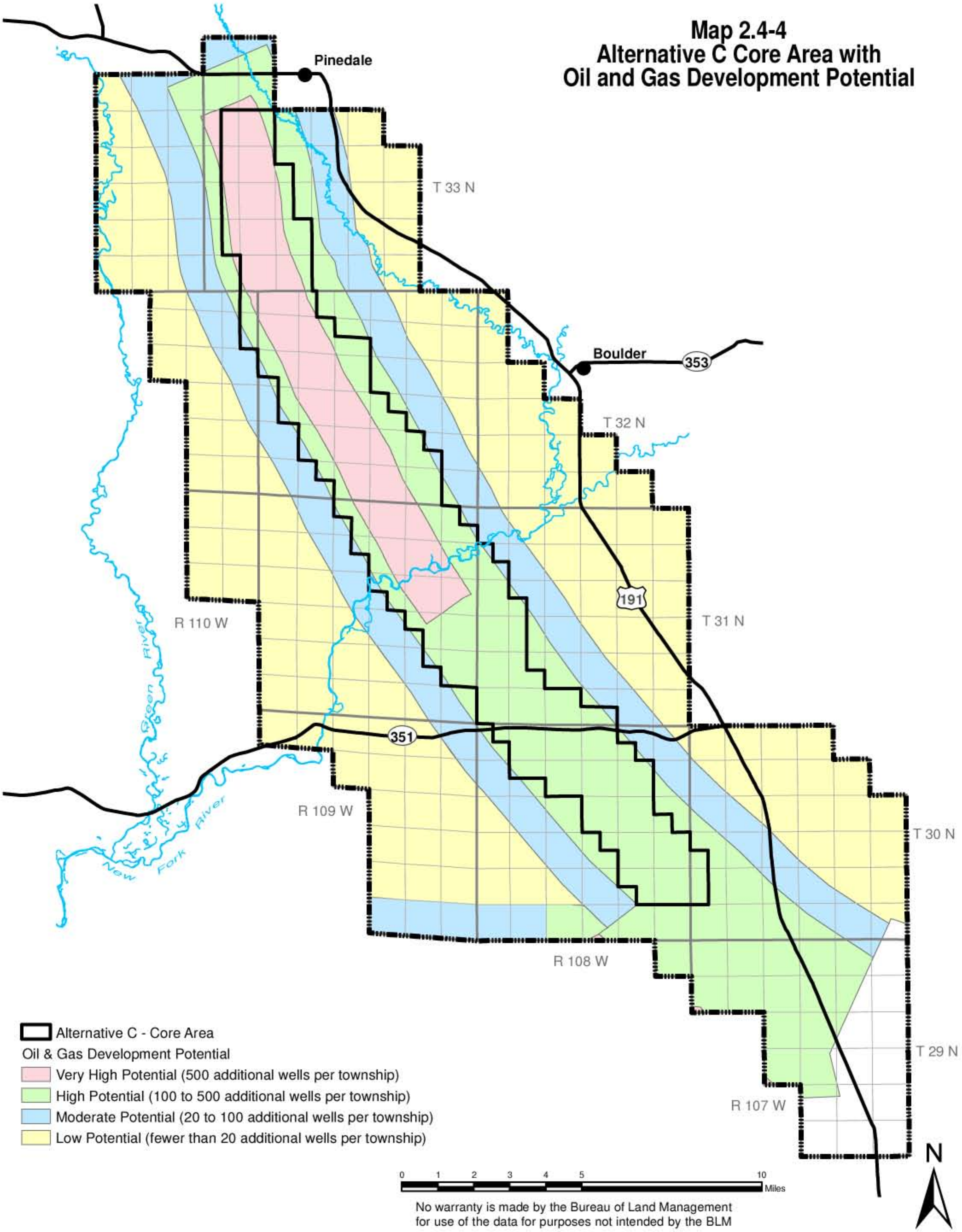
Alternative C is similar to Alternative B with respect to the following and includes:

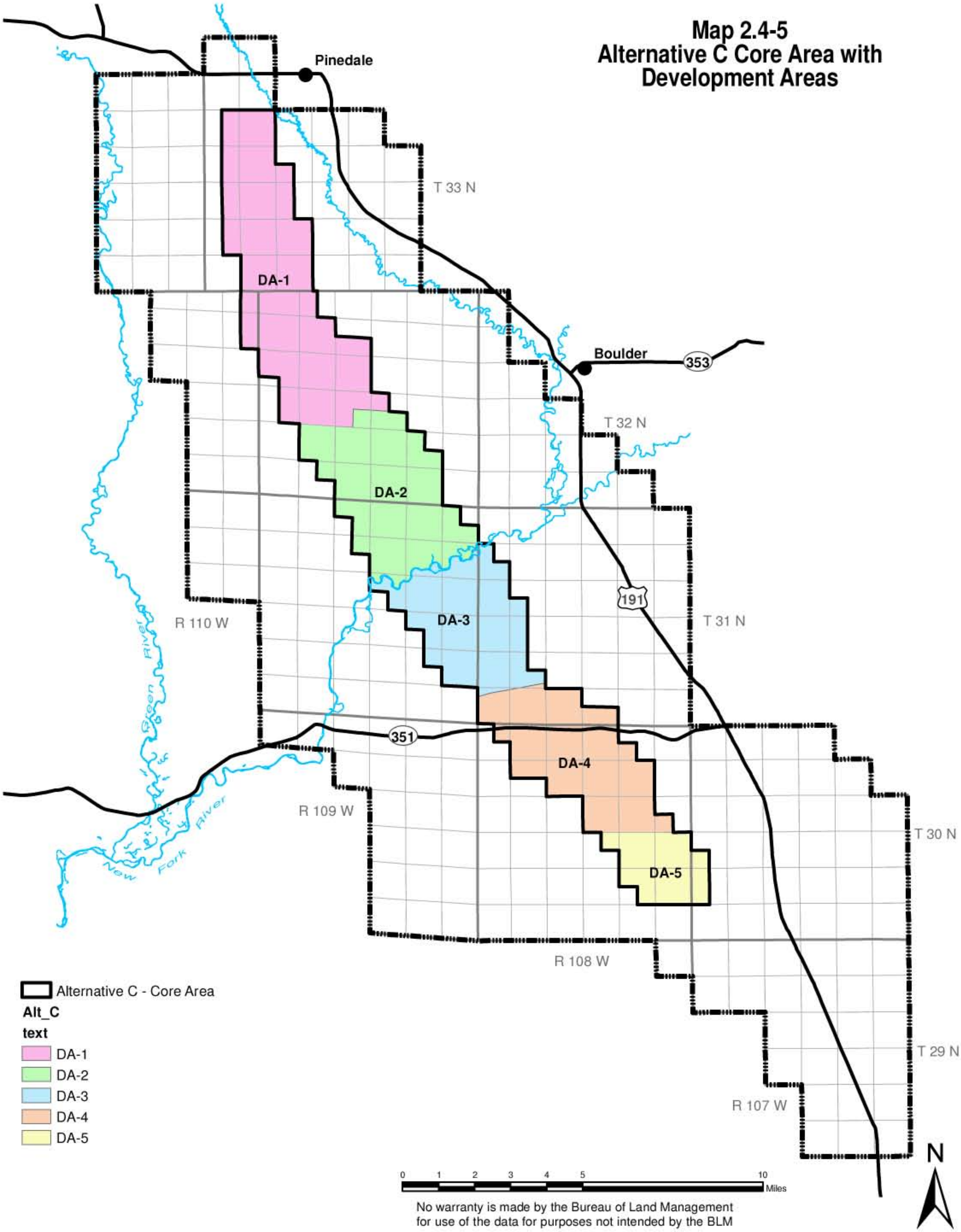
- all project components described for Components Common to All Alternatives (Section 2.4.2.1) and Alternative B (Table 2.4-11);
- the Development Procedures for Wellfield Activities (Appendix 7) and Pipeline Design and Construction Procedures (Appendix 6);
- an estimated 4,399 additional wells drilled by the end of 2025 (Table 2.4-12);
- air quality impact analysis based on a peak of 48 drillings rigs operating in the PAPA, leveling off to 45 rigs after 2010 (Table 2.4-12);
- installation of a liquids gathering system in the central and southern portions of the PAPA (Table 2.4-11);
- 250 additional well pads totaling 535 well pads for LOP since the PAPA ROD (Table 2.4-11); and
- additional initial disturbance of 12,885.6 acres and LOP disturbance of 4,012.5 acres (Table 2.4-11).

Although Alternative C is similar to Alternative B in that it includes the same project components, geographically it is different from Alternative B. That is, rather than only specifying certain areas where year-round development could occur, Alternative C specifies areas where year-round development would not occur. It includes a core area (Alternative C Core Area on Maps 2.4-4 and 2.4-5) that is smaller than the Alternative B Core Area (Map 2.4-3). The overall objective of Alternative C is to control spatial disturbance over time, maximizing development in some areas while minimizing development in other areas, especially in portions of big game seasonal habitats. Specific plans that apply to Alternative C include the Transportation Plan (Appendix 5C), Reclamation Plan (Appendix 8C), and Wildlife Habitat and Mitigation Plan (Appendix 9B).

The Alternative B Core Area was defined by the Proponents and was based on the success of development to date and projections for success in future development. The Alternative C Core Area is based on BLM's Reservoir Management Group (RMG) projections for potential development in the PAPA (see Map 2.4-4). The United State Geological Survey - USGS

Map 2.4-4
Alternative C Core Area with Oil and Gas Development Potential




Map 2.4-5
Alternative C Core Area with Development Areas
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
DA-1
DA-2
DA-3
DA-4
DA-5
Green River
New Fork River
Alternative C - Core Area
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DA-3
DA-4
DA-5
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No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM

(Crockett et al., 2003) has defined “Very High Potential Areas,” “High Potential Areas,” “Moderate Potential Areas,” and “Low Potential Areas” for development of the Pinedale Anticline as follows:

- Very High Potential Area – defined as a 1.5-mile wide band lying on the Pinedale Anticline axis including all acres 1 mile east and 0.5 mile west of the anticlinal axis with a northwest and southeast limit. This area would include over 500 additional wells per township (approximately 36 square miles).
- High Potential Area – defined as a 3-mile wide band lying on the Pinedale Anticline axis including all acres 2 miles east and 1 mile west of the anticlinal axis with a northwest and southeast limit. This area would include 100 to 500 additional wells per township.
- Moderate Potential Area – defined as a 5-mile wide band lying on the Pinedale Anticline axis including all acres 3 miles east and 2 miles west of the anticlinal axis with a northwest and southeast limit. This area would include 20 to 100 additional wells.
- Low Potential Area – includes all other areas in the PAPA and beyond. This area would include fewer than 20 additional wells per township.

The Very High, High, Moderate, and Low potential areas are shown on Map 2.4-4. For Alternative C, the core area is defined as the Very High and High potential areas. Approximately 39,678 acres (62.0 square miles) are included in the Alternative C Core Area. This area is 20 percent of the PAPA and is smaller than the Alternative B Core Area (22 percent of the PAPA).

Alternative C includes five Development Areas (DAs), each with a fixed location, unlike the CDAs of Alternative B. Year-round development would be allowed in four of the DAs (1 through 4) with an exception for seasonal restrictions in big game (pronghorn and mule deer) and greater sage-grouse seasonal habitats during the seasonally restricted periods (Map 2.4-5). For year-round development, in all DAs except for DA-5, Operators would be required to fully develop each existing and/or new well pad in one continuous time span for as long as necessary to drill and complete all wells on the pad. Once an Operator has determined that a well pad has been fully developed, they would not be allowed to reinitiate development on the well pad. Once a well pad has been fully developed, full site restoration and reclamation would begin as soon as the ground is not frozen and would be completed before the onset of winter. These elements of Alternative C would not apply in DA-5 because Operators would not be able to fully develop well pads due to seasonal restrictions in greater sage-grouse seasonal habitats.

Seasonal restrictions would apply to new surface disturbing activities in all areas outside of the Alternative C Core Area. Development activities would be allowed in all DAs and outside of the Alternative C Core Area at any time with adherence to seasonal restrictions.

In all areas of the PAPA, Operators would be required to expand existing well pads before constructing new well pads. Operators would be allowed to develop from all existing well pads in a quarter-section (approximately 160 acres or 0.25 square mile). If there are no existing well pads in a quarter-section, Operators would be allowed to develop one new well pad. Additional well pads in the quarter-section may be considered by BLM on a case-by-case basis for circumstances such as topographical constraints. Most new producing wells would be required to be connected to a liquids gathering system. Outside of the seasonally restricted periods, Operators would not be required to completely develop pads and could return to the pad in the future.

Operators would be required to comply with the Reclamation Plan (Appendix 8C) to fully stabilize sites immediately. Each DA has specific requirements for development as follows:

- DA-1 – this is the northern-most DA, includes mostly contiguous leases currently held by Questar, is entirely within big game crucial winter ranges, and overlaps portions of 2-mile buffers associated with several occupied greater sage-grouse leks. The total area in DA-1 is 12,644 acres. The southern boundary of DA-1 is the approximate boundary of Questar's leases (Map 1.1-2 in Chapter 1) and the Shell/Ultra checkerboard patterned leases to the south (DA-2). The east-west boundaries of DA-1 are defined by the Alternative C Core Area (Map 2.4-5). Year-round development would be allowed in DA-1 with specific limitations.

  Initial year-round development would be restricted to a 2-mile wide area (south to north) beginning at the southern boundary of DA-1. As initial development is completed, the 2-mile wide area would move north. Development activities would not be able to advance to the north until the southern initial development is completed and final reclamation measures have been initiated. As development moves to the north, year-round activities would continue to be confined to a 2-mile wide area (south to north). It is assumed that by the time the 2-mile wide drilling area reaches the northern-most portion of DA-1, the southernmost portion would have achieved a self-replicating vegetative community functioning at a pre-disturbance level. The pattern of development moving north while reclamation is initiated to the south would continue until DA-1 is fully developed. Once final reclamation has been initiated, no new development would occur in the areas to the south of the ongoing development.

  Development could occur in all areas of DA-1 outside of the seasonally restricted periods except for areas that have been fully developed. Such development could include expansion of existing pads and construction of new consolidated pads, single well delineation pads, roads, gathering pipelines and ancillary facilities.

- DA-2 – this DA is located north of the New Fork River in the central portion of the PAPA, is mostly within big game crucial winter ranges, and overlaps portions of 2-mile buffers associated with several occupied greater sage-grouse leks. The total area included in DA-2 is 8,903 acres. The northern boundary of DA-2 is the southern boundary of DA-1. The southern boundary of DA-2 is the New Fork River. The east-west boundaries of DA-2 are defined by the Alternative C Core Area. Year-round development would be allowed in DA-2 with specific limitations.

  Year-round development would be allowed in all areas of DA-2 upon issuance of the ROD, and lasting until DA-2 is entirely developed. Once DA-2 is entirely developed, no new development would be allowed to occur in DA-2 during any season for the remaining life of the project.

- DA-3 – this is located south of the New Fork River in the central portion of the PAPA, is mostly within big game crucial winter ranges and includes 7,127 acres. The northern boundary of DA-3 is the New Fork River and the southern boundary is the southern border of the 0.25-mile buffer on the Lander Trail. East-west boundaries of DA-3 are defined by the Alternative C Core Area.

  Year-round development would be allowed to occur in all areas of DA-3. However, year-round development would not begin in DA-3 until all development is complete in DA-2. Development could occur in all areas of DA-3 outside of the seasonally restricted periods upon issuance of the ROD.

- DA-4 – this is located in the southern portion of the PAPA. There is a small portion of big game crucial winter ranges that coincide with DA-4 and the majority of DA-4 is within 2 miles of several occupied greater sage-grouse leks. The total area for DA-4 is 7,964 acres. The northern boundary of DA-4 is the southern border of the 0.25-mile buffer on the Lander Trail. The southern boundary of DA-4 was defined by the BLM ID Team to be approximately 1.0 mile from the nearest greater sage-grouse lek within the Yellow Point Lek Complex. The boundary is defined by Sections 13, 14, and 15 to the north and Sections 22, 23, and 24 to the south, all of which are in T. 30 N., R. 108 E. East-west boundaries of DA-4 are defined by the Alternative C Core Area.

Year-round development would be allowed in all areas of DA-4 upon issuance of the ROD and would last until DA-4 is entirely developed. Once DA-4 is entirely developed, no new development would be allowed to occur.

- DA-5 – this southernmost DA extends south from the border with DA-4 and includes 3,040 acres. All of DA-5 is within 2 miles of at least one occupied greater sage-grouse lek in the Yellow Point Lek Complex. None of DA-5 coincides with big game crucial winter ranges. East-west boundaries of DA-5 are defined by the Alternative C Core Area. Year-round development would not be allowed in DA-5. All development would comply with seasonal restrictions for greater sage-grouse seasonal habitats.

Proposed project components and estimates of initial and LOP disturbance under Alternative C are the same as those provided in Table 2.4-11 for Alternative B. The initial disturbance under Alternative C is estimated to be 12,885.6 acres, with a LOP disturbance of 4,012.5 acres. The estimates used under Alternative C, including the number of wells to be drilled, the number of drilling rigs required, the volume of associated traffic and the size of the required workforce, are the same as those described for Alternative B.

2.4.3 Alternative D

Based upon public comments received on the Draft SEIS (BLM, 2006a), the BLM has developed Alternative D. Alternative D was created, in part, by comments from the Proponents (Ultra, Shell, Questar, BP, Stone/Newfield, Yates, and Anschutz), the WGFD, and WDEQ - Air Quality Division (WDEQ-AQD).

Alternative D is similar to Alternatives B and C with respect to the following and includes:

- all project components described for Components Common to All Alternatives, Alternative B, and Alternative C (Table 2.4-11);
- the Development Procedures for Wellfield Activities (Appendix 7) and Pipeline Design and Construction Procedures (Appendix 6);
- an estimated 4,399 additional wells drilled by the end of 2025 (Table 2.4-12);
- air quality impact analysis based on a peak of 48 drillings rigs operating in the PAPA, leveling off to 45 rigs after 2010 (Table 2.4-12);
- installation of a liquids gathering system in the central and southern portions of the PAPA (Table 2.4-11);
- 250 additional well pads totaling 535 well pads for LOP since the PAPA ROD (Table 2.4-11); and
- additional initial disturbance of 12,885.6 acres and LOP disturbance of 4,012.5 acres.

Similar to Alternative C, Alternative D includes a core area (the Alternative D Core Area) and Development Areas 1 through 5. Alternative D is unique with respect to the following which includes:

- expansion of DA-1 and DA-2 (and therefore the core area) to include leases currently held by Anschutz;
- expansion of the DA-5 core area as proposed in the Proponents' comments on the Draft SEIS;
- a PDA surrounding the Alternative D Core Area;
- allowance for delineation beyond that allowed in Alternative C;
- exception for seasonal wildlife restrictions in DA-5; and
- around DA-5, a 0.75-mile PDA buffer area outside of the 0.25-mile NSO for five designated occupied greater sage-grouse leks has been added.

Ultra, Shell, and Questar have committed to mitigation measures which are included as part of Alternative D. They are described in Appendix 11 and summarized below:

- concentrated development (simultaneous construction, drilling, completion, and production);
- directional drilling from multi-well pads;
- liquids gathering systems;
- computer-assisted operations;
- emission reductions in NO_x to 2005 levels within 1 year and an additional 80 percent reduction within 42 months;
- wildlife monitoring and mitigation matrix with objectives and sequential outcomes (Appendix 10);
- annual planning and 10-year rolling forecast;
- federal suspended and term NSO leases (49,903 acres); and
- a monitoring and mitigation fund.

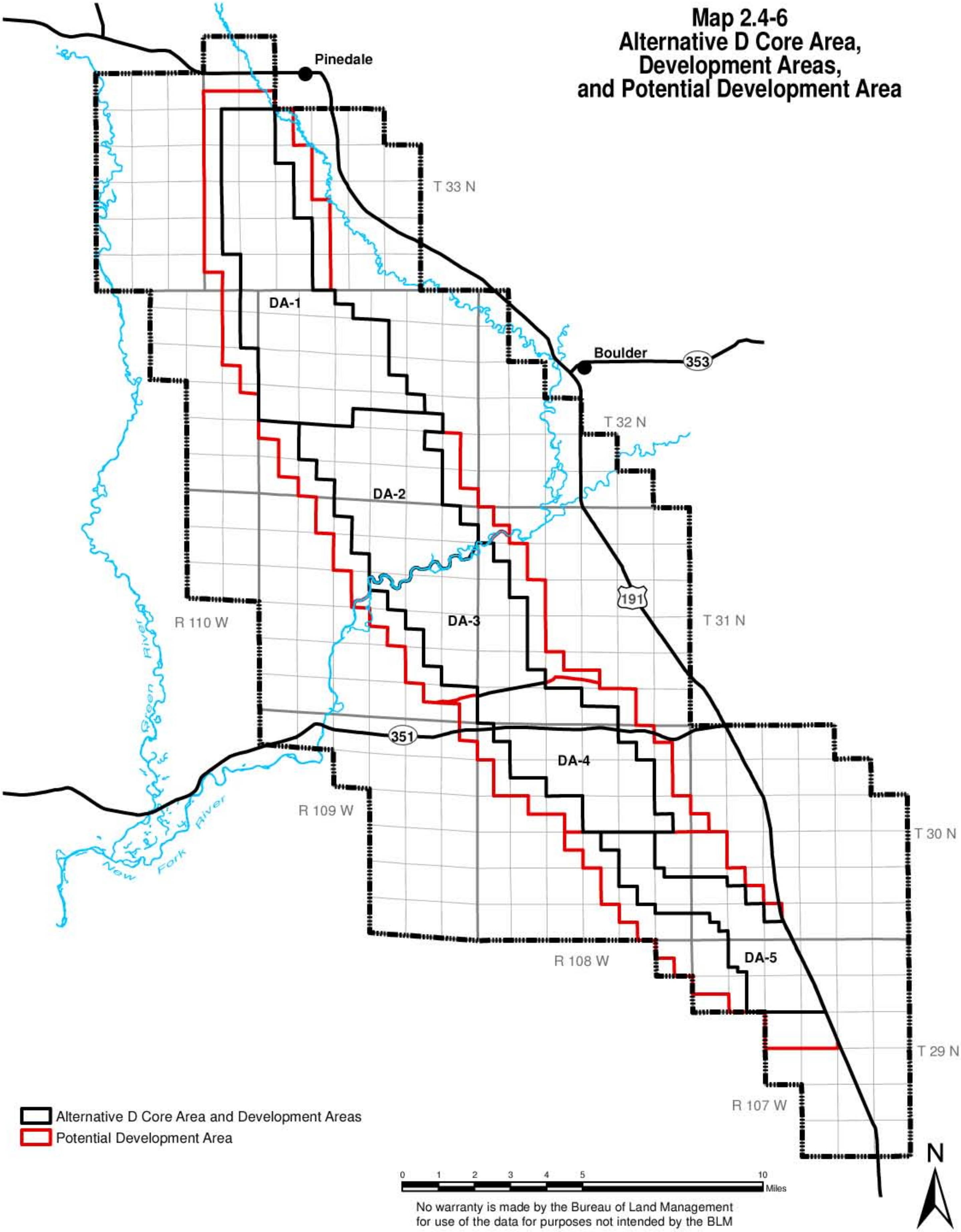
Anschutz, BP (Stone/Newfield), and Yates have committed to the following mitigation measures which are included as part of Alternative D as follows:

- concentrated development (simultaneous drilling and completions); and
- directional drilling from multi-well pads.

2.4.3.1 Alternative D Core Area

The Alternative D Core Area includes 45,415 acres or 23 percent of the PAPA as shown on Map 2.4-6. This is an expansion of the Alternative C Core Area by 14.4 percent. Based on comments received on the Draft SEIS (BLM, 2006a), the Alternative C Core Area boundary has been expanded to the east, along the DA-1 and DA-2 eastern edges to form the Alternative D Core Area. Under Alternative D, DA-1 and DA-2 include 14,872 acres and 9,222 acres, respectively, to allow for year-round development within leases currently held by Anschutz, all within mule deer crucial winter range.

The Alternative C Core Area has been narrowed and elongated in DA-5 to continue the Alternative D Core Area south of the Alternative C Core Area and now includes 6,230 acres. Year-round development with exception for seasonal restriction in big game (pronghorn and mule deer) and greater sage-grouse seasonal habitats would be allowed in the entire Alternative D Core Area.


Map 2.4-6
Alternative D Core Area, Development Areas, and Potential Development Area
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
DA-1
DA-2
DA-3
DA-4
DA-5
Green River
New Fork River
Alternative D Core Area and Development Areas
Potential Development Area
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM

2.4.3.2 Alternative D Potential Development Area

Alternative D contains 24,875 acres adjacent to the Alternative D Core Area which would be potentially open for year-round development. This area is referred to as the Potential Development Area or PDA. The PDA adjacent to DA-1 (PDA-1 - 5,370 acres) and DA-2 (PDA-2 - 3,845 acres) is generally a 0.5-mile buffer around the Alternative D Core Area. On a portion of the east side of DA-1 and DA-2, there is no PDA because the DAs were expanded to allow for year-round development within leases currently held by Anschutz. PDA-3 (3,625 acres) and PDA-4 (4,532 acres) include a 0.5-mile buffer surrounding the Alternative D Core Area. PDA-5 includes 7,503 acres and is greater than the 0.5-mile buffer that surrounds other portions of the Alternative D Core Area.

Year-round development would not initially be allowed within the PDA. The need for year-round development within the PDA would be determined by the success of delineation drilling. Requests by the Operators for expansion of year-round development into the PDA would be reviewed in the Annual Planning Meeting, the Adaptive Management Process proposed under this Alternative. Depending on the outcome, year-round development may be allowed within the PDA if approved by the BLM AO with the intention of reducing the likelihood of a second development pass through caused by adherence to seasonal restrictions for wildlife. For the purpose of the analysis contained in Chapter 4, it is assumed that year-round development would occur in the PDA.

2.4.3.3 Alternative D Development Areas

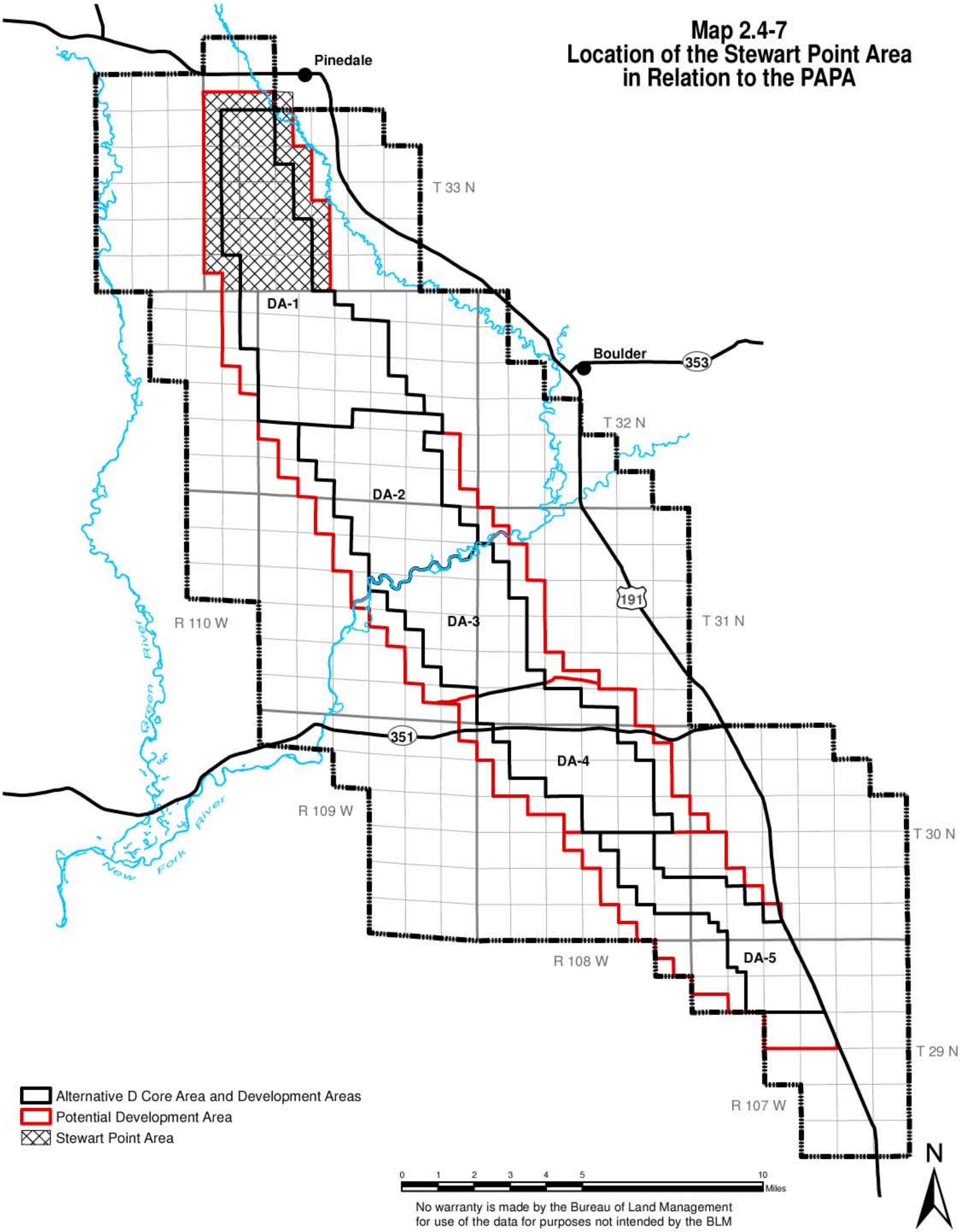
<u>Development Area 1</u>

Development in DA-1. Under Alternative D, DA-1 includes 14,872 acres and has the potential for expansion within PDA-1 (5,370 acres). DA-1 is the northernmost DA, and includes mostly contiguous leaseholds currently held by Questar as well as acreage under lease to Ultra, Shell, and Anschutz. DA-1 is entirely within big game crucial winter ranges and overlaps portions of 2-mile buffers associated with occupied greater sage-grouse leks. The east-west boundaries of DA-1 have the potential to be expanded to include all or a portion of the adjacent PDA, thereby expanding the Alternative D Core Area. Year-round development with an exception to seasonal restrictions for big game (pronghorn and mule deer) and greater sage-grouse would be allowed in DA-1 and the associated PDA with specific limitations as described below.

A transition period of approximately 24 months is believed to be needed upon issuance of a ROD due to a number of reasons, including the lead time for APD approvals, construction window, and acquisition of new equipment. Following the transition period, Questar would begin concentrated year-round development in DA-1 proceeding from south to north. Questar's development in DA-1 would be within a contiguous 6 square mile area. A decision regarding the movement and shape of the 6-square mile area would be made by the BLM AO. Consequently, DA-1 is not open in its entirety to year-round development. The 6 square mile area would be no more than 2 miles in north-south extent except when the 6 square miles cannot be maintained due to narrowing of DA-1 in the east-west direction. Recommendations for the shape and location of the 6 square mile area for each subsequent year after signing of the ROD would be reviewed during the Annual Planning Meeting and determinations would require the approval of the BLM AO.

Approximately 1,111 acres within DA-1 are leased by Anschutz. In a proposal to BLM, Anschutz agreed to limit development within the Alternative D Core Area to no more than three drilling rigs and no more than three active well pads at any given time. Year-round development with exception to seasonal restrictions for big game and greater sage-grouse seasonal habitats would be allowed at any time within the Anschutz leases in DA-1.

Delineation in DA-1. Questar's delineation drilling in the Stewart Point area (see Map 2.4-7) would be conducted during the first 2 years following the ROD, while adhering to seasonal



Map 2.4-7
Location of the Stewart Point Area in Relation to the PAPA
Pinedale
Boulder
353
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
DA-1
DA-2
DA-3
DA-4
DA-5
191
351
Green River
New Fork River
Alternative D Core Area and Development Areas
Potential Development Area
Stewart Point Area
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM

restrictions for wildlife. Questar's proposed delineation would consist of 22 wells on nine well pads (two new well pads). Beyond the 2 years following the ROD, delineation within the Stewart Point area that requires new pads or roads (both inside the Alternative D Core Area and PDA) would only take place either 1 mile or 18 months ahead of the 6 square mile area of development. After 2 years following a ROD, no additional pads for delineation would be allowed unless recommended during the Annual Planning Meeting and approved by the BLM AO. If it is determined that an extended delineation period is necessary in DA-1, it would be recommended during the Annual Planning Meeting and would require approval from the BLM AO.

Development Area 2

Development in DA-2. DA-2 includes 9,222 acres and has the potential for expansion within PDA-2. DA-2 is located north of the New Fork River in the central portion of the PAPA, is mostly within big game crucial winter ranges and overlaps portions of 2-mile buffers associated with several greater sage-grouse leks. The east-west boundaries of DA-2 are defined by the Alternative D Core Area. Year-round development would be allowed within DA-2 immediately following issuance of the ROD. After a 24-month transition period, concentrated development would begin in DA-2. Development would be concentrated by forming two groups of drilling rigs: one at the southern boundary of DA-2 in the area immediately adjacent to the New Fork River and one at the northern boundary of DA-2 just to the south of DA-1. Development in DA-2 would progress with the drilling rig groups moving toward the center of DA-2 from both the north and south ends of DA-2.

Anschutz leases 199 acres of federal minerals in DA-2. Under Alternative D, Anschutz would be able to conduct year-round development with exception to seasonal restrictions for big game and greater sage-grouse seasonal habitats within their leases in DA-2 and would not be subject to the drilling rig grouping discussed above.

Delineation in DA-2. Delineation would be allowed in DA-2 with exception to seasonal restrictions for big game and greater sage-grouse in seasonal habitats; however, seasonal restrictions would apply for delineation in PDA-2. Year-round development in PDA-2 would be subject to recommendation during the Annual Planning Meeting and would require approval from the BLM AO.

Development Area 3

Development in DA-3. DA-3 includes 7,127 acres and has the potential for expansion into PDA-3 (3,625 acres). DA-3 is located south of the New Fork River in the central portion of the PAPA and is mostly within big game crucial winter ranges. The east-to-west movement of development in DA-3 is intended to provide maximum amounts of undisturbed pronghorn crucial winter range and movements.

Year-round development would begin in DA-3 once drilling and completion are finished within a 2-mile band at the southern end of DA-2, north of the New Fork River (see Map 2.4-6). As drilling and completion diminish in DA-2, development could increase proportionately in DA-3. Development in DA-3 with concentrated drilling rigs would progress from south to north and would occur in Range 109 W. until DA-2 drilling and completions are finished. The location and concentration of drilling rigs in DA-3 would be reviewed during the Annual Planning Meeting and revisions in movement and locations would require approval from the BLM AO.

When drilling and completions are finished in DA-2, development could expand to the north end of DA-3 along the range line between Range 108 W. and Range 109 W. and would move to the west occupying Shell and Ultra's leases. The development would continue westward to the DA-3 western boundary and could move into PDA-3 based on recommendations during the Annual Planning Meeting; however, it would require approval from the BLM AO.

After drilling and completions are finished in Range 109 W., eastward development into Range 108 W. would continue to the DA-3 eastern boundary and could occur into PDA-3 if recommended during the Annual Planning Meeting and approved by the BLM AO.

Delineation in DA-3. Delineation would be allowed in DA-3 within the Alternative D Core Area with exception to seasonal restrictions for big game; however, seasonal restrictions for greater sage-grouse would apply. The delineation activity within these parameters may be expanded to PDA-3 based on review and recommendations during the Annual Planning Meeting and approval of the BLM AO.

Delineation would occur in two phases. Phase 1 delineation would begin (after the 24 month transition period) upon issuance of the ROD and would occur on a north-south line in the western-most portion of Range 108 W. It would extend from the south boundary of DA-3 to the north boundary of DA-3 generally occurring within a 1.5 mile-wide area (east-west) at any time. Delineation would then proceed to the east along north to south line toward the east boundary of DA-3 and potentially within PDA-3 based on recommendations by the Operators during the Annual Planning Meeting. Delineation in PDA-3 with exception to seasonal wildlife restrictions would require approval of the BLM AO.

Phase 2 delineation would begin when Phase 1 delineation is complete or 18 months prior to when development begins in the southern end of DA-3 (Range 109 W.), whichever occurs sooner. Phase 2 delineation would precede development and would occur on a north-south line in the eastern-most portion of Range 109 W. It would extend from the south boundary of DA-3 to the north boundary of DA-3 generally occurring within a 1.5-mile area (east-west) at any time proceeding toward the west boundary of DA-3. Year-round development within the PDA would only occur if recommended during the Annual Planning Meeting and approved by the BLM AO.

Notwithstanding the above descriptions of Phase 1 and Phase 2 delineation in DA-3, it is the intent that activities under Phase 1 and Phase 2 would not overlap or be conducted at the same time. If the activities under Phase 1 delineation cease prior to completion of Phase 1 delineation, and Phase 2 delineation begins, the activities under Phase 1 would be allowed to resume once Phase 2 delineation is complete.

<u>Development Area 4</u>

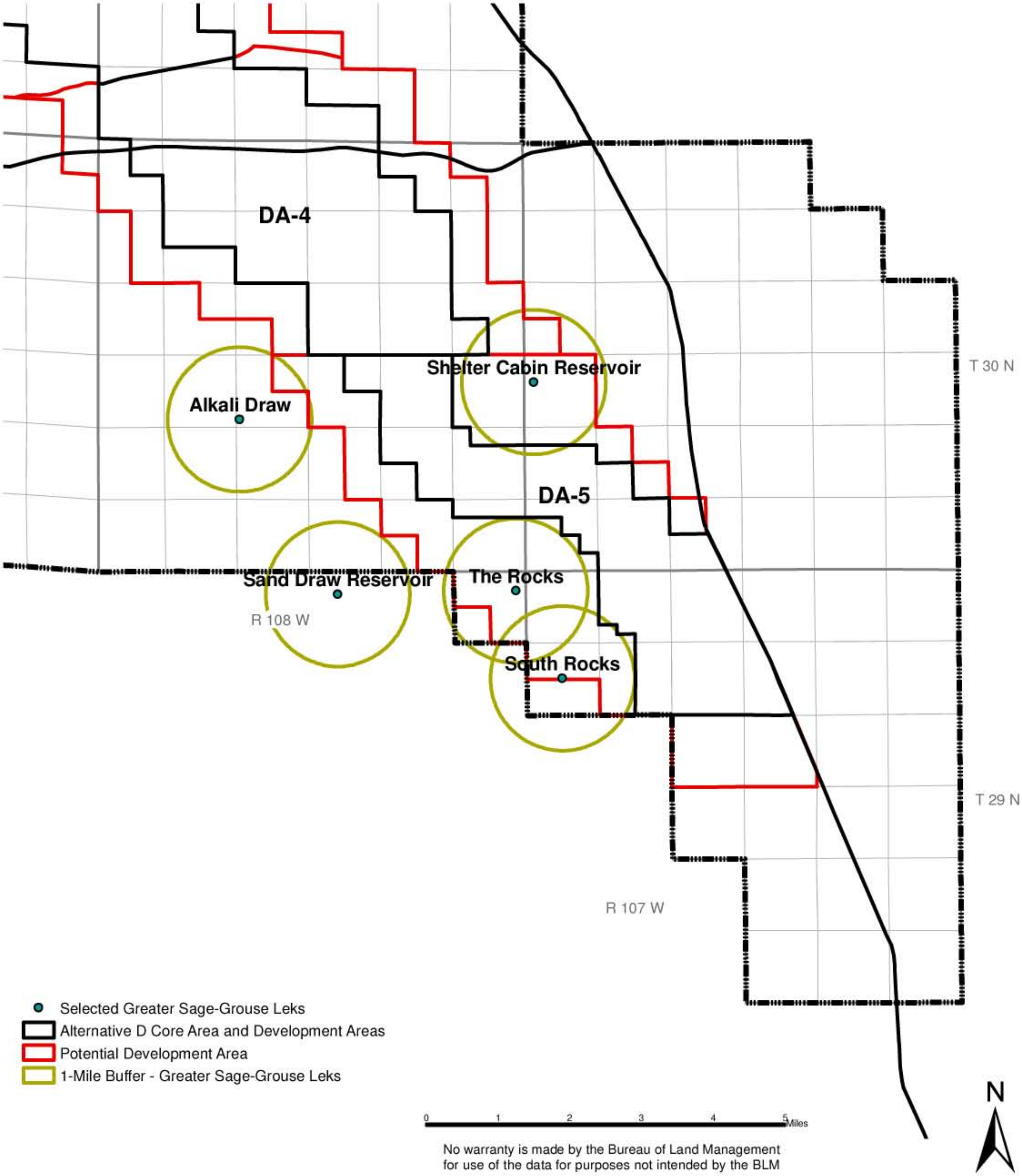
Development in DA-4. DA-4 includes 7,964 acres and has the potential for expansion within PDA-4 (4,532 acres). DA-4 is located in the southern portion of the PAPA and coincides with a portion of big game crucial winter range and is within 2 miles of several occupied greater sage-grouse leks. Year-round development would be allowed within all areas of DA-4 with exception for seasonal restrictions for big game and greater sage-grouse seasonal habitats.

Delineation in DA-4. Year-round delineation would be allowed in all areas of DA-4 after issuance of the ROD. Delineation within PDA-4 would occur within seasonal restrictions. Based upon delineation success and with review during the Annual Planning Meeting, year-round development could occur in PDA-4 with approval of the BLM AO.

<u>Development Area 5</u>

Development in DA-5. DA-5 is the southern-most DA and all of it is within 2 miles of one or more occupied greater sage-grouse leks in the Yellow Point Lek Complex. Under Alternative D, the Alternative C DA-5 has been narrowed and elongated to avoid having the Alternative D Core Area (where there would be year-round development) within 1 mile of the Shelter Cabin Reservoir, The Rocks, South Rocks, Alkali Draw, and Sand Draw Reservoir greater sage-grouse leks (see Map 2.4-8).

Map 2.4-8
Location of Selected Greater Sage-Grouse Leks in Relation to DA-5



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There would be exception to seasonal restrictions for greater sage-grouse seasonal habitats; however, development would not be allowed within a 0.25-mile buffer of occupied greater sage-grouse leks. This is a standard NSO buffer that would apply to all occupied leks. Within DA-5, no additional well pads would be allowed where one or more already exist in a quarter-quarter section and only one well pad in a quarter-quarter section would be allowed where none currently exist. Recommendations for exceptions to the well pad limits in a quarter-quarter section would be reviewed during the Annual Planning Meeting and would be subject to approval from the BLM AO.

PDA-5 surrounding DA-5 consists of 7,503 acres where seasonal restrictions related to greater sage-grouse seasonal habitats would apply. Recommendations for year-round development in PDA-5 would be reviewed during the Annual Planning Meeting and would be subject to approval from the BLM AO. If approval is granted by the BLM AO for year-round development either in all or part of PDA-5, year-round development would occur within 1 mile (excluding the 0.25-mile NSO buffer) of only one of five designated leks (Shelter Cabin, Rocks, South Rocks, Alkali Draw, and Sand Draw) at any one time while also maintaining the 0.25-mile NSO buffer (see Map 2.4-8).

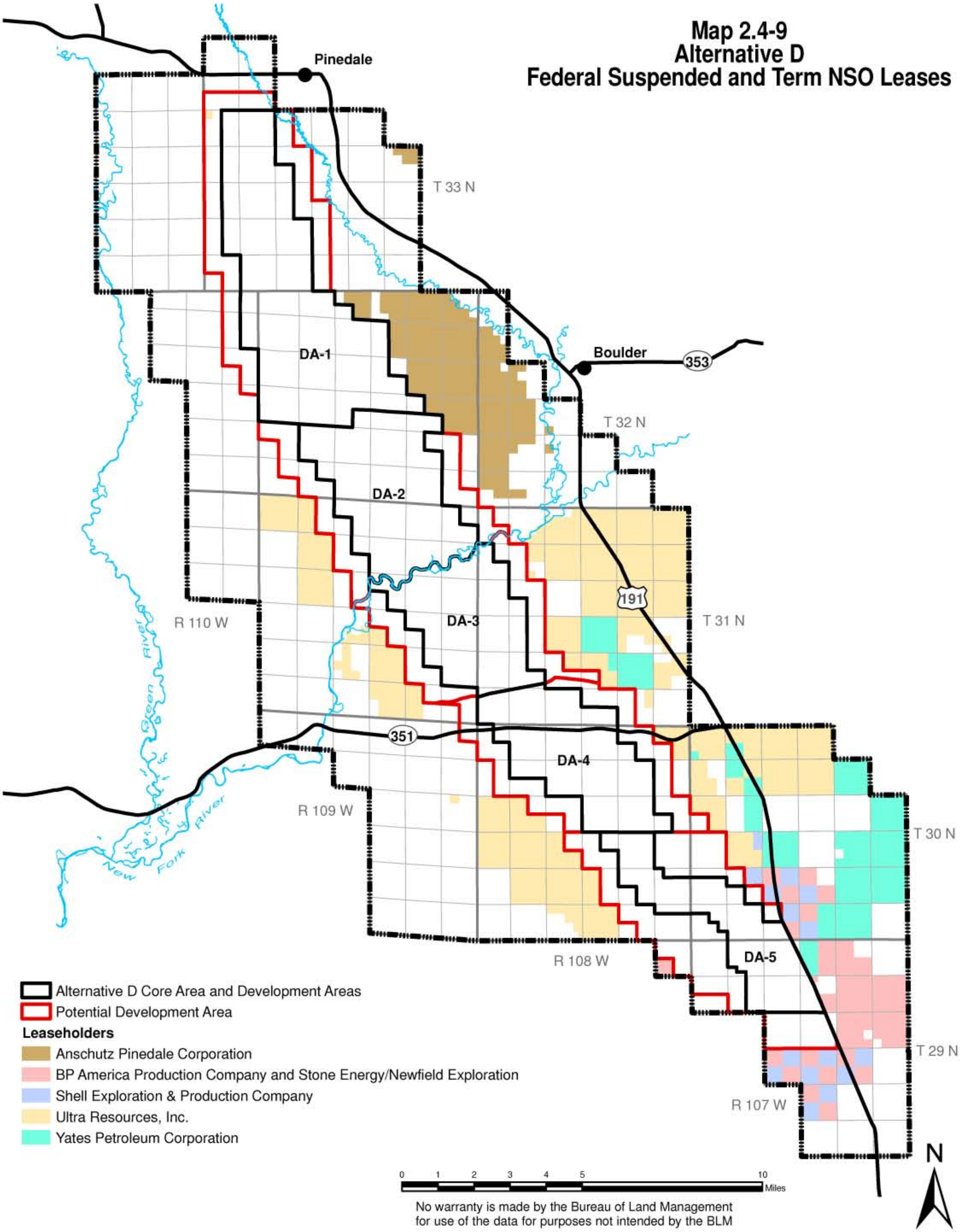
Shell and Ultra propose to construct the liquids gathering system in DA-5. Other Operators are not committing to installation of a liquids gathering system within their leases in DA-5.

Delineation in DA-5. Delineation would be allowed in all areas of DA-5 after issuance of the ROD with exception to seasonal restrictions in greater sage-grouse seasonal habitats. Delineation in PDA-5 would occur within seasonal restrictions for greater sage-grouse seasonal habitats; however, if delineation is successful, recommendations for year-round development in PDA-5 would be made during the Annual Planning Meeting and would require approved from the BLM AO.

2.4.3.4 Federal Suspended and Term NSO Leases

For Alternative D, Ultra, Shell, Anschutz, BP, Stone/Newfield, and Yates have offered to conduct no additional activity on certain leases in the Flanks (outside of the Alternative D Core Area and PDA) for at least 5 years. This would collectively include 49,903 acres inside the PAPA, of which 16,954 acres are within big game crucial winter range and 37,019 acres are within 2-mile buffers of greater sage grouse leks (see Map 2.4-9). An additional 3,825 acres in the vicinity of the PAPA but outside of the PAPA boundary would also have no additional activity on certain leases. To accomplish this, leases without current production would be suspended. Leases that are producing cannot be suspended but would not have additional activity because of the Proponents' commitment to do no additional development in these term NSO leases for 5 years. After the primary term of 5 years, the need for federal suspended and term NSO leases would be reviewed during the Annual Planning Meeting. A determination on the status of the lease (whether to continue suspension or to resume the lease conditions) would be made by the BLM AO. Consistent with their commitment to the BLM, development could proceed on leases held by Anschutz after the primary 5 year term but would be subject to existing seasonal restrictions.

The owner with operating rights can request a lease suspension. If justified, the BLM can approve lease suspensions. BLM can direct lease suspensions in the interest of conservation. The BLM cannot impose NSO restrictions (if not already a lease stipulation) after the lease has been issued; however, the leaseholder can offer and agree to not use all or portions of the lease. Once offered by the leaseholder or Operator, and if selected in the ROD, the agreement would become binding. For the purpose of this analysis, it is assumed that all of the federal leases offered would be suspended and term NSO leases would be accepted.


Map 2.4-9
Alternative D
Federal Suspended and Term NSO Leases
Pinedale
Boulder
353
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
DA-1
DA-2
DA-3
DA-4
DA-5
191
351
Green River
New Fork River
Alternative D Core Area and Development Areas
Potential Development Area
Leaseholders
Anschutz Pinedale Corporation
BP America Production Company and Stone Energy/Newfield Exploration
Shell Exploration & Production Company
Ultra Resources, Inc.
Yates Petroleum Corporation
0 1 2 3 4 5 10
Miles
N
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2.4.3.5 Monitoring and Mitigation Fund

Ultra, Shell, and Questar have voluntarily proposed the creation of the Pinedale Anticline Monitoring and Mitigation Fund to mitigate potential impacts to wildlife, air, and other resources identified in this Final SEIS. The maximum total contribution to the fund by Ultra, Shell, and Questar would be $36 million. Annual contributions to the fund would be based upon the number of wells spud each year. Annual contributions are anticipated to be $1.8 million per year with an initial contribution of at least $4.2 million. The fund is in addition to the net cost Ultra, Shell, and Questar would incur by implementing their operational on-site mitigation measures including but not limited to:

- directional drilling,
- consolidated pad construction and development,
- consolidated completion activity,
- rig engine NO_x emissions controls,
- existing air monitoring agreements with WDEQ,
- liquids gathering system,
- current mule deer, pronghorn, and greater sage-grouse research, and
- current habitat and vegetation inventory.

The fund would be used for both on-site and off-site mitigation and project-related activities in the PAPA vicinity including additional air quality monitoring, additional wildlife, livestock, vegetation and reclamation research, analysis, monitoring, and mitigation. The fund could be used to support wildlife mitigation such as basic habitat enhancements for improvement of habitat function both on-site and off-site and to identify and protect key migration routes and wildlife habitat. The fund may also be used for monitoring impacts of the development and the effectiveness of the mitigation. Mitigation and monitoring may occur on federal, state, or private lands. It may also be used to provide funds to governmental agencies to pay personnel to complete, oversee, mitigate, and monitor PAPA activities. The fund is not intended to fund projects or proposals to mitigate potential impacts beyond those identified in this Final SEIS.

The fund would be managed by the proposed Pinedale Anticline Mitigation and Monitoring Board which would consist of local representation of BLM, WDA, WGFD, WDEQ, and a Representative of Sublette County. The primary purpose of the Board would be to generate, approve, and fund appropriate project proposals. The fund is intended to be used in a manner consistent with the BLM policy on off-site compensatory mitigation found in WO IM 2005-069 (BLM, 2005d).

Wildlife Heritage Foundation of Wyoming would be the trustee or escrow agent of the funds. The fund would be used to implement mitigation outlined in the Wildlife Monitoring and Mitigation Matrix, as appropriate. The fund would also be used to provide additional staffing for WDEQ and provide for monitoring upgrades as outlined in more detail in Section 4.9.3.5 of Chapter 4. Projects submitted by non-profit and/or governmental agencies would be reviewed by the Pinedale Anticline Mitigation and Monitoring Board. Approved projects on federal lands, the effects of which are not analyzed in this Final SEIS, would require the appropriate level of environmental review prior to implementation. In that instance, the project proponent would prepare an environmental assessment for independent review and adoption by the BLM or other federal agency in compliance with NEPA.

2.4.4 Alternative E

Based upon public comments received on the Draft SEIS (BLM, 2006a), the BLM has developed Alternative E. Alternative E was created by the ID Team in response to comments concerning pace of development. Alternative E slows the pace of development by approximately 10 years with construction through 2015, drilling through 2033, and production through 2073.

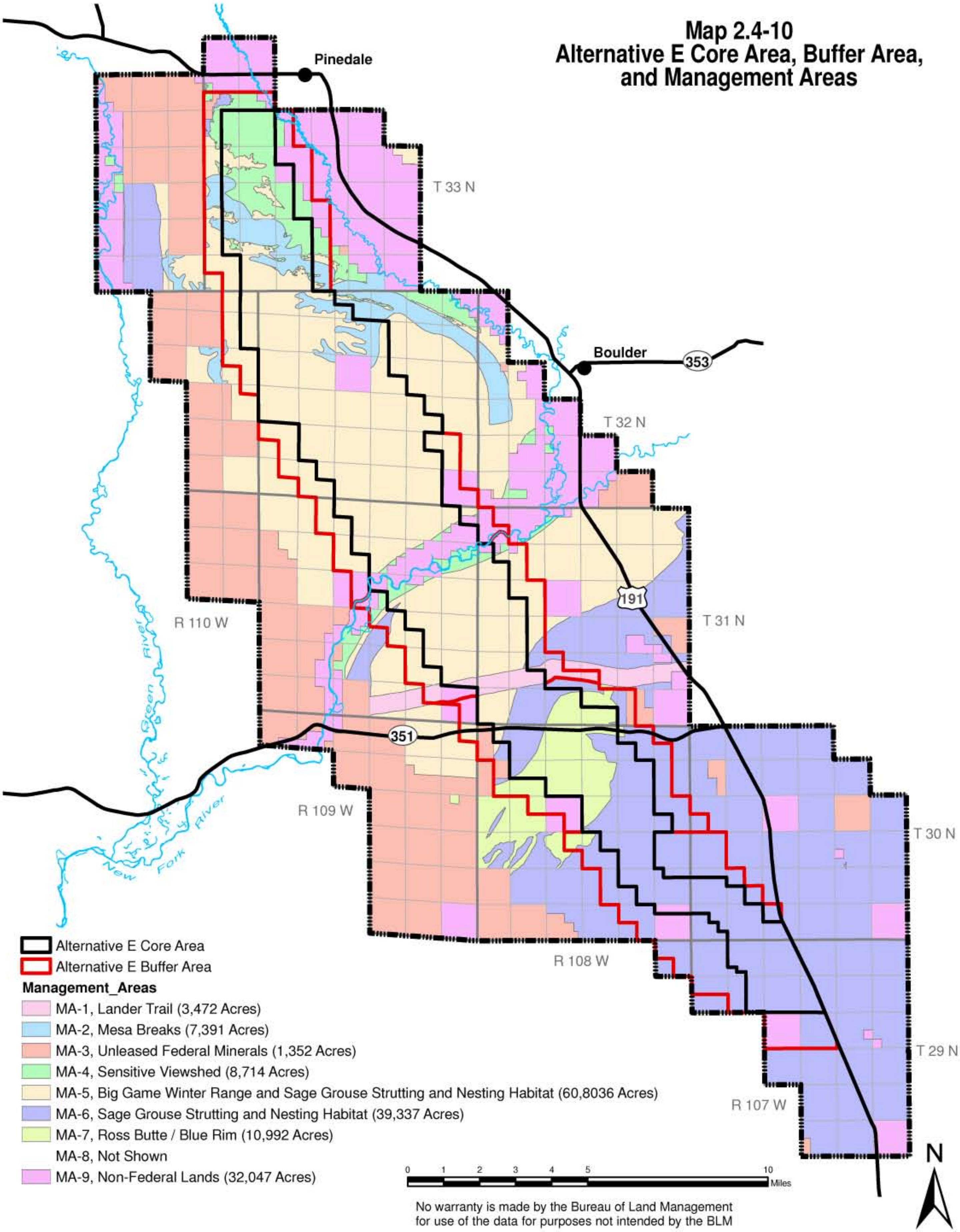
Alternative E is similar to Alternatives B, C, and D with respect to the following and includes:

- all project components described for Components Common to All Alternatives, Alternative B, and Alternative C with the exception of the liquids gathering system;
- the Development Procedures for Wellfield Activities (Appendix 7) and Pipeline Design and Construction Procedures (Appendix 6);
- an estimated 4,399 additional wells; and
- air quality impact analysis based on a peak of 48 drillings rigs operating in the PAPA.

Alternative E is unique with respect to the following and includes:

- year-round development allowed by exception and existing decisions only (otherwise seasonal restrictions apply);
- development period through 2033;
- 415 additional well pads totaling 700 well pads for LOP since the PAPA ROD;
- additional initial disturbance of 10,427.0 acres and LOP disturbance of 4,185.6 acres; and
- designation of management areas as developed in the PAPA DEIS and carried through into the PAPA ROD.

The Alternative E Core Area is the same geographically as the Alternative D Core Area and under this Alternative is defined as the area containing the majority of the existing high intensity development. Year-round development would not be allowed in the Alternative E Core Area under Alternative E. The Alternative E the Buffer Area is geographically the same as the Alternative D PDA, and areas outside of the Buffer Area are defined as the Flanks (Map 2.4-10). Limits on disturbance are defined for the Alternative E Core Area, Buffer Area, and for the Flanks (see Table 2.4-13 and Appendix 13). Alternative E does not contain provisions for federal suspended or term NSO leases in the Flanks outside of the Buffer Area. Alternative E is very similar to the No Action Alternative, but clearly allows for 700 producing well pads (since the PAPA ROD) and assumes that 4,399 wells would be drilled on the 700 well pads. The 700 well pad limit would apply to all lands in the PAPA, regardless of surface or mineral ownership. Once the 700 well pad limit is reached, additional well pads can be developed as well pads are reclaimed to full bond release status.



Map 2.4-10
Alternative E Core Area, Buffer Area, and Management Areas
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Alternative E Core Area
Alternative E Buffer Area
Management_Areas
MA-1, Lander Trail (3,472 Acres)
MA-2, Mesa Breaks (7,391 Acres)
MA-3, Unleased Federal Minerals (1,352 Acres)
MA-4, Sensitive Viewshed (8,714 Acres)
MA-5, Big Game Winter Range and Sage Grouse Strutting and Nesting Habitat (60,8036 Acres)
MA-6, Sage Grouse Strutting and Nesting Habitat (39,337 Acres)
MA-7, Ross Butte / Blue Rim (10,992 Acres)
MA-8, Not Shown
MA-9, Non-Federal Lands (32,047 Acres)
0 1 2 3 4 5 10 Miles
N
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Management Areas and Limitations. Under Alternative E, the MAs established in the PAPA ROD (BLM, 2000b) would be carried forward. Adjustments to the MA boundaries have been made to account for the changes in leased/unleased federal minerals since 2000. MA 3 is designated as *Unleased Federal Minerals*. In 2000, when the PAPA ROD was issued, this MA included 1,347 acres (0.7 percent of the PAPA). Since 2000, many of the federal leases have expired and now MA 3 includes 37,067 acres or 18.7 percent of the PAPA. This adjustment to MA 3 causes an adjustment to the boundaries of the other MAs, thereby reducing their acreage. MA 8, *Minimal Conflict Area*, has been dissolved into the other MAs because it has been determined that no lands in the PAPA are truly “minimal conflict” and all lands now have new management concerns for a number of resources.

The PAPA ROD provided for an “average” number of well pads/square mile within MAs. Under Alternative E, this provision is replaced with a maximum number of active well pads per section. Well pad limits within MAs were provided for in the PAPA ROD but have been replaced in Alternative E with limitations on locations with production activity, active drilling, and unreclaimed disturbance. Restrictions and limitations have been developed for Alternative E. Generally, the most active well pads and surface disturbance would be allowed in the Alternative E Core Area, fewer would be allowed in the Buffer Area, and even fewer would be allowed in the Flanks. The Summary Management Prescriptions for each MA under Alternative E are provided in Table 2.4-13. The full requirements of Alternative E are included in Appendix 13.

Table 2.4-13
Summary Management Prescriptions under Alternative E

Management Area	Summary Management Prescription		
	Alternative E Core Area	**Buffer Area**	**Flanks**
MA-1 Lander Trail	No surface occupancy within 0.25-mile buffer of the Lander Trail	No surface occupancy within 0.25-mile buffer of the Lander Trail	No surface occupancy within 0.25-mile buffer of the Lander Trail
MA-2 Mesa Breaks	No more than four active well pads and 80 acres of surface disturbance per section No more than two CPFs per Operator per section	No more than two active well pads and 60 acres of surface disturbance per section No permanent facilities - would be moved to the Alternative E Core Area	No more than two active well pads and 40 acres of surface disturbance per section No more than two CPFs per Operator per section
MA-3 Unleased Federal Minerals These federal minerals are currently unleased. The BLM would not make leasing decision on these parcels until completion of the RMP revision, consistent with Section 2.4.21, Components Common to All Alternatives.	Any lease parcels that expire during preparation of the RMP would be included in this MA	Any lease parcels that expire during preparation of the RMP would be included in this MA	Any lease parcels that expire during preparation of the RMP would be included in this MA

Management Area	Summary Management Prescription		
	Alternative E Core Area	**Buffer**	**Flanks**
MA-4 Sensitive Viewshed	No more than four active well pads and 80 acres of surface disturbance per section No restriction on permanent facilities as long as surface disturbance limits are not exceeded	No more than four active well pads and 60 acres of surface disturbance per section No permanent facilities - would be moved to the Alternative E Core Area	No more than four active well pads and 40 acres of surface disturbance per section No permanent facilities (90 days or more) that cannot be adequately mitigated for the protection of visual resources would be authorized
MA 5 Big Game Winter Range and Sage-Grouse Strutting and Nesting Habitat	No more than eight active well pads and 80 acres of surface disturbance per section No more than two CPFs per Operator per section	No more than two active well pads and 60 acres of surface disturbance per section No permanent facilities - would be moved to the Alternative E Core Area	No more than two active well pads and 40 acres of surface disturbance per section No more than two CPFs per Operator per section
MA 6 Sage Grouse Strutting and Nesting Habitat	No more than eight active well pads and 80 acres of surface disturbance per section No more than one CPF per Operator per section Within VRM Class III – no more than four active well pads per section	No more than one active well pad and 40 acres of surface disturbance per section No permanent facilities - would be moved to the Alternative E Core Area Same as core	No more than one active well pad and 40 acres of surface disturbance per section No more than one CPF per Operator per section Same as core
MA 7 Ross Butte/Blue Rim	No more than four active well pads and 80 acres of surface disturbance per section Permanent facilities allowed as long as surface disturbance limits are not exceeded	No more than one active well pad and 40 acres of surface disturbance per section No permanent facilities - would be moved to the Alternative E Core Area	No more than one active well pad and 40 acres of surface disturbance per section No more than one CPF per Operator per section
MA 8 Minimal Conflict Area	Areas of Minimal Conflict have been dissolved into MA 5, MA 6, and MA 7. MA 8 no longer exists, but is provided for continuity between the PAPA ROD (2000) and this analysis.		
MA 9 Non-Federal Lands (Private and state lands not under the jurisdiction of the BLM)	To compensate for impacts resulting from development on private and state lands, well pads in this MA would count against the 700 total well pad limit. BLM cannot impose management objectives or restrictions/limitations on these lands. The COE regulates the discharge of dredged or fill materials into waters of the United States and would require Operators to demonstrate that impacts to special aquatic sites, including wetlands, have been avoided and minimized to the maximum extent practicable. The USFWS administers migratory bird species, threatened and endangered species, and species that are proposed for listing. Operators are required to comply with the Endangered Species Act, Bald and Golden Eagle Protection Act, and Migratory Bird Treaty Act, regardless of land ownership, in the implementation of construction, drilling, and operation of natural gas development.		

Project Components. The project components under Alternative E include well pads, roads, gas gathering and limited liquids gathering pipelines. Transportation corridors, gas sales pipelines, trunk pipelines, and some of the ancillary facilities are also included in Alternative E. These components are required for continued transport of natural gas and liquids from the PAPA as development carries forward under the PAPA ROD (BLM, 2000b) or under any Alternative, and are detailed in Section 2.4.2.1 – Components Common to All Alternatives. Projected disturbance was determined from responses provided by the Proponents regarding how they would continue to develop natural gas resources under the PAPA ROD and subsequent Decision Records (BLM, 2004a, 2005a, 2005b, 2005c, and 2006b) assuming that seasonal restrictions for big game and greater sage-grouse in seasonal habitats would apply.

The proposed project components and estimated disturbance for Alternative E are provided in Table 2.4-14. Initial disturbance is defined as the amount of acreage that is disturbed at the time of construction. Alternative E initial disturbance for well pads, roads, and gathering pipelines is estimated to be 10,427.0 acres. LOP disturbance for the same components is expected to be 4,185.6 acres. LOP disturbance is defined as the amount of disturbance remaining once reclamation has occurred. For example, it is assumed that 60 percent of initial surface disturbance associated with well pads would be reclaimed when all development activities have been completed. Likewise, it is assumed that 20 percent of the initial disturbance for roads would be reclaimed while 80 percent of the disturbance would remain to support continued operations.

Table 2.4-14
Estimated Initial and Life-of-Project Disturbance under Alternative E

Component	**Number or Miles**	**Initial Disturbance (acres)**	**Life-of-Project Disturbance (acres)**
Well Pads, Roads and Gas Gathering Pipelines			
Well Pads[1]	415 pads	8,113.0	3,245.2
Local and Resource Roads[2]	166 miles	1,006.1	804.9
Gas Gathering Pipelines[3]	166 miles	503.0	0.0
Liquids Gathering Pipelines[4]	31.5 miles	190.9	0.0
Subtotal		**9,813.0**	**4,050.1**
Trunk Pipelines and Ancillary Facilities			
30- to 42-inch Mesa Loop Lines[5]	15.3 miles	370.9	1.0
8-inch water line[6]	18.0 miles	109.1	0.5
Compressor Sites (expansion)	3 sites	110.0	110
Central Gathering Facilities	6 sites	12.0	12.0
Water Trucking Facility	1 site	7.0	7.0
Expand Stabilizer Site	1 site	5.0	5.0
Subtotal		**614.0**	**135.5**
Total Wellfield Components		**10,427.0**	**4,185.6**

[1] Disturbance includes new well pads and expansion of existing well pads. LOP disturbance assumes 60 percent reclamation of well pads.
[2] Assumes no new collector roads would be built within the PAPA, estimate for miles of proposed roads is based on factors determined from existing roads. LOP disturbance assumes 20 percent reclamation of roads.
[3] Estimate for miles of proposed gas gathering pipelines is based on factors determined from existing roads.
[4] Estimate for miles of proposed liquids gathering pipelines is based on data provided by the Proponents.
[5] Disturbance is based on 200-foot construction right-of-way width. Includes two co-located 30- to 42-inch gas pipelines from Stewart Point to Pinedale/Gobblers Knob Compressor Station. Includes 30.6 miles of pipeline but because they are co-located, 200-foot construction right-of-way is 15.3 miles. The two pipelines will be built at separate times.
[6] Disturbance is based on 50-foot construction right-of-way width from Stewart Point area to Highway 351.

Nearly all initial disturbance for pipelines would be reclaimed, leaving almost no LOP disturbance. In contrast, for other ancillary facilities such as compressor station expansion, central gathering facilities, etc., the LOP disturbance would be the same as the initial disturbance, i.e., none of the disturbance would be reclaimed until the facility is no longer in use.

Wells and Drilling Rigs. An estimate of the number of wells drilled, new well pads, and drilling rigs under Alternative E by year is provided in Table 2.4-15. More drilling rigs would be operating in the summer than in the winter under Alternative E because seasonal restrictions for big game and greater sage-grouse in seasonal habitats would apply.

Table 2.4-15
Estimated Wells, New Well Pads, and
Drilling Rigs by Year under Alternative E

Year	Wells	New Well Pads	Drilling Rigs	
			Summer	Winter
2007	231	92	43	30
2008	235	53	43	30
2009	236	54	43	30
2010	217	27	40	27
2011	220	48	40	27
2012	185	44	36	23
2013	191	45	36	23
2014	188	41	36	23
2015	188	11	36	23
2016	187	0	36	23
2017	186	0	36	23
2018	186	0	36	23
2019	185	0	36	20
2020	178	0	32	20
2021	175	0	32	20
2022	175	0	32	20
2023	175	0	32	20
2024	175	0	32	20
2025	137	0	27	15
2026	130	0	26	14
2027	130	0	26	14
2028	130	0	26	14
2029	102	0	26	14
2030	101	0	26	14
2031	70	0	22	14
2032	70	0	16	8
2033	16	0	2	2
Total	**4,399**	**415**		

Well Pads. The Proponents provided information on the number and locations of wells pads within each MA if they were to continue development under the PAPA ROD (BLM, 2000b). This scenario was used to describe Alternative E for 4,399 wells. There are no limits to the number of well pads within each individual MA under Alternative E, unlike management under the PAPA ROD. The limit of 700 producing well pads allowed under the PAPA ROD applies to all well pads constructed since July 2000. As of November 2006, there were 285 well pads constructed since the issuance of the PAPA ROD and therefore, there were 415 remaining well pads to reach the limit of 700 well pads.

Initial surface disturbance estimates are for 8,113.0 acres to construct 415 new well pads under Alternative E, with a LOP surface disturbance of 3,245.2 acres. Interim reclamation would be limited under Alternative E because well pads would be left open when seasonal wildlife restrictions go into effect. Operators would have to move rigs and return during the next season to the same pad. Reclamation would be similar to what is occurring now with management under the PAPA ROD.

Roads and Gathering Pipelines. Under Alternative E and similar to other Alternatives, it is assumed that there would be no additional construction of collector roads in the PAPA. There would be an estimated 166 miles of local and resource roads constructed in the PAPA for an initial disturbance of 1,006.1 acres and a LOP disturbance of 804.9 acres, assuming that 20 percent of the initial road disturbance is reclaimed after construction (see Table 2.4-14). It is estimated that there would be 166 miles of gas gathering pipelines and 31.5 miles of liquids gathering pipelines (continuation of existing liquids gathering system in leaseholds currently held by Questar), with an initial disturbance of 503.0 and 190.9 acres, respectively. There is no LOP disturbance associated with construction of gathering pipelines because the entire disturbance is reclaimed after construction.

Pad Drilling and Centralized Production Facilities. This Alternative considers pad drilling as an option for reducing surface disturbance and human presence in the PAPA and the use of centralized production facilities (CPFs) to minimize storage of condensate and produced water on each well pad, collecting them at central locations.

Year-Round Development. Under Alternative E, year-round development would not be allowed in big game (pronghorn and mule deer) and greater sage-grouse seasonal habitats except as allowed by BLM's 2004 Decision Record (BLM, 2004a). This allowed limited year-round development within Questar's leaseholds through winter 2013-2014. Approved components in the Decision Record are provided in Appendix 1.

2.4.4.1 Summary of Surface Disturbance for Alternatives Analyzed in Detail

A comparison of the Alternatives is provided in Table 2.4-16, showing estimates of initial and LOP disturbance for each of the Alternatives. Table 2.4-17 provides a comparison of the impacts across all Alternatives that were analyzed in detail. Detailed descriptions of the impacts are presented in Chapter 4, Environmental Consequences.

Table 2.4-16
Summary of Surface Disturbance for Alternatives Analyzed in Detail

	Alternative A (acres)	Alternatives B, C and D (acres)	Alternative E (acres)
Well Pads, Roads, and Gas Gathering Pipelines			
Initial Surface Disturbance	3,465.5	9,022.0	9,622.1
Life-of-Project Disturbance	1,507.0	3,730.0	4,050.1
Components Associated with Liquids Gathering System			
Initial Surface Disturbance	196.70	3,382.7	324.0
Life-of-Project Disturbance	24.5	171.5	24.5
Other Components			
Initial Surface Disturbance	460.9	480.9	480.9
Life-of-Project Disturbance	91.0	111.0	111.0
All Wellfield Components – Combined			
Initial Surface Disturbance	4,123.1	12,885.6	10,427.0
Life-of-Project Disturbance	1,622.5	4,012.5	4,185.6

2.4.5 Alternatives Considered but not Analyzed in Detail

Elements of Alternatives identified as not analyzed in detail in the Draft SEIS (BLM, 2006a) are included in Alternatives analyzed in detail in this Final SEIS.

2.4.5.1 Conservation Alternative

The Conservation Alternative would be similar to the No Action Alternative but would require additional mitigation. All seasonal restrictions for big game and greater sage-grouse seasonal habitats would apply and there would be no exceptions allowed. All Operators would be required to use liquids gathering systems for transport of condensate and produced water to central gathering facilities. No new pads would be allowed in a quarter-section (approximately 160 acres) if there are one or more existing pads. Operators would be required to expand existing pads unless there are topographical constraints. Operators would be required to drill out a quarter-section before moving to another area and would not be allowed to return. No more than four active well pads per section would be allowed. Operators would be required to have Tier 2 equivalent emission controls on all drilling rigs in the PAPA, and all completions would be required to be “green” (recover most of the production rather than flaring it all). This Alternative was not analyzed in detail for the following reasons:

- The use of Tier 2 equivalent emission controls on drilling rigs requires that existing drilling rigs either be retrofitted or that new drilling rig engines be built with these emission controls. With all seasonal restrictions in effect, Operators are not able to keep drilling rigs through the winter and there is no guarantee that they could get the same drilling rigs (with the emission controls) back to the PAPA for the spring/summer/fall drilling. This is especially true currently, because drilling rigs are difficult to obtain.
- Although in most cases Operators would be able to develop the resource on four well pads per section (one well pad per quarter section); in some locations it would not be possible due to topographical or resource constraints. In these locations, more well pads could be required to avoid steep slopes, sensitive soils, greater sage-grouse leks, bald eagle nests, etc. A limitation on well pads per section has been analyzed as part of Alternative E.
- Most completion operations in the PAPA are green as specified in the Operators’ WDEQ permits. Due to safety issues or location (insufficient production pressure), it is not feasible to use green completions all the time. This practice is used, where feasible, and is included in the analysis of Alternatives.

2.4.5.2 Maximum Development Alternative

A Maximum Development Alternative was considered but not analyzed in detail. This Alternative would include development of natural gas resources by wells with 5-acre bottom-hole spacing from the Lance Formation and development of the deeper Rock Spring Formation natural gas resource as yet undefined, on 160-acre bottom-hole spacing. This development level would be allowed year-round within a core area flanking the Anticline Crest (where there is maximum potential for development) and would extend to an additional 0.5 mile distance from the core area. If the development would expand beyond the core area and reach a density of two well pads per section, then that would become part of the core area. None of the seasonal restrictions for wildlife would apply to the core area. Exceptions would be allowed outside of the core area. There would be no requirement for Tier 2 equivalent emission controls on drilling rig engines. This Alternative was considered but not analyzed in detail for the following reasons:

- this Alternative would have no provisions for Tier 2 equivalent emission controls on drilling rigs. Previous air quality impact analysis (BLM, 2006c) has shown that at least some control of drilling rig emissions is required for this level of development due to the proximity of the PAPA to the Bridger Wilderness Area; and
- under this Alternative, there would be no provision for consolidating development to allow for areas with no drilling activity during seasonal restrictions along the Anticline Crest.

Table 2.4-17
Comparison of Impacts for all Alternatives

Resource	No Action Alternative	Alternative B	Alternative C	Alternative D	Alternative E
Environmental Justice					
Susceptible Populations	No impact to minority populations, low income populations, or Indian Tribes	No impact - similar to No Action	No impact - similar to No Action	No impact - similar to No Action	No impact - similar to No Action
Socioeconomic Resources					
Workforce	The number of development workers would peak in 2009 at 1,060, and fall to 0 in 2012. The number of production workers would peak in 2011 at 210, and remain through 2051	The number of development workers would peak in 2009 at 1,370, and fall to 0 in 2026. The number of production workers would peak in 2025 at 381, and remain through 2065	Impact similar to Alternative B	Impact similar to Alternative B	The number of development workers would peak in 2009 at 1,060, same as No Action, and fall to 0 in 2034. The number of production workers would peak in 2033 at 601, and remain through 2073
Housing	There is pressure on a tight housing market. A sharp decline in development workers may adversely affect the housing market in 2012	There is a greater up-front demand for housing for development workers, and it is expected that the market would continue to expand. The production workforce would remain steady for 40 years, providing stabilization	Impact similar to Alternative B	Impact similar to Alternative B	There may be a larger demand for housing for production workers than in the other the other Alternatives, although this workforce would remain steady for 40 years, providing stabilization
Population	Population estimate for Sublette, Sweetwater, and Lincoln counties in 2011 is 69,380 and in 2020 is 77,380, with the greatest increase in Sublette County	Low impact population estimate for Sublette, Sweetwater, and Lincoln counties in 2011 is 69,510, and in 2020 is 78,169 with the greatest increase in Sublette County	Impact similar to Alternative B	Impact similar to Alternative B	Low impact population estimate for Sublette, Sweetwater, and Lincoln counties in 2011 is the same as No Action and in 2020, it is 78,257, with the greatest increase in Sublette County
		Medium impact population estimate for Sublette, Sweetwater, and Lincoln counties in 2011 is 69,615, and in 2020 is 77,448 with the greatest increase in Sublette County			Medium impact population estimate for Sublette, Sweetwater, and Lincoln counties in 2011 is 69,380 and in 2020, it is 78,523
		High impact population estimate for Sublette, Sweetwater, and Lincoln counties in 2011 is 69,717 in 2011, and 77,721 in 2020			High impact population estimate for Sublette, Sweetwater, and Lincoln counties is 69,380 in 2011 and in 2020, it is 78,783
Local Demands	Local infrastructure, services, and facilities demand continues in similar manner, with need lessening greatly in 2012	Increased immediate need for local infrastructure, services, and facilities because of development workers, with a steady production workforce for 40 years	Impact similar to Alternative B	Impact similar to Alternative B	Local infrastructure, services, and facilities demand continues in similar manner, with demand gradually decreasing for both development and production workers
Economic Benefit	Direct, indirect, and induced economic benefits from drilling total $2,430,179 per well	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative
	Earnings from development are estimated to peak in 2009, at $573,522,150	Earnings from development are estimated to peak in 2009, at $741,204,473	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action Alternative
	Earnings from production are estimated to peak in 2011 at $110,292,283	Earnings from production are estimated to peak in 2017, at $162,628,449	Impact similar to Alternative B	Impact similar to Alternative B	Earnings from production are estimated to peak in 2013, at $109,505,086
Mineral Royalties	The average total federal mineral royalty from the PAPA, 2007-2051, is $79,048,715, based on 2006 rates	The average total federal mineral royalty from the PAPA, 2007-2065, is $232,854,993, based on 2006 rates	Impact similar to Alternative B	Impact similar to Alternative B	The average total federal mineral royalty from the PAPA, 2007-2073, is $205,051,412, based on 2006 rates
Ad Valorem Tax	The average ad valorem production from the PAPA, 2007-2051, is $40,537,803, based on 2006 rates	The average ad valorem production from the PAPA, 2007-2065, is $119,412,817, based on 2006 rates	Impact similar to Alternative B	Impact similar to Alternative B	The average ad valorem production from the PAPA, 2007-2073, is $105,154,570, based on 2006 rates
Transportation					
Road Construction	More vehicles in the PAPA due to increased construction of 99.6 miles of new road	More vehicles in the PAPA due to increased construction of 100 miles of new road	Impact similar to Alternative B	Impact similar to Alternative B	More vehicles in the PAPA due to increased construction of 166 miles of new road
Traffic	Increased development- and production-related traffic due to increased development with limited liquids gathering system and use of computer-assisted operations	Increased development-related traffic due to increased development. Reduction in production-related traffic of 3,820 vehicles per day in production phase due to installation and use of liquids gathering system and computer-assisted operations	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action Alternative
Road Maintenance	Increased arterial road maintenance cost to WDOT due to increased traffic volume	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative
Vehicular Crashes	Increased vehicular crash rates due to increased traffic volume	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative

Resource	No Action Alternative	Alternative B	Alternative C	Alternative D	Alternative E
Land Use and Residential Areas					
Existing Land Use Categories	Change of existing land use categories to wellfield development by 4,123.1 acres of initial surface disturbance and 1,622.5 acres of life-of-project surface disturbance	Impact similar to No Action but increased to 12,885.6 acres of initial surface disturbance and increased to 4,012.5 acres of life-of-project surface disturbance	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased to 10,427.0 acres of initial surface disturbance and increased to 4,185.6 acres of life-of-project surface disturbance
Sublette County Resource Conservation Zoning District	New initial surface disturbance of 147.7 acres on non-federal land in conflict with Sublette County Resource Conservation Zoning District	New initial surface disturbance of 710.0 acres on non-federal land in conflict with Sublette County Resource Conservation Zoning District	Impact similar to Alternative B	Impact similar to Alternative B	New initial surface disturbance of 371.1 acres on non-federal land in conflict with Sublette County Resource Conservation Zoning District
Residential SRMZ and 0.25-Mile Residential Buffer	No new wellfield development conflicting with any Sublette County residential zoning districts but 82.6 acres of initial disturbance in the 0.25-mile residential buffer and 91.7 acres of initial disturbance in the Residential SRMZ	No new wellfield development conflicting with any Sublette County residential zoning districts but 71.9 acres of initial disturbance in the 0.25-mile residential buffer and 114.9 acres of initial disturbance in the Residential SRMZ	Impact similar to Alternative B	Impact similar to Alternative B	No new wellfield development conflicting with any Sublette County residential zoning districts but 212.6 acres of initial disturbance in the 0.25-mile residential buffer and 235.5 acres of initial disturbance in the Residential SRMZ
Recreation Resources					
Recreation in the PAPA	Decreased recreational use of three OHV areas in the PAPA by 3,636.5 acres of initial surface disturbance	Decreased recreational use of three OHV areas in the PAPA by 11,185.4 acres of initial surface disturbance	Impact similar to Alternative B	Impact similar to Alternative B	Decreased recreational use of three OHV areas in the PAPA by 9,247.0 acres of initial surface disturbance
	Decreased hunting opportunities in the PAPA with decreased abundance of big game and upland game birds from increased density of wellfield development and 4,123.1 acres of initial surface disturbance and 1,622.5 acres of life-of-project surface disturbance	Impact similar to No Action but increased by 12,885.6 acres of initial surface disturbance and increased to 4,012.5 acres of life-of-project surface disturbance	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased by 10,427.0 acres of initial surface disturbance and increased to 4,185.6 acres of life-of-project surface disturbance
Visual Resources					
Visual Resource Management Classes	Wellfield development becomes a locally dominant feature in VRM II class with 111.0 acres of new surface disturbance on federal land	Impact similar to No Action but increased to 495.5 acres of new surface disturbance in VRM II class	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased to 240.8 acres of new surface disturbance in VRM II class
	Wellfield development becomes a locally dominant feature in VRM III class with 848.7 acres of new surface disturbance on federal land	Impact similar to No Action but increased to 2,189.7 acres of new surface disturbance in VRM III class on federal land	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased to 1,947.1 acres of new surface disturbance in VRM III class on federal land
Sensitive Viewshed SRMZ	Local industrialized appearance in the Sensitive Viewshed SRMZ with 253.6 acres of new surface disturbance on federal land	Impact similar to No Action but increased by 1,540.2 acres of new surface disturbance in the Sensitive Viewshed SRMZ on federal land	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased to 410.2 acres of new surface disturbance in the Sensitive Viewshed SRMZ on federal land
Condensate and Water Storage Tanks	All producing locations would continue to have high profile condensate and water storage tanks	Approximately 90 percent of all condensate and water storage tanks would be reduced due to liquids gathering system	Impact similar to Alternative B	Impact similar to Alternative B	All producing locations would continue to have high profile condensate and water storage tanks
Cultural Resources					
Unexpected Discoveries	Destruction and/or unexpected discoveries of archaeological resources by 4,123.1 acres of new surface disturbance in the PAPA	Impact similar to No Action but increased to 12,885.6 acres of new surface disturbance	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased to 10,427.0 acres of new surface disturbance
	Increased disturbance to areas with high potential for major finds (sandy bluffs south of the New Fork River, not in Mesa Breaks)	Increased disturbance to areas with high potential for major finds (sandy bluffs south of New Fork River and Mesa Breaks)	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action Alternative
	No new surface disturbance in frozen soils and with limited or no destruction of archaeological resources	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative
Lander Trail	No disturbance in the 0.25-mile buffer of the Lander Trail	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative
	Decreased visual integrity within the Lander Trail SRMZ by 458.0 acres of surface disturbance on federal lands	Impact similar to No Action but increased by potential surface disturbance (1,307.9 acres on federal land) within the Lander Trail SRMZ	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased by potential surface disturbance (1,383.3 acres on federal land) within the Lander Trail SRMZ

Resource	No Action Alternative	Alternative B	Alternative C	Alternative D	Alternative E
Air Quality					
Concentrations of Criteria Pollutants CO, NO_2, SO_2, O_3, PM_{10},and $PM_{2.5}$ Within and Nearby the Project Area	Predicted concentrations are in compliance with the applicable NAAQS and WAAQS that were in effect at the time the Revised Draft SEIS was released for public comment; predicted ozone concentrations are slightly above the new NAAQS for ozone; predicted concentrations are above the applicable Class II PSD 24-hour PM_{10} increment, and the annual NO_2 increment; and below the PSD annual PM_{10} increment and increments for SO_2	Predicted concentrations are in compliance with applicable NAAQS and WAAQS that were in effect at the time the Revised Draft SEIS was released for public comment; predicted ozone concentrations are slightly above the new NAAQS for ozone; predicted concentrations of NO_2 are above the applicable Class II PSD annual NO_2 increment, and below the PSD increments for SO_2 and PM_{10}	Phase I Mitigation: Predicted concentrations are in compliance with the applicable NAAQS and WAAQS that were in effect at the time the Revised Draft SEIS was released for public comment; predicted ozone concentrations are slightly above the new NAAQS for ozone; predicted concentrations of NO_2 are above the applicable Class II PSD annual NO_2 increment, and below the PSD increments for SO_2 and PM_{10} Phase II Mitigation: Predicted concentrations are in compliance with the applicable NAAQS and WAAQS that were in effect at the time the Revised Draft SEIS was released for public comment; predicted ozone concentrations are slightly above the new NAAQS for ozone; predicted concentrations are below the applicable PSD increments for NO_2, SO_2 and PM_{10}	Phase I Mitigation: Predicted concentrations are in compliance with the applicable NAAQS and WAAQS that were in effect at the time the Revised Draft SEIS was released for public comment; predicted ozone concentrations are slightly above the new NAAQS for ozone; predicted concentrations of NO_2 are above the applicable Class II PSD annual NO_2 increment, and below the PSD increments for SO_2 and PM_{10} Phase II Mitigation: Predicted concentrations are in compliance with the applicable NAAQS and WAAQS that were in effect at the time the Revised Draft SEIS was released for public comment; predicted ozone concentrations are slightly above the new NAAQS for ozone; predicted concentrations are below the applicable PSD increments for NO_2, SO_2, and PM_{10}	Predicted concentrations are in compliance with the applicable NAAQS and WAAQS that were in effect at the time the Revised Draft SEIS was released for public comment; predicted ozone concentrations are slightly above the new NAAQS for ozone; predicted concentrations are above the applicable Class II PSD 24-hour PM_{10} increment and the annual NO_2 increment; and below the PSD annual PM_{10} increment and increments for SO_2
Concentrations of Criteria Pollutants NO_2, SO_2, O_3, PM_{10},and $PM_{2.5}$ at PSD Class I and Sensitive PSD Class II Areas	Predicted concentrations are in compliance with the applicable NAAQS and WAAQS that were in effect at the time the Revised Draft SEIS was released for public comment; predicted ozone concentrations are slightly above the new NAAQS for ozone; predicted concentrations are below PSD increments	Predicted concentrations are in compliance with the applicable NAAQS and WAAQS that were in effect at the time the Revised Draft SEIS was released for public comment; predicted ozone concentrations are slightly above the new NAAQS for ozone; predicted concentrations are below PSD increments	Phase I Mitigation: Predicted concentrations are in compliance with the applicable NAAQS and WAAQS that were in effect at the time the Revised Draft SEIS was released for public comment; predicted ozone concentrations are slightly above the new NAAQS for ozone; predicted concentrations are below PSD increments Phase II Mitigation: Predicted concentrations are in compliance with the applicable NAAQS and WAAQS that were in effect at the time the Revised Draft SEIS was released for public comment; predicted ozone concentrations are slightly above the new NAAQS for ozone; predicted concentrations are below PSD increments	Phase I Mitigation: Predicted concentrations are in compliance with the applicable NAAQS and WAAQS that were in effect at the time the Revised Draft SEIS was released for public comment; predicted ozone concentrations are slightly above the new NAAQS for ozone; predicted concentrations are below PSD increments Phase II Mitigation: Predicted concentrations are in compliance with the applicable NAAQS and WAAQS that were in effect at the time the Revised Draft SEIS was released for public comment at all locations; predicted concentrations are slightly above the new NAAQS for ozone; predicted concentrations are below PSD increments	Predicted concentrations are in compliance with the applicable NAAQS and WAAQS that were in effect at the time the Revised Draft SEIS was released for public comment; predicted ozone concentrations are slightly above the new NAAQS for ozone; predicted concentrations are below PSD increments
Visibility (Regional Haze) Impacts at PSD Class I and Sensitive PSD Class II areas	Predicted visibility impacts are greater than the 1.0 dv threshold for a maximum of 62 days per year at the Bridger Wilderness, 8 days at the Fitzpatrick Wilderness, 2 days at Grand Teton National Park, 6 days at the Gros Ventre Wilderness, 12 days at the Popo Agie Wilderness, 1 day at the Teton Wilderness, 2 days at the Washakie Wilderness, 9 days at the Wind River Roadless Area, and below 1.0 dv at all other sensitive areas	Predicted visibility impacts are greater than the 1.0 dv threshold for a maximum of 67 days per year at the Bridger Wilderness, 10 days at the Fitzpatrick Wilderness, 3 days at Grand Teton National Park, 8 days at the Gros Ventre Wilderness, 14 days at the Popo Agie Wilderness, 1 day at the Teton Wilderness, 2 days at the Washakie Wilderness, 10 days at the Wind River Roadless Area, and below 1.0 dv at all other sensitive areas	Phase I Mitigation: Within 1 year of the ROD, predicted visibility impacts would be greater than the 1.0 dv threshold for a maximum of 40 days per year at the Bridger Wilderness, 5 days at the Fitzpatrick Wilderness, 1 day at Grand Teton National Park, 2 days at the Gros Ventre Wilderness, 6 days at the Popo Agie Wilderness, 5 days at the Wind River Roadless Area, and below 1.0 dv at all other sensitive areas Phase II Mitigation: Within an additional 48 months, predicted visibility impacts would be greater than the 1.0 dv threshold for a maximum of 10 days per year at the Bridger Wilderness, 1 day at the Fitzpatrick Wilderness, 1 day at the Gros Ventre Wilderness, 1 day at the Wind River Roadless Area, and below 1.0 dv at all other sensitive areas The final goal is zero days above 1.0 dv at the Bridger Wilderness Area	Phase I Mitigation: Within 1 year of the ROD, predicted visibility impacts would be greater than the 1.0 dv threshold for a maximum of 40 days per year at the Bridger Wilderness, 5 days at the Fitzpatrick Wilderness, 1 day at Grand Teton National Park, 2 days at the Gros Ventre Wilderness, 6 days at the Popo Agie Wilderness, 5 days at the Wind River Roadless Area, and below 1.0 dv at all other sensitive areas Phase II Mitigation: Within an additional 42 months, predicted visibility impacts would be greater than the 1.0 dv threshold for a maximum of 10 days per year at the Bridger Wilderness, 1 day at the Fitzpatrick Wilderness, 1 day at the Gros Ventre Wilderness, 1 day at the Wind River Roadless Area, and below 1.0 dv at all other sensitive areas. The final goal is zero days above 1.0 dv at the Bridger Wilderness Area. A plan would be submitted by the fifth Annual Planning Meeting and the plan would be implemented by the sixth Annual Planning Meeting.	Predicted visibility impacts are greater than the 1.0 dv threshold for a maximum of 62 days per year at the Bridger Wilderness, 8 days at the Fitzpatrick Wilderness, 2 days at Grand Teton National Park, 6 days at the Gros Ventre Wilderness, 12 days at the Popo Agie Wilderness, 1 day at the Teton Wilderness, 2 days at the Washakie Wilderness, 9 days at the Wind River Roadless Area, and below 1.0 dv at all other sensitive areas

Resource	No Action Alternative	Alternative B	Alternative C	Alternative D	Alternative E
Visibility (Regional Haze) Impacts at Regional Communities	Predicted visibility impacts are greater than the 1.0 dv threshold for a maximum of 126 days per year at Boulder, 89 days at Pinedale, and 58 days at Cora	Predicted visibility impacts are greater than the 1.0 dv threshold for a maximum of 138 days per year at Boulder, 91 days at Pinedale, and 62 days at Cora	Phase I Mitigation: Within 1 year of the ROD, predicted visibility impacts would be greater than the 1.0 dv threshold for a maximum of 107 days per year at Boulder, 70 days at Pinedale, and 47 days at Cora Phase II Mitigation: Within an additional 48 months, predicted visibility impacts would be greater than the 1.0 dv threshold for a maximum of 45 days per year at Boulder, 25 days at Pinedale, and 12 days at Cora	Phase I Mitigation: Within 1 year of the ROD, predicted visibility impacts are greater than the 1.0 dv threshold for a maximum of 107 days per year at Boulder, 70 days at Pinedale, and 47 days at Cora Phase II Mitigation: Within an additional 42 months, predicted visibility impacts would be greater than the 1.0 dv threshold for a maximum of 45 days per year at Boulder, 25 days at Pinedale, and 12 days at Cora	Predicted visibility impacts are greater than the 1.0 dv threshold for a maximum of 126 days per year at Boulder, 89 days at Pinedale, and 58 days at Cora
Atmospheric/terrestrial Deposition	Predicted impacts from sulfur and nitrogen deposition are less than the total deposition LOC at all analyzed areas	Predicted impacts from sulfur and nitrogen deposition are less than the total deposition LOC at all analyzed areas	Phase I Mitigation: Predicted impacts from sulfur and nitrogen deposition are less than the total deposition LOC at all analyzed areas Phase II Mitigation: Predicted impacts from sulfur and nitrogen deposition are less than the total deposition LOC at all analyzed areas	Phase I Mitigation: Predicted impacts from sulfur and nitrogen deposition are less than the total deposition LOC at all analyzed areas Phase II Mitigation: Predicted impacts from sulfur and nitrogen deposition are less than the total deposition LOC at all analyzed areas	Predicted impacts from sulfur and nitrogen deposition are less than the total deposition LOC at all analyzed areas
Sensitive Lake ANC	Predicted impacts resulted in less than the LAC at all acid-sensitive lakes	Predicted impacts resulted in less than the LAC at all acid-sensitive lakes	Phase I Mitigation: Predicted impacts resulted in less than the LAC at all acid sensitive lakes Phase II Mitigation: Predicted impacts resulted in less than the LAC at all acid-sensitive lakes	Phase I Mitigation: Predicted impacts resulted in less than the LAC at all acid sensitive lakes Phase II Mitigation: Predicted impacts resulted in less than the LAC at all acid-sensitive lakes	Predicted impacts resulted in less than the LAC at all acid-sensitive lakes
Noise					
Noise-Sensitive Sites	Drilling and completion at some of the 1,139 new wells would increase noise above 10 dBA at noise-sensitive sites (residences, greater sage-grouse leks).up to 2,800 feet away	Impact similar to No Action by some of the 4,399 new wells drilled and completed	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to Alternative B
Geology and Geologic Hazards					
High Erosion Potential	Increased erosion and slope instability by disturbance to soils on slopes ≥ 15% with high erosion potential of 203.1 acres and disturbance of 529.1 acres to soils with high erosion potential	Impact similar to No Action with increased surface disturbance in 974.3 acres on slopes ≥ 15% and increased surface disturbance in 1,167.7 acres of soils with high erosion potential	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action with increased surface disturbance in 478.5 acres on slopes ≥ 15% and increased surface disturbance in 1,390.0 acres of soils with high erosion potential
Mineral Depletion	Depletion of the 6 to 9 trillion cubic feet by drilling 1,139 new wells	Depletion of 20 to 25 trillion cubic feet by drilling 4,399 new wells	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to Alternative B
Paleontological Resources					
Blue Rim Area	Loss, damage, or destruction of fossils in the Blue Rim Area by additional surface disturbance of 529.1 acres	Impact similar to No Action with additional surface disturbance in the Blue Rim Area of 1,167.7 acres	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action with additional surface disturbance in the Blue Rim Area of 1,390.0 acres
Groundwater Resources					
Groundwater Withdrawal	Removal of 2,280 acre-feet of water to drill 1,139 wells could lead to temporary depletion of the Wasatch Formation aquifer	Impact similar to No Action 2011 with 8,800 acre-feet of water required to drill 4,399 wells	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to Alternative B
Surface Water					
Sediment Yield	The amount of surface disturbance in six hydrologic basins will at least double with increased annual sediment yields by 10 percent above current conditions	Impact similar to No Action with increased surface disturbance with increased annual sediment yields by 20 percent above current conditions	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to Alternative B
Soil Resources					
High Erosion Potential	Disturbance to sensitive soils with high erosion potential and low revegetation capabilities of 529.1 acres	Impact similar to No Action with increased surface disturbance of 1,167.7 acres of sensitive soils	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action with increased surface disturbance of 1,390.0 acres of sensitive soils
Steep Slopes	Disturbances to soils on slopes ≥ 15% with high erosion potential of 203.1 acres	Impact similar to No Action 2011 with increased surface disturbance of 974.3 acres on slopes ≥ 15%	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action 2011 with increased surface disturbance of 478.5 acres on slopes ≥ 15%
Sedimentation	Increased soil erosion and sedimentation in aquatic habitats (up to 10 percent over current conditions)	Impact similar to No Action with erosion and sedimentation up to 10 percent over current conditions	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to Alternative B

Resource	No Action Alternative	Alternative B	Alternative C	Alternative D	Alternative E
Vegetation Resources					
Native Vegetation	Removal of existing native vegetation of 4,123.1 acres of surface disturbance in native vegetation	Impact similar to No Action with increased surface disturbance of 12,885.6 acres in native vegetation	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action with increased surface disturbance of 10,427.0 acres in native vegetation
Shrub and Tree Dominated Vegetation	Surface disturbance in native vegetation dominated by shrubs and trees would be converted to herbaceous vegetation 3,172.0 acres of sagebrush steppe, 69.2 acres of greasewood, 251.3 acres of desert shrub, and 68.4 acres of riparian forest and shrub	Impact similar to No Action with increased surface disturbance in vegetation dominated by shrubs and trees (10,117.2 acres of sagebrush steppe, 218.8 acres of greasewood, 629.6 acres of desert shrub, and 181.1 acres of riparian forest and shrub)	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action with increased surface disturbance in vegetation dominated by shrubs and trees (7,988.0 acres of sagebrush steppe, 213.6 acres of greasewood, 709.5 acres of desert shrub, and 121.1 acres of riparian forest and shrub)
Nonnative Invasive Species	Unsuccessful revegetation with increased presence of noxious weeds (Canada thistle, perennial pepperweed) on un-reclaimed bare ground (4,123.1 acres)	Impact similar to No Action with increased surface disturbance and potentially more un-reclaimed bare ground (12,885.6 acres)	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action with increased surface disturbance and potentially more un-reclaimed bare ground (10,427.0 acres)
Grazing Resources					
Grazing Capacity	Loss of livestock grazing capacity (AUMs) by removal of existing native vegetation of 4,123.1 acres	Impact similar to No Action with increased surface disturbance in 12,885.6 acres of native vegetation	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action with increased surface disturbance in 10,427.0 acres of native vegetation
Nonnative Invasive Species	Potential for decreased grazing capacity with increased presence of noxious weeds (Canada thistle, perennial pepperweed) on un-reclaimed bare ground	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative
Wetlands, Riparian Resources and Flood Plains					
Wetlands	Potential loss of wetlands due to construction of linear facilities	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative
Riparian Resources	Increased sedimentation in aquatic habitats with loss of 68.9 acres of forest-dominated riparian and shrub vegetation	Impact similar to No Action but increased surface disturbance of 183.9 acres in forest-dominated riparian and shrub vegetation	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased surface disturbance of 122.1 acres in forest-dominated riparian and shrub vegetation
Flood Plains	Surface disturbance within 100-year flood plain due to construction of linear facilities with potential loss of flood plain function	Impact similar to No Action	Impact similar to No Action	Impact similar to No Action	Impact similar to No Action
Threatened, Endangered Species and Special Status Species					
Endangered Colorado River Fish	Groundwater withdrawals for drilling and surface water withdrawals for pipeline construction; possible average annual depletion of 509.31 acre-feet from Colorado River System	Impact similar to No Action but decreased; average annual depletion of 479.58 acre-feet from Colorado River System	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but decreased, average annual depletion of 336.11 acre-feet from Colorado River System
Bald Eagle Wintering-Feeding-Sheltering Habitat	Surface disturbance and associated human presence within 1 mile of the New Fork Riparian zone (584.8 acres) and potential affects to forested-dominated riparian habitat (68.4 acres)	Impact similar to No Action but increased – 1,943.8 acres within 1 mile of the New Fork Riparian zone and 181.6 acres disturbed in forest –dominated riparian habitat	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased – 1,454.4 acres within 1 mile of the New Fork Riparian zone and 121.1 acres disturbed in forest –dominated riparian habitat
Other Special Status Wildlife Species	Direct effects to species depending on upland habitats (sagebrush steppe, mixed grass prairie, greasewood and desert shrub) (3,800 acres) as well as forest-dominated riparian habitats (potentially 68.4 acres)	Impact similar to No Action but increased – disturbance to upland habitat of 11,956 acres, forest-dominated riparian habitats of 181.6 acres	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased – disturbance to upland habitat of 10,425 acres, forest-dominated riparian habitats of 121.1 acres
Special Status Fish Species	Increased sedimentation in aquatic habitats (up to 10 percent over current conditions)	Impact similar to No Action but increased - up to 20 percent increase in sedimentation to aquatic habitats	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to Alternative B
Special Status Plants	Direct effects to existing populations by surface disturbance in Blue Rim Area – surface disturbance of 529.1 acres	Impact similar to No Action but increased – surface disturbance of 1,167.7 acres	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased – surface disturbance of 1,390.0 acres
Wildlife and Aquatic Resources					
All terrestrial wildlife species	Creation of barriers to movement, edges, and patches within former contiguous habitats. The total pad perimeter of 253.3 miles due to 249 new pads with total edge length of 496.3 miles	Impact similar to No Action but increased - pad perimeter of 370.3 miles due to 250 new well pads, total edge length of 1,106.4 miles	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased - pad perimeter of 418.9 miles due to 415 new well pads, total edge length of 815.7 miles
	Direct effects to species depending on upland habitats (sagebrush steppe, mixed grass prairie, greasewood and desert shrub) (3,800 acres) as well as forest-dominated riparian habitats (potentially 68.4 acres)	Impact similar to No Action but increased – disturbance to upland habitat of 11,956 acres, forest-dominated riparian habitats of 181.6 acres	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased – disturbance to upland habitat of 10,425 acres, forest-dominated riparian habitats of 121.1 acres

Resource	No Action Alternative	Alternative B	Alternative C	Alternative D	Alternative E
Pronghorn	Direct loss of crucial winter range by surface disturbance (1,260.7 acres)	Impact similar to No Action but increased surface disturbance (3,519.3 acres)	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased surface disturbance (3,618.3 acres)
	Direct loss of spring/summer/fall range by surface disturbance (2,862.4 acres)	Impact similar to No Action but increased surface disturbance (9,366.3 acres)	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased surface disturbance (6,808.7 acres)
	Decreased habitat function near roads and well pads due to human presence – 249 well pads and 99.6 miles of road	Impact similar to No Action but 250 well pads and 100 miles of road	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to Alternative B
	No year-round development in crucial winter range during winter	Drilling on crucial winter ranges during winter in the Alternative B Core Area	Drilling on crucial winter ranges during winter in the Alternative C Core Area with the exception of DA-5	Drilling on crucial winter ranges during winter in the Alternative D Core Area	Impact similar to No Action Alternative
Mule Deer	Direct loss of crucial winter range by surface disturbance (1,174.6 acres)	Impact similar to No Action but increased surface disturbance (4,593.3 acres)	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased surface disturbance (2,285.6 acres)
	Decreased habitat function near roads and well pads due to human activity – 249 well pads and 99.6 miles of road	Impact similar to No Action but increased – 250 well pads and 100 miles of road	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased – 415 well pads and 166 miles of road
	Limited year-round development in crucial winter range during winter as stated in BLM's 2004 Decision Record	Drilling on crucial winter ranges during winter in the Alternative B Core Area	Drilling on crucial winter ranges during winter in the Alternative C Core Area except for DA-5	Drilling on crucial winter ranges during winter in Alternative D Core Area	Impact similar to No Action Alternative
Moose	Direct loss of crucial winter/yearlong range by surface disturbance (210.2 acres)	Impact similar to No Action but increased surface disturbance (603.0 acres)	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased surface disturbance (404.4 acres)
	Continued drilling on crucial winter range on non-federal lands/minerals during winter	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative
Greater Sage-Grouse	No surface disturbance or human presence within 0.25 mile of leks during breeding	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative	Impact similar to No Action Alternative
	Decreased habitat function at leks and within 2 miles in nesting and brood-rearing habitat by surface disturbance (3,161.1 acres) and human activity	Impact similar to No Action but increased surface disturbance (9,822.6 acres)	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased surface disturbance (8,128.4 acres)
	Decreased habitat function near roads and well pads due to human activity – 245 well pads and 99.6 miles of road	Impact similar to No Action but increased – 250 well pads and 100 miles of road	Impact similar to Alternative B	Impact similar to Alternative B	Decreased habitat function near roads and well pads due to human activity – 415 well pads and 166 miles of road
	Fragmentation and loss of contiguous sagebrush steppe habitat by surface disturbance (3,172.0 acres)	Impact similar to No Action but increased surface disturbance (10,117.2 acres) in sagebrush steppe	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased surface disturbance (7,988.0 acres) in sagebrush steppe
	Limited drilling within 2 miles of occupied greater sage-grouse leks during seasonal restricted periods – federal lands/minerals only.	Drilling within 2 miles of occupied greater sage-grouse leks during seasonally restricted periods in the Alternative B Core Area.	Drilling within 2 miles of occupied greater sage-grouse leks during seasonally restricted periods in the Alternative C Core Area with the exception of DA-5	Drilling within 2 miles of occupied greater sage-grouse leks during seasonally restricted periods in the Alternative D Core Area	Impact similar to No Action Alternative
Small Game and Fur-Bearing Mammals	Fragmentation and direct loss of native habitats by surface disturbance (4,123.1 acres)	Impact similar to No Action but increased surface disturbance (12,885.6 acres)	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased surface disturbance (10,427.0 acres)
Migratory Birds	Decreased habitat function in fragmented habitats and along edges of well pad perimeters of 253.3 miles for 249 pads.	Impact similar to No Action but increased pad perimeter of 370.3 miles for 250 pads	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action but increased pad perimeter of 418.9 miles for 415 pads
	Decreased habitat function near roads due to edges and human activity ≈ 99.6 miles of road and 99.6 miles of pipeline corridor	Impact similar to the No Action but increased with 100 miles of road and 100 miles of pipeline corridor	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to the No Action but increased with 166 miles of road and 166 miles of pipeline corridor
	Fragmentation and loss of contiguous sagebrush steppe habitat by surface disturbance (3,172.0 acres) in habitats used by sagebrush-obligate species	Impact similar to the No Action but increased surface disturbance (10,117.2 acres) in sagebrush steppe	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to the No Action but increased surface disturbance (7,988.0 acres) in sagebrush steppe
	Decreased raptor nesting habitat effectiveness with 68.4 acres of surface disturbance within forest-dominated riparian vegetation and 584.8 acres disturbed within 1 mile of New Fork riparian zone	Impact similar to the No Action but increased surface disturbance (181.6 acres) in forest-dominated riparian vegetation and 1,943.8 acres disturbed within 1 mile of New Fork riparian zone	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to the No Action but increased surface disturbance (121.1 acres) in forest-dominated riparian vegetation and 1,454.4 acres disturbed within 1 mile of New Fork riparian zone
Aquatic Resources	Decreased reproductive success in spring-spawning native salmonid species from increased sedimentation in aquatic habitats (up to 10 percent over current conditions) and loss of 68.9 acres of forest-dominated riparian forest and shrub vegetation	Impact similar to No Action with increased sedimentation up to 20 percent over current conditions and increased loss of 183.9 acres of forest-dominated riparian and shrub vegetation	Impact similar to Alternative B	Impact similar to Alternative B	Impact similar to No Action with increased sedimentation up to 20 percent over current conditions and increased loss of 122.1 acres of forest-dominated riparian and shrub vegetation

2.4.5.3 Reduced Pace of Development Alternative

A Reduced Pace of Development Alternative was originally considered but not analyzed in detail in the Draft SEIS (BLM, 2006a). Based on public comment on the Draft SEIS, this Alternative has now been analyzed in detail as Alternative E. The No Action Alternative does have the elements of a reduced pace of development; however, it is carried forward only through 2011. Alternative E includes 4,399 additional wells which allows for a similar comparison to other action Alternatives.

2.4.5.4 Alternative Pipeline Corridor and Sales Pipeline Alignment

An alternative route for BCC, R6 Pipeline (Segment 1) and the PBC Pipeline was initially considered. The alternative route deviated from the proposed route at approximate milepost 12.1 and returned to the proposed route at milepost 17.1 (see Map 2.4-2). The 6.4-mile long segment would replace 5.0 miles of the proposed route. The alternative route was considered but not analyzed in detail for the following reasons:

- a 500-foot corridor would be required for two large diameter pipelines with 120-foot construction rights-of-way, which is unavailable along the alternative route and this would render the route infeasible,
- there is one greater sage-grouse lek within 0.25 mile, and one lek within 2 miles, of the alternative alignment and there would have been seasonal restrictions on pipeline construction potentially resulting in additional impacts,
- the length of the alternative pipeline segment between the two points of deviation was longer than the proposed route's segment; therefore, there would be less surface disturbance to vegetation, soils, and wildlife habitat, and overall, less environmental impact by using the proposed route, and
- there are fewer sensitive cultural resources along the proposed route in comparison to the alternative route.

2.4.6 BLM Preferred Alternative

In accordance with NEPA, federal agencies are required by CEQ (40 CFR §1502.14) to identify their Preferred Alternative for a project in the Draft if a preference has been identified, and in the Final prepared for a project. The Preferred Alternative is not a final agency decision; rather, it is an indication of the agency's preference.

The BLM has selected the Preferred Alternative based on the analysis in this Final SEIS as well as on comments received during the public comment period on the Draft SEIS (BLM, 2006a) and the Revised Draft SEIS (BLM, 2007a). The Preferred Alternative is the Alternative that best fulfills the agency's statutory mission and responsibilities of sustaining the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations while considering economic, environmental, technical, and other factors.

The BLM has determined that the Preferred Alternative is Alternative D as described in Section 2.4.3, including the environmental protection measures as identified in Appendices 4, 5D, 8D, 9C, 10, and 11.

Chapter 3
Affected Environment

3.1 INTRODUCTION

This chapter describes the current condition of the existing human and natural environment in the PAPA and the degree to which specific resources have been affected by natural gas development. Relevant management objectives that the BLM advanced for each resource in the Pinedale RMP (BLM, 1988b) were reviewed for maintenance changes made since the RMP was first published. Maintenance changes are included in the annotated version of the RMP available online (BLM, 2006d). None of the management objectives included in the PAPA DEIS (BLM, 1999a) has changed. Relevant management objectives advanced by the BLM in the Green River RMP (BLM, 1997), the Kemmerer RMP (BLM, 1986), and in subsequent revisions were reviewed by resource. None of the management objectives included in the RMPs has changed; however, the Pinedale and Kemmerer RMPs are under revision. Management objectives for each of the three RMPs are not repeated here.

BLM Manual H-1790-1 (BLM, 1988a) lists critical elements that must be addressed in every EIS. These are:

- air quality;
- Areas of Critical Environmental Concern;
- cultural resources;
- environmental justice;
- farmlands;
- flood plains;
- invasive non-native species;
- migratory birds;
- Native American religious concerns;
- threatened or endangered species;
- wastes (hazardous or solid);
- water quality;
- wetlands/riparian zones;
- Wild and Scenic Rivers, and
- designated wilderness.

All of the aforementioned critical elements are potentially affected by implementation of each Alternative, with the exception of “Areas of Critical Environmental Concern” and “Wild and Scenic Rivers.” Each critical element is addressed in a level of detail commensurate with the degree of impact to the critical element or resource. A brief description is provided for resources that are expected to have minor impacts under the Alternatives. Detailed information is provided for resources that are expected to have significant impacts, consistent with guidance in BLM Manual H-1790-1 (BLM, 1988a).

For resources described in this chapter, repetition of pertinent information disclosed in the PAPA DEIS (BLM, 1999a) has been avoided. This chapter describes how each resource has been affected or altered since implementation of the PAPA ROD (BLM, 2000b).

The concept of SRMZs was developed in the PAPA DEIS (BLM, 1999a). A SRMZ is an area containing resources that require specific surface disturbance limitations, seasonal construction constraints, monitoring, or other actions to ensure that undue impacts to the resource do not occur. SRMZs occupy distinct geographic areas and in many cases, SRMZs for several resources overlap. For instance, it is common to have areas located within mule deer, greater sage-grouse, sensitive viewshed, and sensitive soil SRMZs. To address overlapping SRMZs, the BLM has divided the PAPA into nine distinct MAs. MA 1 through MA 8 apply to federal lands and minerals. MA 9 applies to all non-federal lands and minerals. The MAs and limits to surface disturbances approved in the PAPA ROD (BLM, 2000b) are discussed in Chapter 2.

Summaries of quantitative effects to SRMZs and other geographically-oriented resources by current levels of development are provided in the appropriate sections of this chapter. This information provides the basis for predicting future impacts associated with each Alternative analyzed in Chapter 4.

Surface disturbance (in acres) due to wellfield activities across the entire PAPA was mapped in December 2005 using QuickBird satellite imagery. Portions of the imagery were updated using additional QuickBird satellite imagery and aerial photography in November 2006.

Before issuance of the PAPA ROD (BLM, 2000b), 8,080.3 acres had been disturbed in the PAPA. Areas of disturbance were primarily concentrated on private lands and were mostly associated with residential areas, recreational facilities, agricultural operations, and the Wenz Field airport. Of this disturbance, 7,639.0 acres is not associated with natural gas development in the PAPA and is not discussed further in this chapter; however, 441.3 acres is associated natural gas development in the PAPA. As of November 2006, there was a total of 4,834.6 acres of natural gas related disturbance in the PAPA. Of this, 441.3 acres were disturbed before issuance of the PAPA ROD and 4,393.3 acres were disturbed subsequent to issuance of the PAPA ROD. These estimates are initial disturbance and do not account for reclamation. Total wellfield related disturbance in the PAPA accounts for 2.4 percent of all lands in the PAPA.

As a result of the proposed increase in natural gas production, the BLM, in consultation with the pipeline companies, has identified three potential corridors for pipelines that would carry hydrocarbon products from the PAPA to processing plants in southwest Wyoming. The pipeline companies have defined two natural gas sales pipelines that would be constructed within the three corridors. Both pipelines would be in one corridor as they leave the PAPA and diverge south of the Bird Canyon Compressor Station. The affected environment for the proposed corridor/pipeline alignments is discussed in this chapter.

3.2 LAND AND MINERAL OWNERSHIP

Federally-managed lands and minerals in the PAPA account for 79.4 percent of lands and minerals while privately owned lands and minerals account for 11.1 percent. Approximately 4.9 percent of all lands in the PAPA are comprised of state-owned lands and minerals while the remaining 4.6 percent of the lands in the PAPA are comprised of mixed surface and mineral ownership (Map 3.2-1 and Table 3.2-1).

As of November 2006, there were 4,834.6 acres of disturbance in the PAPA (2.4 percent) as a result of wellfield activities (Table 3.2-1). Since issuance of the PAPA ROD, most surface disturbance has been on federal lands and minerals ownership.

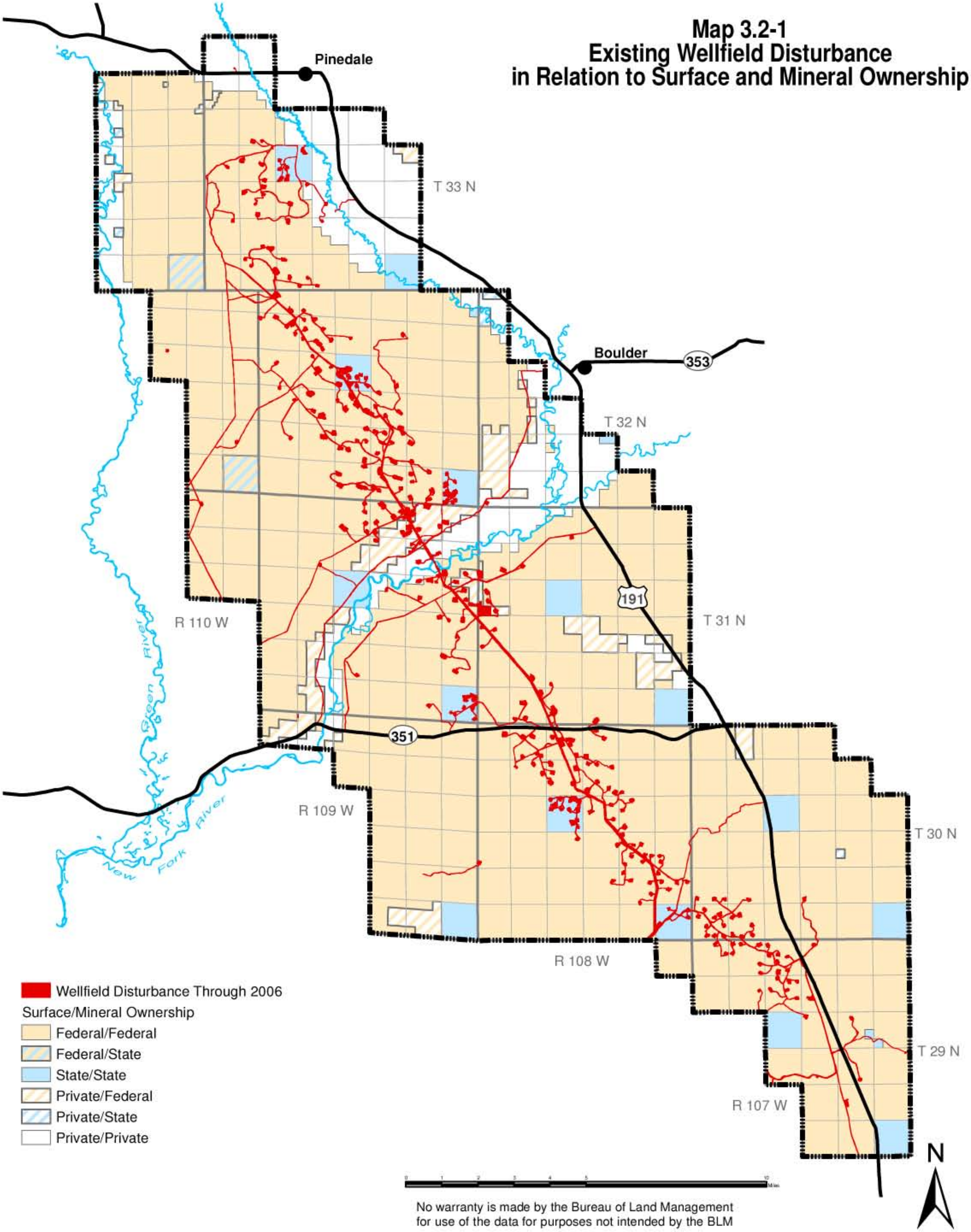

Map 3.2-1
Existing Wellfield Disturbance
in Relation to Surface and Mineral Ownership
Pinedale
Boulder
353
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
191
351
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
Surface/Mineral Ownership
Federal/Federal
Federal/State
State/State
Private/Federal
Private/State
Private/Private
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

Table 3.2-1
Existing Wellfield Disturbance in Relation to Land and Mineral Ownership

Management/Ownership Category	Total Area in the PAPA (acres)	Percent	Existing Wellfield Disturbance through November 2006 (acres)		
			Federal Lands	Non-Federal Lands	All Lands
Federal Surface/Federal Minerals	157,136	79.4	3,835.1	0.0	3,835.1
Federal Surface/State Minerals	1,279	0.6	0.0	0.0	0.0
State Surface/State Minerals	9,800	4.9	0.0	550.8	550.8
Private Surface/Private Minerals	21,866	11.1	0.0	142.8	142.8
Private Surface/State Minerals	344	0.2	0.0	0.0	0.0
Private Surface/Federal Minerals	7,612	3.8	305.9	0.0	305.9
Total	**198,037**	**100.0**	**4,141.0**	**693.6**	**4,834.6**

3.3 CLIMATE

The climate in the PAPA is semiarid and continental, with short, dry summers and long, cold winters. July and August are the hottest months of the year, while December and January are the coldest. Freezing temperatures can occur anytime of the year (Martner, 1986). According to the National Weather Service (NWS), Pinedale's mean temperature in January is 12.6°F with a mean of 59.8°F in July (Western Regional Climate Center, 2007). High elevation and dry air facilitate thermal radiation gain and loss, as evidenced by Pinedale's wide variation between daily minimum and maximum temperatures (BLM, 1999a).

Annual precipitation (including rain and the water equivalent in snow) in the PAPA averaged 10.6 inches over the 30 water years (a water year extends from October through September) from 1970-1971 through 1999-2000. Snowfall from October through April averages 58 inches in the PAPA (Table 3.3-1).

Table 3.3-1
Estimated Values of Climate Parameters in the PAPA since 2000 Compared to the 30-Year Average from Water Year 1970-1971 through Water Year 1999-2000[1]

Climate Parameter	30-Year Average (1971-2000)	Parameter Values in Water Year					
		2001	2002	2003	2004	2005	2006
Total Precipitation (inches in Water Year)	10.58	5.45	6.26	8.00	11.29	11.78	6.94
Total Snowfall (inches October-April)	57.87	43.54	34.91	49.01	58.89	53.02	42.48
Average Monthly Temperature (°F)	35.84	36.06	35.04	36.82	34.61	36.40	36.30
Average Minimum Monthly Temperature (°F)	19.67	18.62	17.79	20.26	18.63	20.40	18.91
Average Maximum Monthly Temperature (°F)	52.02	53.36	52.28	53.37	50.59	52.40	53.42

[1] Source: Western Regional Climate Center, 2007.

Beginning in 2000 and continuing through 2003, precipitation in the PAPA was consistently below the 30-year average, exhibiting drought conditions. Precipitation during water years 2004 and 2005 was above the 30-year average but below the long-term average in 2006. Total snowfall (October through April) in the PAPA has been below the 30-year average of 58 inches since 1987 (including winter 2006-2007) except during winter 2003-2004. Maximum monthly temperatures, averaged by water year, have generally been above the 30-year average (Table 3.3-1). Average maximum monthly temperature in 2006 was the warmest since 2000.

The region is subject to strong and gusty winds, reflecting channeling and mountain valley flows due to complex terrain. During the winter, strong winds are often accompanied by snow, producing blizzard conditions. The closest comprehensive wind measurements were collected in the Jonah Field Project Area adjacent to the southeast corner of the PAPA at a meteorological station operated by BP from 1999 through 2003. Winds in the PAPA (Table 3.3-2) are from the west to northwest approximately 40 percent of the time.

Table 3.3-2
Wind Direction Frequency Distribution in the Vicinity of the PAPA Averaged from 1999 through 2003[1]

Wind Direction	Frequency (%)
N	5.3
NNE	3.9
NE	3.5
ENE	3.9
E	3.8
ESE	3.3
SE	2.9
SSE	2.8
S	3.8
SSW	4.8
SW	6.0
WSW	6.6
W	9.9
WNW	15.9
NW	14.4
NNW	9.2
[1] Source: BP, 2004.	

While the annual mean wind speed is 11.2 miles per hour (mph), wind speeds in excess of 19 mph occur more than 12 percent of the time (Table 3.3-3).

Table 3.3-3
Distribution of Wind Speeds in the Vicinity of the PAPA Averaged from 1999 through 2003[1]

Wind Speed (mph)	Frequency (%)
0 – 4.0	9.1
4.0 – 7.5	25.4
7.5 – 12.1	28.1
12.1 – 19.0	24.7
19.0 – 24.7	7.2
Greater than 24.7	5.5
[1] Source: BP, 2004.	

The atmospheric stability class (Table 3.3-4) is a measure of atmospheric turbulence, which directly affects pollutant dispersion. The stability classes are divided into six categories designated "A" (unstable) through "F" (very stable). The "D" (neutral) stability class occurs more than half of the time. The frequency and strength of winds greatly affect the transport and dispersion of air pollutants. Because of the strong winds in the region, the potential for atmospheric dispersion is relatively high, although nighttime cooling enhances stable air and inhibits air pollutant mixing and transport.

Table 3.3-4
Atmospheric Stability Class
Distribution Averaged from 1999 through 2003[1]

Stability Class [2]	Frequency (%)
A	2.4
B	6.1
C	12.2
D	60.2
E	15.4
F	3.7

[1] Source: BP, 2004.
[2] A = unstable; D = neutral; F = very stable

3.4 ENVIRONMENTAL JUSTICE

Federal agencies are required to conduct programs, policies, and activities that substantially affect human health or the environment in a manner that ensures no person is excluded from participation therein, denied the benefit thereof, or subjected to discrimination due to race, color, or national origin. Executive Order (EO) 12898 requires federal agencies to assess their projects to ensure that they do not result in disproportionately high or adverse environmental, health, or safety effects to minority or low-income populations.

The minority populations in Lincoln, Sublette, and Sweetwater counties constitute smaller percentages of total population than figures for the United States as a whole (Table 3.4-1). There is a lower percentage of the population below the poverty line in Lincoln, Sublette, and Sweetwater counties than for the State of Wyoming and United States as a whole.

Table 3.4-1
Race and Poverty as a Percentage of Total Population in 2000[1]

State or County	White	Black or African-American	American Indian and Alaska Native	Asian	Native Hawaiian and other Pacific Islander	Some other race	Persons reporting other race or multiple races	Total[2]	Hispanic or Latino origin[3]	Below the poverty line
Lincoln	97.1	0.1	0.6	0.2	0.1	0.7	1.2	100.0	2.2	9.0
Sublette	97.5	0.2	0.5	0.2	0.1	0.5	1.0	100.0	1.9	9.7
Sweetwater	91.6	0.7	1.0	0.6	0.0	3.6	2.4	99.9	9.4	7.8
Wyoming	92.1	0.8	2.3	0.6	0.1	2.5	1.8	100.2	6.4	11.4
U.S.	75.1	12.3	0.9	3.6	0.1	5.5	2.4	99.9	12.5	12.4

[1] Source: U.S. Census Bureau, 2007.
[2] This table uses U.S. Census Bureau statistics which, due to rounding, may total slightly more or less than 100 percent.
[3] People who identify their origin as Hispanic or Latino may be of any race. Thus, the percent Hispanic or Latino should not be added to the race as a percentage of population categories.

3.5 SOCIOECONOMIC RESOURCES

The affected environment for socioeconomic resources includes Sublette, Sweetwater, and Lincoln counties. In this section, the term “Southwest Wyoming” is used to refer to these three counties. The following discussion is for the proposed development in the PAPA and for the proposed corridor/pipeline alignments.

3.5.1 Socioeconomic Trends

Southwest Wyoming is primarily rural with sparse populations that have historically relied on livestock ranching (Rosenberg, 1990; Blevins et al., 2004; and BLM, 2006c). While ranching remains culturally important in Southwest Wyoming, the region's economy has shifted toward mineral extraction (including natural gas production). Sublette County shifted to natural gas drilling about 1920 (Rosenberg, 1990), Lincoln County shifted to coal mining around 1900, and Sweetwater County shifted to trona mining in 1946. Tourism and travel grew as important economic components following World War II (Western, 2002). In Sublette County in 2005, 849 workers were employed in mineral development, 610 in travel/tourism, and 383 in agriculture. The same year in Lincoln County, 664 workers were employed in agriculture, 684 in mineral development, and 590 in travel/tourism. In Sweetwater County, 5,225 workers were employed in mineral development, 1,950 in travel/tourism, and 194 in agriculture in 2005 (U.S. Department of Commerce, 2007 and Dean Runyan Associates, 2006).

The significance of oil and gas revenues to the region's economy has increased and is expected to grow (BLM, 2006c). In 1985, oil and gas interests contributed over 80 percent of tax revenues in Sublette County (Rosenberg, 1990). In 2005, oil and gas production and ancillary facilities accounted for 96 percent of the total assessed valuation for Sublette County, 55 percent for Lincoln County, and 61 percent for Sweetwater County (Wyoming Department of Revenue, 2007). Since 2000, the assessed valuation growth index for Sublette County has increased substantially and has outpaced the statewide average, but Sweetwater County and Lincoln County have trailed the statewide average (Table 3.5-1). Per-capita assessed valuation revenues from oil and gas production facilities are substantially higher for Sublette County than for neighboring counties or for Wyoming (Table 3.5-2).

Table 3.5-1
Total Assessed Valuation and Assessed Valuation Indices, Southwest Wyoming from 2000 to 2006[1]

Year	Lincoln County (millions)	Sublette County (millions)	Sweetwater County (millions)	Wyoming (billions)	Lincoln County Index	Sublette County Index	Sweetwater County Index	Wyoming Index
2000	$437.8	$475.8	$1,126.3	$7.9	100.0	100.0	100.0	100.0
2001	$574.1	$851.3	$1,407.0	$10.5	131.1	178.9	124.9	133.5
2002	$591.7	$1,097.1	$1,404.3	$11.2	135.1	230.6	124.7	141.4
2003	$448.0	$934.7	$1,160.7	$10.3	102.3	196.4	103.1	130.9
2004	$597.5	$2,039.1	$1,563.3	$13.7	136.5	428.5	138.8	173.2
2005	$753.1	$2,924.0	$1,821.9	$16.4	172.0	614.5	161.8	208.2
2006	$943.6	$4,401.6	$2,380.6	$21.0	215.5	925.0	211.4	265.7

[1] Source: Wyoming Department of Revenue, 2007.

Table 3.5-2
Per-Capita Assessed Valuation from Oil and Gas Production Facilities, Southwest Wyoming from 2000 to 2006[1]

Year	Lincoln County Per-Capita	Sublette County Per-Capita	Sweetwater County Per-Capita	State of Wyoming Per-Capita
2000	$30,042	$80,378	$29,944	$15,993
2001	$38,957	$143,389	$38,268	$21,338
2002	$39,604	$176,362	$37,654	$22,381
2003	$29,380	$147,008	$31,289	$20,601
2004	$38,130	$306,452	$41,612	$27,041
2005	$47,074	$422,177	$47,976	$32,290
2006	$70,509	$598,127	$61,415	$40,735

[1] Source: Wyoming Department of Revenue, 2007.

In 2006, per-capita sales tax collections were $1,403 in Lincoln County, $6,514 in Sublette County, and $2,049 in Sweetwater County. In 2006, statewide per-capita sales tax collections averaged $1,396 (WDAI, 2007a).

Oil and gas exploration and drilling operations in Southwest Wyoming have been cyclical in nature. During the 1970s, employment in the oil and gas sector grew steadily as drilling activity increased in southern Sublette County. Employment spiked in the early 1980s when natural gas processing plants were built in Southwest Wyoming but employment dropped in the mid-1980s. There was gradual job growth in the oil and gas sector in Southwest Wyoming during the 1990s with increased exploration and development of the Jonah Field Project Area and the PAPA.

Since 1999, job growth associated with oil and gas development has increased at an accelerating rate. Average annual earnings per development job and average earnings per production job are higher than wages paid in other employment sectors (Table 3.5-3). Employment related to natural gas development in the PAPA constituted an increasing component of total regional employment from 2000-2006 (Table 3.5-4). In a 1997 survey, the University of Wyoming reported that residents believed oil and gas would be more important than hospitality or agriculture industries in Sublette County within the next 10 years (McLeod et al., 1997). Sublette County residents have recently expressed strong opinions on the issues associated with changes and growth accompanying oil and gas exploration and drilling.

Increased tax revenues from oil and gas development in the PAPA have supported infrastructure investments in Sublette County. Recent community projects in Sublette County include expansion of the county library, extension and renovation of the courthouse, remodeling in School District Number 1, a new riding arena, baseball fields, a skateboard park (Blevins et al., 2004), a new jail, landfill, senior center, and a public clinic upgrade (BLM, 2006e). The county recently completed a $17.2 million aquatic center, which includes a three-story climbing wall, two racquetball courts, and a competition-sized swimming pool (Gruver, 2006). Some residents fear that the likelihood of a future lag in oil and gas exploration makes it imprudent to continue to increase infrastructure investments in the county. For example, in the early 1980s, the second phase of a drilling project failed to occur and the county had already constructed a high school with 50 percent surplus capacity. Accordingly, local residents are engaged in an ongoing debate concerning the appropriate scope and pace for oil and gas development in Sublette County, and the appropriate level of infrastructure investments to support growth and development.

Table 3.5-3
Employment and Earnings Associated with Natural Gas Development from 2000 to 2006 (2006$)[1,2]

PAPA Related Data	2000	2001	2002	2003	2004	2005	2006
Resource Development Phase:							
Wells Drilled [1]	2	39	58	75	119	117	185
Total Employment per Well	47.4	47.4	47.4	47.4	47.4	47.4	47.4
Local Employment per Well	24.6	24.6	24.6	24.6	24.6	24.6	24.6
Total Development Employment	95	1,848	2,748	3,554	5,638	5,543	8,765
Local Development Employment	49	959	1,427	1,845	2,927	2,878	4,551

PAPA Related Data	2000	2001	2002	2003	2004	2005	2006
Total Earnings per Well	$2661,751	$2,661,751	$2,661,751	$2,661,751	$2,661,751	$2,661,751	$2,661,751
Local Earnings per Well	$1,224,159	$1,224,159	$1,224,159	$1,224,159	$1,224,159	$1,224,159	$1,224,159
Total Development Earnings	$5,323,502	$103,808,286	$154,381,554	$199,631,320	$316,748,360	$311,424,859	$492,423,922
Local Development Earnings	$2,448,318	$47,742,194	$71,001,211	$91,811,911	$145,674,899	$143,226,582	$226,469,381
Average Earning per Job-Total	$56,179	$56,179	$56,179	$56,179	$56,179	$56,179	$56,179
Average Earning per Job-Local	$49,762	$49,762	$49,762	$49,762	$49,762	$49,762	$49,762
Resource Production Phase:							
Natural Gas Production (MMSCF)	10,587	21,702	61,747	109,864	180,399	237,910	284,790
Condensate Production (MBO)	100	210	551	882	1,425	1,869	2,202
Employment per MMSCF	0.002008	0.002008	0.002008	0.002008	0.002008	0.002008	0.002008
Employment per MBO	0.013388	0.013388	0.013388	0.013388	0.013388	0.013388	0.013388
Total Production Employment	23	46	131	232	381	503	601
Earnings per MMSCF	$114,90	$114,90	$114,90	$114.90	$114.90	$114.90	$114.90
Earnings per MBO	$766.07	$766.07	$766.07	$766.07	$766.07	$766.07	$766.07
Total Production Earnings	$1,293,044	$2654,416	$7,516,782	$13,298,954	$21,819,342	$28,767,441	$34,409,015
Average earnings per production job	$57,221	$57,221	$57,221	$57,221	$57,221	$57,221	$57,221

[1] WOGCC, 2007.
[2] Assumes all wells drilled are completed.

Table 3.5-4
PAPA Contribution to Total Regional Employment from 2000 to 2006[1]

Region	2000	2001	2002	2003	2004	2005	2006[2]
Lincoln County	8,114	8,434	8,751	9,195	9,270	9,302	10,060
Sublette County	3,977	4,251	4,548	4,818	5,133	5,703	6,760
Sweetwater County	24,249	24,493	23,989	24,849	26,030	27,628	30,196
Total Tri-County Employment	36,340	37,178	37,288	38,862	40,433	42,633	47,016
Percent employed in the PAPA-Total	0.3	5.1	7.7	9.7	14.9	14.2	19.9
Percent employed in the PAPA-Local	0.2	2.7	4.2	5.3	8.2	7.9	11.0

[1] Source: U.S. Department of Commerce, 2007.
[2] Source: U.S. Department of Labor, 2007.

Production from the PAPA represents 13.6 percent of Wyoming's natural gas production. The PAPA is the third largest oil and gas production field in Wyoming (WOGCC, 2007). The Pinedale Anticline ranks second of the top 100 U.S. fields according to proven gas reserves from estimated 2005 field level data and fourth in gas production (Energy Information Administration, 2007). Southwest Wyoming produces 22.9 percent of the oil produced in Wyoming and 60.1 percent of the natural gas produced in the state (Table 3.5-5).

Table 3.5-5
Oil and Gas Production in Southwest Wyoming, 2006[1]

County	Producing Wells	Oil (Bbls)	Percent of Wyoming's Oil Total	Natural Gas (MSCF)	Percent of Wyoming's Gas Total
Lincoln	1,309	778,037	1.51	85,705,325	4.28
Sublette	3,035	5,753,809	11.14	879,285,436	43.93
Sweetwater	2,898	5,295,805	10.26	238,004,077	11.89
Total	**7,242**	**11,827,651**	**22.91**	**1,202,994,838**	**60.10**

[1] Source: WOGCC, 2007.

3.5.2 Population

The population of Southwest Wyoming is growing (Figure 3.5-1 and Table 3.5-6). After experiencing population losses during the 1980s, the region's population began to rebound in the 1990s. Since 1980, Sweetwater County has experienced the greatest population fluctuations, and most of the growth has occurred in Lincoln and Sublette counties. Between 1990 and 2006, Lincoln County's population grew 30 percent, Sublette County's population grew 52.0 percent, and Sweetwater County's population remained relatively stable. These regional growth rates compare with a 13.5 percent growth rate over the same period for the State of Wyoming. It is worth noting that these census statistics are likely to underestimate the rate of growth in Southwest Wyoming because they do not account for the increasing number of transient workers who consider residences outside the counties their primary homes (Blevins et al., 2004).

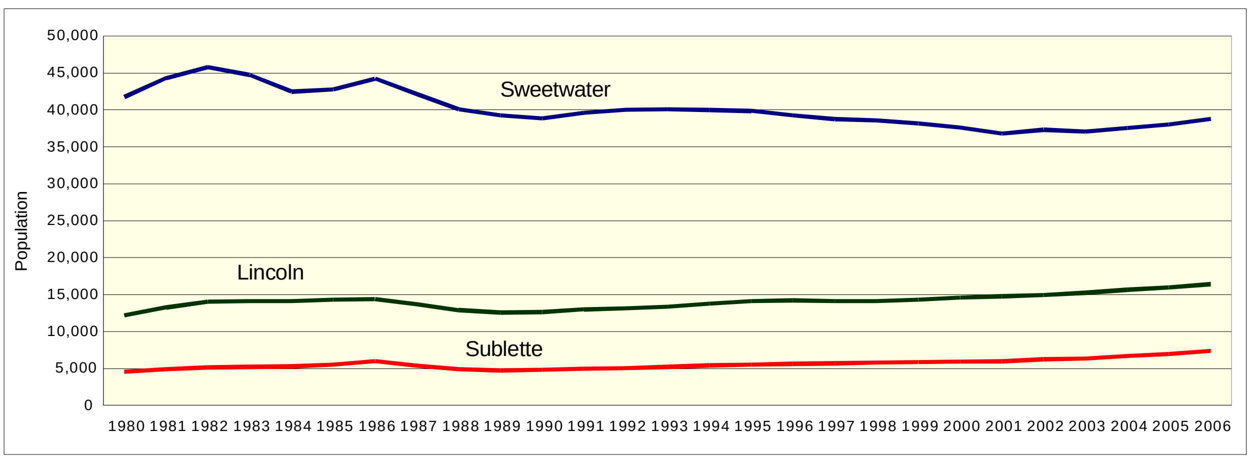


Figure 3.5-1
Population Estimates in Southwest Wyoming, 1980 – 2006
(Source: U.S. Census Bureau, 2008)

The greatest population gains in Southwest Wyoming have occurred since 2000. Overall, the population of Southwest Wyoming has grown more rapidly since 2000 than it did during the 1990s (Table 3.5-6). Regional population growth has also overtaken the state average. Between 2000 and 2006, Southwest Wyoming's population grew 7.6 percent compared to statewide growth rate of 4.3 percent. During this period, Lincoln County's population increased 12.4 percent, Sublette County's population increased 24.3 percent, and Sweetwater County's population increased 3.1 percent.

Table 3.5-6
Population Growth Rates in Southwest Wyoming, 1980 to 2006[1]

Area	1980 – 1990	1990 – 2000	2000 – 2006
Lincoln County	3.7%	15.4%	12.4%
Sublette County	6.5%	22.2%	24.3%
Sweetwater County	-7.0%	-3.0%	3.1%
Southwest Wyoming	-3.7%	3.2%	7.6%
Wyoming	-3.4%	8.9%	4.3%
[1] Source: U.S. Census Bureau, 2008.			

Major towns in Southwest Wyoming, including Kemmerer, Green River, and Rock Springs, experienced population losses in the 1980s and 1990s, while smaller towns, such as Afton, Marbleton, and Pinedale, had increasing populations (Table 3.5-7). Since 2000, several towns in Southwest Wyoming, including LaBarge, Opal, Big Piney, Green River, and Rock Springs have recouped earlier population losses. Other towns, most notably Marbleton, Pinedale, and Alpine, have continued to experience substantial population gains.

Table 3.5-7
Population Growth in Southwest Wyoming Towns, 1980 to 2006[1]

Town	1980	1990	2000	2006	1980-1990	1990-2000	2000-2006
Lincoln County	12,177	12,625	14,573	16,383	3.7%	15.4%	12.4%
Afton	1,481	1,630	1,818	1,988	10.1%	11.5%	9.4%
Alpine	--	200	550	789	--	175.0%	43.5%
Kemmerer	3,273	3,020	2,651	2,525	-7.7%	--12.2%	-4.8%
LaBarge	302	493	431	440	63.2%	-12.6%	2.1%
Sublette County	4,548	4,843	5,920	7,359	6.5%	22.2%	24.3%
Big Piney	530	454	408	461	-14.3%	-10.1%	13.0%
Marbleton	537	634	720	862	18.1%	13.6%	19.7%
Pinedale	1,066	1,181	1,412	1,846	10.8%	19.6%	30.7%
Sweetwater County	41,723	38,823	37,613	38,763	-7.0%	-3.0%	3.1%
Green River	12,807	12,711	11,808	11,933	-0.7%	-7.1%	1.1%
Rock Springs	19,458	19,050	18,708	19,324	-2.1%	-1.8	3.3%
[1] Source: U.S. Census Bureau, 2008.							

Population growth results from natural increase (more births than deaths) and net in-migration (more people moving in than moving out). Between 2000 and 2006, net in-migration accounted for 71 percent of Lincoln County's growth and 91 percent of Sublette County's growth. These in-migration rates are substantially higher than the State of Wyoming's 33 percent in-migration rate over this period. Between 2000 and 2006, natural increase accounted for all of Sweetwater County's population growth and the county experienced modest out-migration (WDAI, 2007b).

The Wyoming Department of Administration and Information (WDAI) projects that Southwest Wyoming's population will continue to grow over the next several years. The WDAI's population forecasts, shown in Table 3.5-8, incorporate long-term trends in commodity prices and mineral development (WDAI, 2007b). The WDAI's population projections were most recently updated in 2006 and do not consider quality of life factors that may have a negative impact on future population growth in the region.

Table 3.5-8
Population Forecasts for Southwest Wyoming, 2007 to 2020[1]

Location	2007 Forecast	2010 Forecast	2015 Forecast	2020 Forecast
Lincoln County	**16,800**	**17,990**	**19,480**	**21,070**
Afton	1,988	2,129	2,305	2,493
Alpine	787	842	912	987
Cokeville	539	577	625	676
Diamondville	763	817	885	957
Kemmerer	2,802	3,001	3,250	3,515
La Barge	459	492	532	576
Opal	109	116	126	136
Thayne	376	403	436	472
Sublette County	**7,690**	**8,870**	**10,460**	**12,320**
Big Piney	517	596	703	828
Marbleton	917	1,057	1,247	1,469
Pinedale	1,813	2,092	2,467	2,905
Sweetwater County	**39,540**	**41,620**	**42,810**	**43,990**
Bairoil	101	106	109	112
Granger	153	161	166	170
Green River	12,336	12,985	13,356	13,725
Rock Springs	19,595	20,626	21,216	21,801
Superior	252	266	273	281
Wamsutter	277	291	300	308
SW Wyoming Totals	**64,030**	**68,480**	**72,750**	**77,380**

[1] Source: WDAI, 2007b.

3.5.3 Employment and Income Levels

Employment in Southwest Wyoming is increasing faster than the region's population (Figure 3.5-2 and Table 3.5-9). Between 1990 and 2000, employment in Southwest Wyoming increased 6.2 percent while the region's population increased 3.2 percent. In part, this is due to changes in the size of the labor force. When employment increases, wages tend to rise and more people choose to work and become counted as employed. However, the region's substantial employment gains in recent years cannot be explained by an expanding labor force alone. Between 2000 and 2006, employment in Southwest Wyoming increased 22.9 percent, while the region's population increased 7.6 percent. This indicates an increasing presence of non-resident workers in Southwest Wyoming. Non-resident, or transient, workers maintain homes in other parts of the country and come to Southwest Wyoming to work on a temporary basis. They are therefore counted in the region's employment figures, but not its population estimates.

Historically, Sweetwater County has seen the greatest employment shifts within the region. Between 1980 and 1990, employment in Sweetwater County fell 10.4 percent. Employment began to rebound in the 1990s. Employment in Sweetwater County increased 6.2 percent between 1990 and 2000, and 22.9 percent between 2000 and 2006. Lincoln and Sublette counties have experienced increasing rates of job growth since the 1980s. Employment in Lincoln County increased 4.2 percent between 1980 and 1990, 18.1 percent between 1990 and 2000, and 24.2 percent between 2000 and 2006. Sublette County's job growth has been even more dramatic. Employment in Sublette County increased 9.4 percent between 1980 and 1990, 29.2 percent between 1990 and 2000, and 63.1 percent between 2000 and 2006. These growth rates compare with statewide job growth rates of –2.6 percent between 1980 and 1990, 20.4 percent between 1990 and 2000, and 14.7 percent between 2000 and 2006.

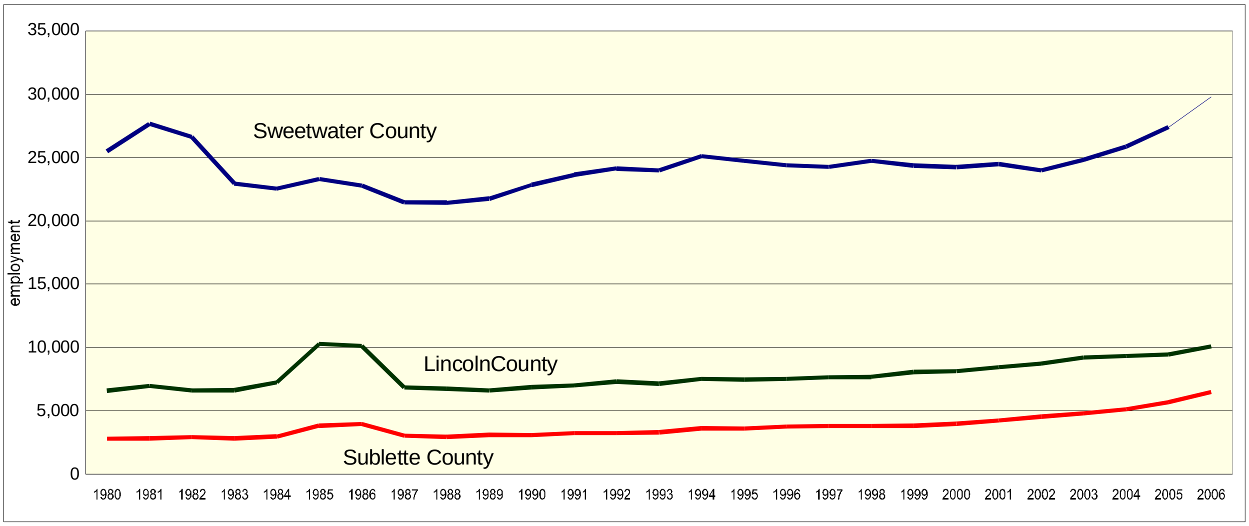


Figure 3.5-2
Employment Levels in Southwest Wyoming, 1980 to 2006
(Source: U.S. Bureau of Economic Analysis, 2008)

Table 3.5-9
Employment Growth Rates in Southwest Wyoming, 1980 to 2006[1]

Area	1980 – 1990	1990 – 2000	2000 – 2006
Lincoln County	4.2%	18.1%	24.2%
Sublette County	9.4%	29.2%	63.1%
Sweetwater County	-10.4%	6.2%	22.9%
Wyoming	-2.6%	20.4%	14.7%
[1] Source: U.S. Bureau of Economic Analysis, 2008.			

Historically, unemployment rates in Sublette County have been lower than those in neighboring Lincoln and Sweetwater counties, as well as the statewide and national averages (Table 3.5-10). Unemployment rates in Lincoln and Sweetwater counties have been below the national unemployment rate since 2000.

Table 3.5-10
Regional, State and National Unemployment Rates, 1990 to 2006[1]

Year	United States	Wyoming	Lincoln County	Sublette County	Sweetwater County
1990	5.6%	5.3%	6.3%	2.7%	5.3%
1991	6.9%	5.1%	7.2%	2.8%	5.9%
1992	7.5%	5.7%	8.1%	3.4%	6.3%
1993	6.9%	5.5%	8.1%	3.6%	6.3%
1994	6.1%	5.0%	7.3%	3.1%	5.2%
1995	5.6%	4.9%	7.5%	3.8%	5.4%
1996	5.4%	5.2%	6.9%	3.7%	6.5%
1997	4.9%	4.8%	6.2%	2.8%	5.6%
1998	4.5%	4.9%	6.4%	3.3%	5.5%
1999	4.2%	4.9%	6.1%	3.8%	6.3%
2000	4.0%	3.8%	3.9%	2.9%	4.0%
2001	4.7%	3.9%	4.0%	2.7%	4.0%
2002	5.8%	4.2%	4.7%	2.9%	4.2%
2003	6.0%	4.5%	4.6%	3.1%	4.1%

Year	United States	Wyoming	Lincoln County	Sublette County	Sweetwater County
2004	5.5%	3.9%	4.0%	2.4%	3.3%
2005	5.1%	3.7%	4.2%	2.1%	3.0%
2006	4.6%	3.2%	3.5%	1.8%	2.5%
[1] Sources: U.S. Bureau of Labor Statistics, Wyoming Department of Employment, 2008.					

Income is also increasing in Southwest Wyoming. Per-capita income measures the total income of a geographic area divided by its population. Per-capita income includes wages, interests and dividends from estates and trusts, and transfer payments (e.g. social security, public assistance, and disability pensions). Figure 3.5-3 shows per-capita income levels in Southwest Wyoming in constant 2006 dollars. Between 1980 and 1990, per-capita income fell by 2.6 percent in Lincoln County, 1.7 percent in Sublette County and 9.5 percent in Sweetwater County. These regional income losses compare with a 3.0 fall in statewide per-capita income over the same period. Per-capita income began to recover during the 1990s. Between 1990 and 2000, per-capita income increased 21.0 percent in Lincoln County, 12.6 percent in Sublette County and 22 percent in Sweetwater County, compared to a 20.0 increase in statewide per-capita income. Between 2000 and 2006, per-capita income increased 14.1 percent in Lincoln County, 51.4 percent in Sublette County and 25.8 percent in Sweetwater County, compared to a 22.0 increase in statewide per-capita income.

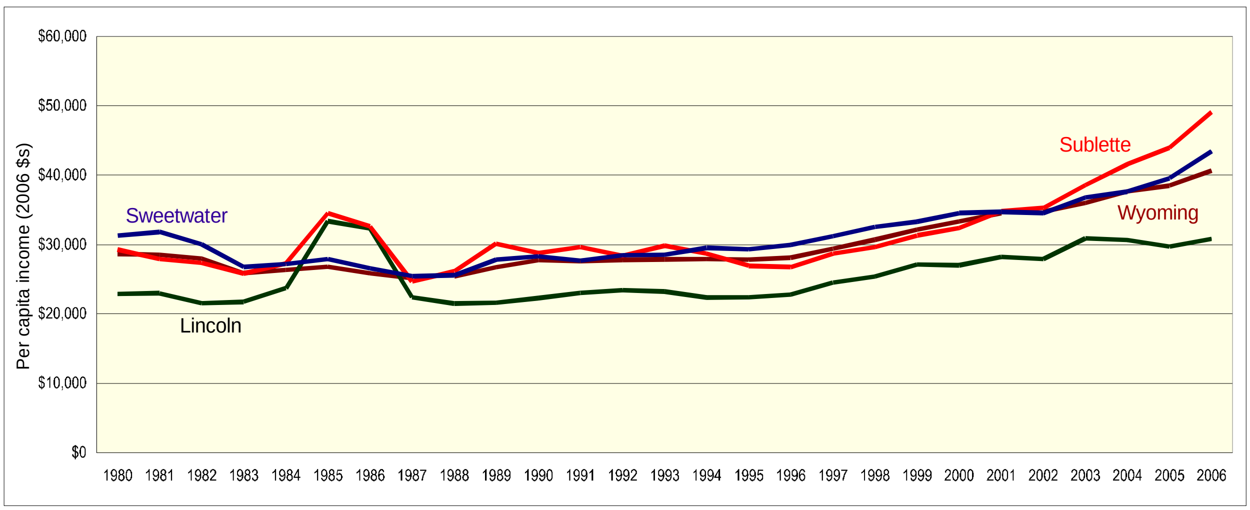


Figure 3.5-3
Real Per Capita Income in Southwest Wyoming, 1980 to 2006 (constant 2006 dollars)
(Source: Wyoming Department of Administration and Information, 2008.)

Wages are an important source of income in Southwest Wyoming. Figure 3.5-4 shows the average annual wage rate in Southwest Wyoming in constant 2006 dollars. Since 1980, real average annual wages in Sweetwater County have generally remained above the state average, while real average wages in Sublette County have been below the state average. Except for a brief period in the mid-1980s, average annual wages in Lincoln County have also been below the state average. Between 1980 and 1990, real average annual wages increased by 5.5 percent across Wyoming, but fell in Southwest Wyoming. During the 1980s, the real average annual wage rate decreased 19.3 percent in Lincoln County, 19.5 percent in Sublette County and 12.6 percent in Sweetwater County. Wages in Southwest Wyoming generally continued to decline between 1990 and 2000. Although real average annual wages increased 11.4 percent across Wyoming in the 1990s, they increased only 0.7 percent in Sweetwater County and continued to fall in Lincoln and Sublette counties (9.2 percent and 6.2 percent, respectively). Average wage levels have rebounded in southwest Wyoming since 2000, and regional growth has exceeded the state average. Between 2000 and 2006, the real average annual wage level increased 18.1 percent in Lincoln County, 58.7 percent in Sublette County and 15.7 percent in Sweetwater County, compared to a statewide average of 3.5 percent.

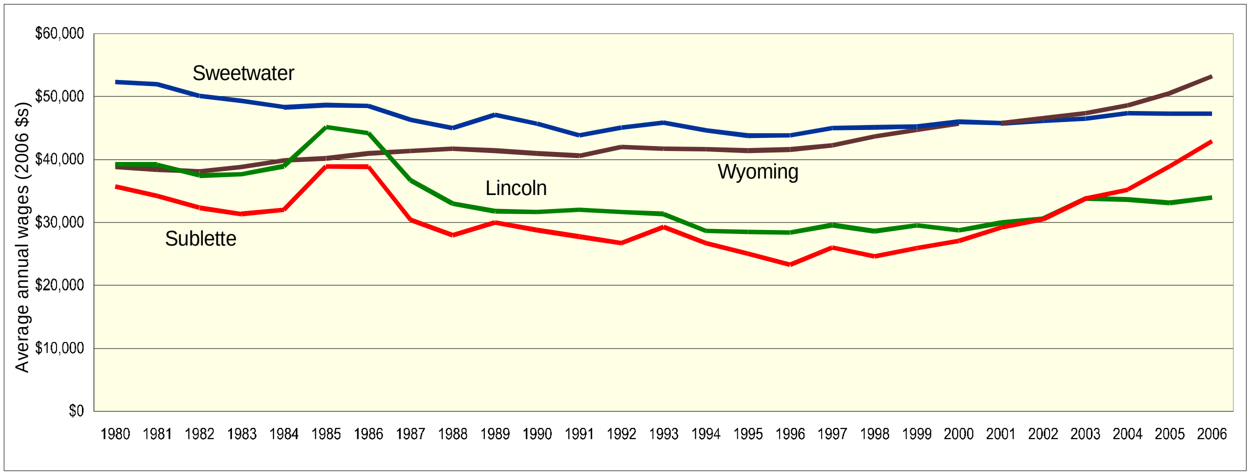


Figure 3.5-4
Real Average Annual Wages in Southwest Wyoming, 1980 to 2006 (constant 2006 dollars)
(Source: Wyoming Department of Administration and Information, 2008)

Some residents of Southwest Wyoming, including retirees who have moved to the area, have notable levels of unearned income (e.g. dividends, interest, and rent). Figure 3.5-5 shows that there was a slight decline in unearned income levels in Southwest Wyoming between 1999 and 2004. This is most likely due to contractions in the national economy and stock market adjustments that occurred in the early 2000s. This trend is most pronounced in Sweetwater and Lincoln counties. In 2005, the Dividends, Interest, and Rent reported for Southwest Wyoming were $387 million or 17.6 percent of total personal income (U.S. Department of Commerce, 2007).

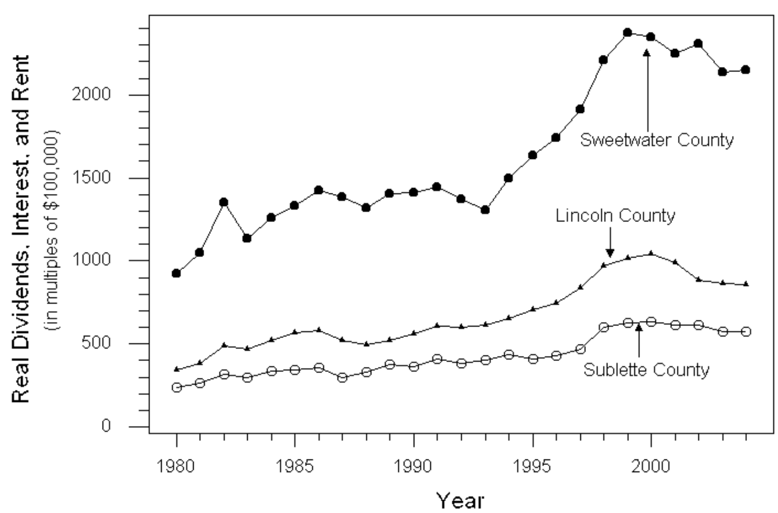


Figure 3.5-5
Real Dividends, Interest, and Rent in Southwest Wyoming between 1980 and 2004
(Source: U.S. Dept. of Commerce, 2007)

3.5.4 Cost of Living

In recent years, residents of Southwest Wyoming have experienced increases in the cost-of-living above the state and national averages (Figure 3.5-6). The inflation rate in Southwest Wyoming has generally exceeded the statewide and national inflation rates since 2003.

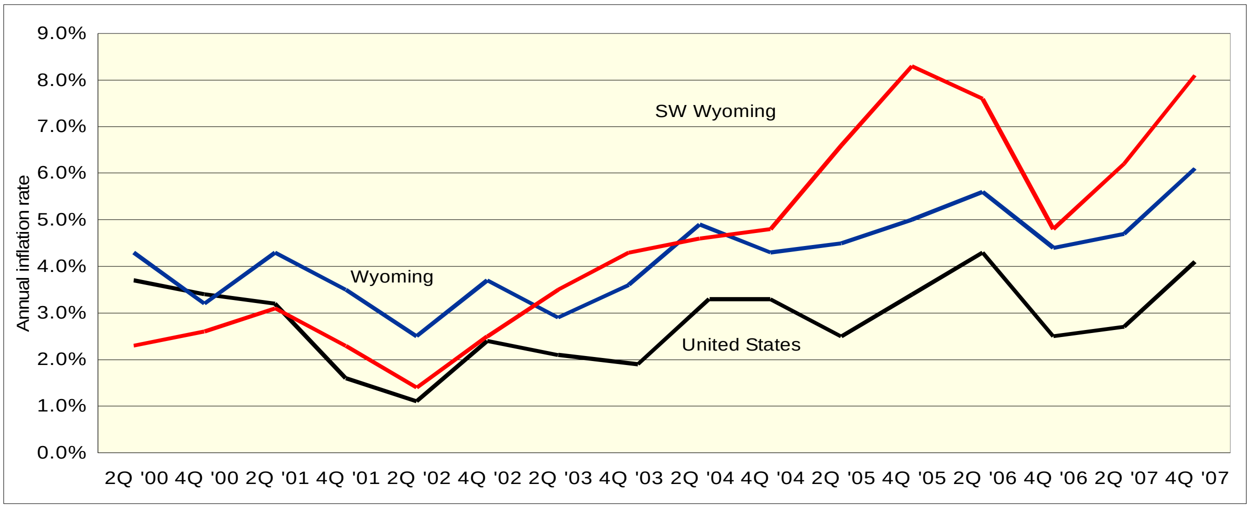


Figure 3.5-6
Annual Inflation Rates for United States, Wyoming, and Southwest Wyoming
(Source: WDAI, 2008)

Sublette County currently has the highest cost of living in Southwest Wyoming (Table 3.5.11). In particular, the cost of housing, which accounts for nearly half of the WDAI's cost-of-living index, is highest in Sublette County. The cost of housing in Sublette County was 27 percent above the statewide average in the fourth quarter of 2006, and 32 percent higher than the state average in the fourth quarter of 2007.

Table 3.5-11
A Comparison of Cost of Living Index Statistics for Southwest Wyoming and the State of Wyoming in the Fourth Quarter, 2006, and Fourth Quarter 2007[1]

County	All Items	Food	Housing	Apparel	Transportation	Medical	Recreation & Personal Care
Lincoln – Afton							
4th Qtr 2006	100	97	101	87	100	96	106
4th Qtr 2007	104	98	110	88	101	104	100
Lincoln (Kemmerer)							
4th Qtr 2006	92	85	88	100	102	85	109
4th Qtr 2007	95	90	94	100	101	85	105
Sublette							
4th Qtr 2006	117	106	127	125	101	105	115
4th Qtr 2007	119	106	132	122	102	98	111
Sweetwater							
4th Qtr 2006	107	97	117	92	100	104	96
4th Qtr 2007	109	97	120	94	102	101	98
Wyoming State Average	100	100	100	100	100	100	100

[1] Source: WDAI, 2008.

3.5.5 Trends in Sectoral Employment and Income

Changes in reporting methodologies for sectoral employment data make it difficult to compare industry-level employment data compiled before and after 2000. Therefore, the following discussion of industry trends in Southwest Wyoming is divided into trends that occurred between 1980 and 2000, and trends that occurred between 2001 and 2006.

In Lincoln County, the Mining, Construction, Retail Trade, Services, and Government sectors were the largest industries between 1980 and 2000 (Table 3.5-12). Coal production accounts for most mining activity in Lincoln County. During the 1980s, most of Lincoln County's job growth occurred in the Services, Government, and Retail Trade sectors, while most job gains during the 1990s were in the Construction, Retail Trade, and Government sectors.

Table 3.5-12
Lincoln County Industry Employment and Average Earnings, 1980 to 2000[1]

Industry Sector	Total Employment			Average earnings per job (2006 dollars)		
(SIC codes)	1980	1990	2000	1980	1990	2000
Total full- and part-time employment	6,591	6,868	8,114	$39,229	$31,652	$28,745
Agricultural services, fishing, forestry	32	77	149	$15,510	$8,237	$8,550
Mining	1,359	667	518	$69,347	$65,028	$67,005
Construction	575	444	858	$49,993	$40,763	$37,211
Manufacturing	467	613	531	$34,141	$35,267	$31,578
Transportation & Utilities	503	567	581	$61,023	$64,739	$64,975
Wholesale Trade	196	80	133	$40,405	$31,346	$20,840
Retail Trade	821	1,080	1,379	$24,640	$17,025	$13,534
Finance, Insurance & Real Estate	287	307	472	$21,988	$14,804	$15,545
Services	576	1,041	1,291	$24,259	$17,467	$18,729
Government	924	1,259	1,515	$34,899	$37,006	$35,560

[1] Source: U.S. Bureau of Economic Analysis, 2008.

Between 2001 and 2006, most of the job growth in Lincoln County was in the Mining, Construction, and Government sectors. In 2006, average industry wages in Lincoln County ranged from a high of $89,000 in mining to lows of $18,200 in Retail Trade and $9,700 in Accommodations and Food Services (Table 3.5-13).

Table 3.5-13
Lincoln County Industry Employment and Average Earnings, 2001 to 2006[1]

Industry Sector	Total Employment		Average earnings per job (2006 dollars)	
(NAICS codes)	2001	2006	2001	2006
Total full- and part-time employment	8,434	10,077	$29,931	$33,951
Forestry, fishing	87	93	$15,147	$12,269
Mining	436	744	$78,102	$89,027
Utilities	(D)	(D)	--	--
Construction	1,227	1,687	$38,199	$39,141
Manufacturing	403	330	$36,398	$32,382
Wholesale trade	(D)	(D)	--	--
Retail trade	1,009	974	$15,832	$18,186
Transportation & warehousing	220	268	$51,926	$47,004
Information	125	178	$30,861	$32,719
Finance & insurance	224	291	$36,797	$21,186

Industry Sector	Total Employment		Average earnings per job (2006 dollars)	
(NAICS codes)	2001	2006	2001	2006
Real estate, rental & leasing	324	373	$15,977	$27,180
Professional & technical svcs	231	347	$26,393	$27,066
Mgmt of companies	--	--	--	--
Admin & waste services	--	--	--	--
Educational services	21	45	--	$3,822
Health care & social assistance	--	444	--	$18,928
Arts, entertainment, recreation	124	138	$23,946	$21,935
Accommodations & food svcs	585	643	$10,177	$9,687
Other services	376	529	$14,243	$12,253
Government	1,556	1,738	$35,931	$43,286

[1] Source: U.S. Bureau of Economic Analysis, 2008.

Figure 3.5-7 illustrates the relationship between employment in Lincoln County's mining and construction sectors and county-wide employment between 1980 and 2006. Construction related to development of the Shute Creek natural gas field near LaBarge had a substantial influence on total employment levels in Lincoln County in the mid-1980s. Between 2000 and 2006, employment levels in Lincoln County increased 44 percent in the mining sector, 97 percent in the construction sector, and 24 percent across all sectors. Note that large percentage changes often result from low employment levels. For example, employment in Lincoln County's mining sector increased from 518 workers in 2000 to 744 workers in 2006.

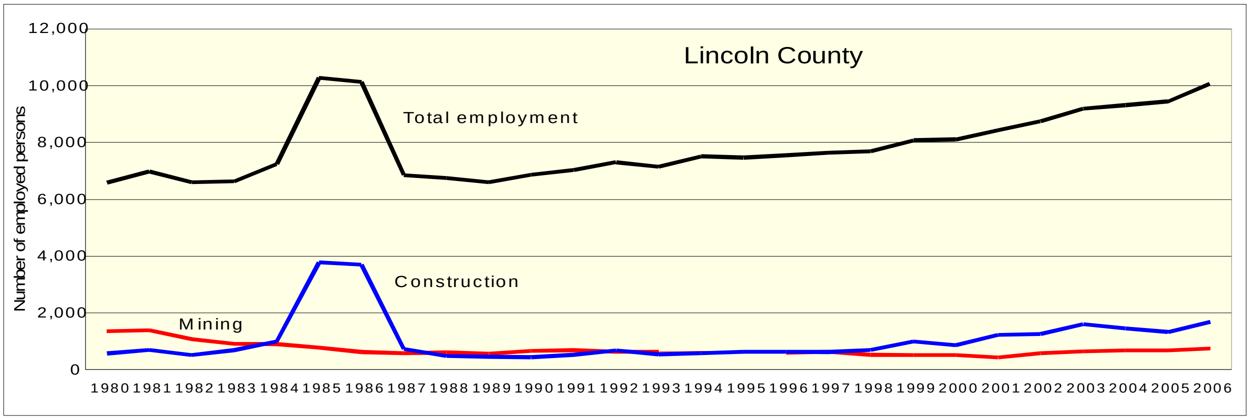


Figure 3.5-7
Lincoln County Employment in Mining, Construction and All Sectors, 1980 to 2006
(Source: U.S. Bureau of Economic Analysis, 2008)

In Sublette County, the Services, Government, and Retail Trade sectors were the largest industries between 1980 and 2000 (Table 3.5-14). During the 1980s, most of Sublette County's job growth occurred in the Services and Government sectors, while most of the job gains during the 1990s were in the Services, Retail Trade and Construction sectors.

Table 3.5-14
Sublette County Industry Employment and Average Earnings, 1980 to 2000[1]

Industry Sector	Total Employment			Average earnings per job (2006 dollars)		
(SIC codes)	1980	1990	2000	1980	1990	2000
Total full- and part-time employment	2,812	3,077	3,977	$35,711	$28,820	$27,046
Agricultural services, fishing, forestry	27	83	132	$16,390	$10,115	$6,751
Mining	276	315	326	$73,341	$56,575	$62,812
Construction	388	261	426	$48,969	$34,950	$37,355
Manufacturing	31	--	91	$24,450	--	$16,303
Transportation & Utilities	176	145	107	$55,929	$46,775	$37,547
Wholesale Trade	25	--	55	$49,193	--	$20,396
Retail Trade	499	408	601	$22,397	$17,055	$15,343
Finance, Insurance & Real Estate	147	184	228	$16,566	$9,175	$23,337
Services	395	599	923	$32,998	$20,871	$22,413
Government	419	558	679	$36,926	$36,279	$37,698

[1] Source: U.S. Bureau of Economic Analysis, 2008.

Between 2001 and 2006, most of the job growth in Sublette County was in the Mining, Construction, and Accommodations/Food Services sectors. Natural gas and oil extraction accounts for all mining activity in Sublette County. In 2006, average industry wages in Sublette County ranged from a high of $85,100 in Mining to lows of $23,800 in Accommodation/Food Services and $22,600 in Retail Trade (Table 3.5-15).

Table 3.5-15
Sublette County Industry Employment and Average Earnings, 2001 to 2006[1]

Industry Sector	Total Employment		Average earnings per job (2006 dollars)	
(NAICS codes)	2001	2006	2001	2006
Total full- and part-time employment	4,251	6,488	$29,189	$42,911
Forestry, fishing	78	91	$11,506	$12,330
Mining	432	1,141	$60,164	$85,089
Utilities	--	41	--	$96,585
Construction	472	983	$33,464	$43,142
Manufacturing	(D)	96	--	$32,479
Wholesale trade	(D)	42	--	$44,976
Retail trade	442	562	$21,787	$22,605
Transportation & warehousing	81	176	$41,930	$47,273
Information	51	72	$25,280	$29,028
Finance & insurance	81	129	$30,991	$43,426
Real estate, rental & leasing	175	210	$15,477	$24,857
Professional & technical svcs	237	306	$41,882	$42,729
Mgmt of companies	--	--	--	--
Admin & waste services	--	184	--	$22,272
Educational services	--	--	--	--
Health care & social assistance	--	--	--	--
Arts, entertainment, recreation	95	83	$28,522	$22,181
Accommodations & food svcs	386	578	$14,904	$23,789
Other services	211	288	$13,138	$13,250
Government	702	875	$39,341	$52,983

[1] Source: U.S. Bureau of Economic Analysis, 2008.

Figure 3.5-8 illustrates the relationship between employment in Sublette County's mining and construction sectors and county-wide employment between 1980 and 2006. Construction related to development of the Shute Creek natural gas field near LaBarge had a substantial influence on total employment levels in Sublette County in the mid-1980s. Between 2000 and 2006, employment levels in Sublette County increased 250 percent in the mining sector, 131 percent in the construction sector, and 63 percent across all sectors.

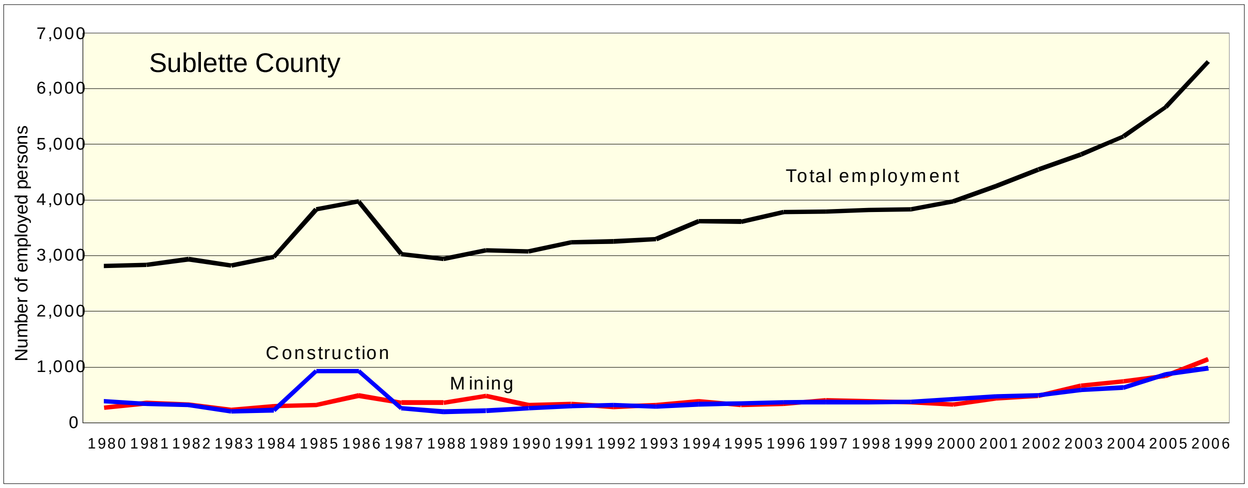


Figure 3.5-8
Sublette County Employment in Mining, Construction and All Sectors, 1980 to 2006
(Source: U.S. Bureau of Economic Analysis, 2008.)

In Sweetwater County, the Mining, Retail Trade, Services, and Government sectors were the largest industries between 1980 and 2000 (Table 3.5-16). Mining activities in Sweetwater County include trona, coal, and oil and natural gas extraction. During the 1980s, most of Sweetwater County's job growth occurred in the Government and Finance/Insurance/Real Estate sectors, while most of the job gains during the 1990s were in the Services, Manufacturing and Retail Trade sectors.

Table 3.5-16
Sweetwater County Industry Employment and Average Earnings, 1980 to 2000[1]

Industry Sector	Total Employment			Average earnings per job (2006 dollars)		
by SIC code	1980	1990	2000	1980	1990	2000
Total full- and part-time employment	25,503	22,840	24,249	$52,282	$45,682	$46,014
Agricultural services, fishing, forestry	48	81	187	$18,388	$11,126	$8,704
Mining	7,318	4,990	3,736	$74,129	$88,223	$99,882
Construction	3,282	1,534	1,497	$67,494	$47,990	$44,363
Manufacturing	494	746	1,648	$54,443	$57,614	$81,982
Transportation & Utilities	2,209	1,981	1,781	$61,649	$63,632	$65,945
Wholesale Trade	773	649	614	$52,831	$42,349	$41,682
Retail Trade	3,743	3,732	4,420	$25,422	$19,009	$17,869
Finance, Insurance & Real Estate	693	1,125	1,130	$26,729	$14,021	$27,414
Services	3,605	3,757	4,747	$36,846	$23,894	$26,002
Government	3,072	4,025	4,288	$38,205	$38,379	$37,945

[1] Source: U.S. Bureau of Economic Analysis, 2008.

Between 2001 and 2006, most of the job growth in Sweetwater County was in the Construction/Transportation and Other Services sectors. In 2006, average industry wages in Sweetwater County ranged from a high of $97,300 in Manufacturing and $94,600 in Mining to lows of $17,600 in Accommodations/Food Services and $11,400 in Educational Services (Table 3.5-17).

Table 3.5-17
Sweetwater County Industry Employment and Average Earnings, 2001 to 2006[1]

Industry Sector	Total Employment		Average earnings per job (2006 dollars)	
(NAICS codes)	**2001**	**2006**	**2001**	**2006**
Total full- and part-time employment	24,493	29,811	$45,801	$53,236
Forestry, fishing	--	59	--	$18,373
Mining	--	6,051	--	$94,588
Utilities	--	--	--	--
Construction	1,811	2,695	$45,901	$52,372
Manufacturing	1,426	1,275	$88,201	$97,260
Wholesale trade	--	--	--	--
Retail trade	2,928	3,064	$21,862	$25,465
Transportation & warehousing	1,111	1,680	$58,023	$62,703
Information	258	254	$27,962	$29,319
Finance & insurance	540	608	$35,681	$36,490
Real estate, rental & leasing	675	874	$47,094	$42,746
Professional & technical svcs	616	824	$45,586	$48,210
Mgmt of companies	90	73	$58,378	$51,411
Admin & waste services	799	922	$22,424	$30,632
Educational services	91	155	$9,625	$11,394
Health care & social assistance	1,196	1,286	$31,207	$33,183
Arts, entertainment, recreation	284	(D)	$13,848	--
Accommodations/food svcs	2,102	2,417	$14,935	$17,634
Other services	1,062	1,542	$21,109	$32,872
Government	4,210	4,282	$39,302	$44,954

[1] Source: U.S. Bureau of Economic Analysis, 2008.

Figure 3.5-9 illustrates the relationship between employment in Sweetwater County's mining and construction sectors and county-wide employment between 1980 and 2006. Employment statistics for Sweetwater County's mining sector are only available through the year 2000. Between 2000 and 2006, employment levels in Sweetwater County increased 80 percent in the construction sector and 23 percent across all sectors.

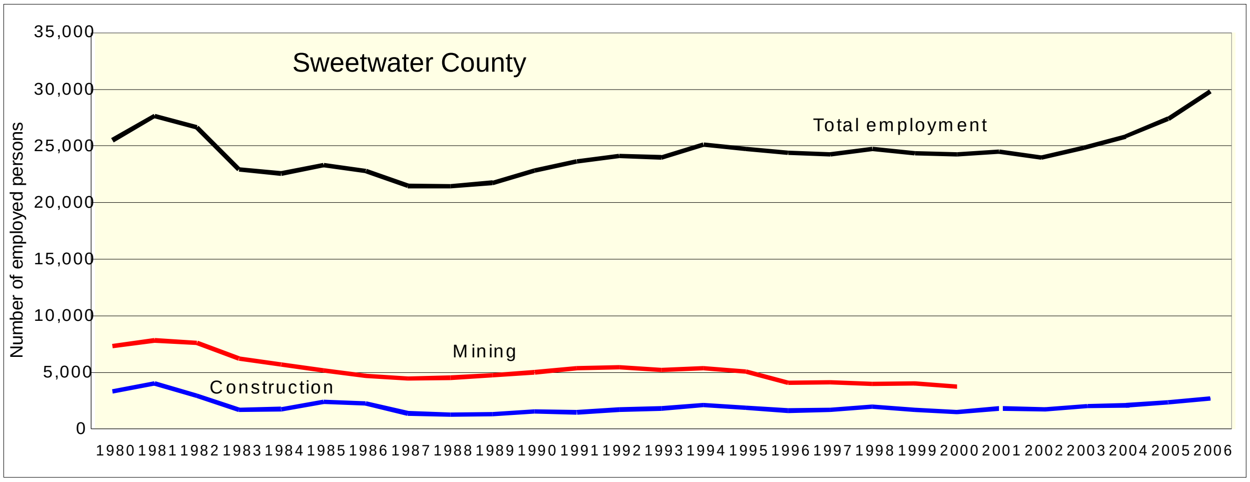


Figure 3.5-9
Sublette County Employment in Mining, Construction and All Sectors, 1980 to 2006
(Source: U.S. Bureau of Economic Analysis, 2008)

Table 3.5-18 presents a summary of Southwest Wyoming's largest industries. In 2006, the largest industries in terms of employment in Southwest Wyoming were Mining (7,936 total workers), Government (6,895 total workers), Construction (5,345 total workers), Retail Trade (4,600 employees), and Accommodations/Food Services (3,638 total workers).

Table 3.5-18
Five Largest Employment Sectors in Southwest Wyoming, 2006

	Lincoln County		Sublette County		Sweetwater County	
Industrial Sector	**# of Workers**	**Average earnings**	**# of Workers**	**Average earnings**	**# of Workers**	**Average earnings**
Mining	744	$89,027	1,141	$85,089	6,051	$94,588
Construction	1,667	$39,141	983	$43,142	2,695	$52,372
Retail trade	974	$18,186	562	$22,605	3,064	$25,465
Accommodation/food services	643	$9,687	578	$23,789	2,417	$17,634
Government	1,738	$43,286	875	$52,983	4,282	$44,954

3.5.6 Housing

The U.S. Census Bureau estimates that between 2000 and 2006, the number of housing units increased by 17.6 percent in Lincoln County, 15.9 percent in Sublette County, and 3.5 percent in Sweetwater County. In 2000, homes for seasonal, occasional, or recreational use accounted for 26.2 percent of the housing units in Sublette County, 13.4 percent of the housing units in Lincoln County, and 1.5 percent of the housing units in Sweetwater County (Table 3.5-19).

Table 3.5-19
Housing Unit Estimates in Southwest Wyoming and Wyoming from 2000 and 2006[1]

	Lincoln County		Sublette County		Sweetwater County		Wyoming	
Value	**Housing Units**	**Percent Change from 2000**	**Housing Units**	**Percent Change from 2000**	**Housing Units**	**Percent Change from 2000**	**Housing Units**	**Percent Change from 2000**
2000	6,831	N/A	3,552	N/A	15,921	N/A	223,854	N/A
2001	7,014	2.68	3,620	1.91	15,995	0.46	225,959	0.94
2002	7,224	5.75	3,693	3.97	16,026	0.66	227,772	1.75
2003	7,417	8.57	3,773	6.22	16,045	0.78	229,638	2.58

Value	Lincoln County		Sublette County		Sweetwater County		Wyoming	
	Housing Units	Percent Change from 2000	Housing Units	Percent Change from 2000	Housing Units	Percent Change from 2000	Housing Units	Percent Change from 2000
2004	7,591	11.12	3,859	8.64	16,078	0.99	232,560	3.89
2005	7,788	14.01	3,944	11.04	16,254	2.09	235,657	5.27
2006	8,030	17.55	4,118	15.93	16,484	3.54	239,178	6.85

[1] Source: U.S. Census Bureau, 2007.

Recent studies of housing affordability suggest that it may be prohibitively expensive for wage earners, including workers employed in the PAPA, to move to Southwest Wyoming (Sublette SE, 2007 and Economic Research Group, 2008). Table 3.5-20 shows that, between the 2nd Quarter 2000 and 4th Quarter 2007, the cost of renting an apartment increased 133 percent in Lincoln County, 100 percent in Sublette County, and 105 percent in Sweetwater County. During this same period, the cost of renting a house increased 69 percent in Lincoln County, 122 percent in Sublette County, and 121 percent in Sweetwater County. The cost of renting a mobile home lot increased 44 percent in Lincoln County, 57 percent in Sublette County, and 44 percent in Sweetwater County. The cost of renting a mobile home on a lot increased 88 percent in Lincoln County, 55 percent in Sublette County, and 91 percent in Sweetwater County.

Table 3.5-20
Average Rental Housing Costs in Southwest Wyoming from 2000 to 2006[1]

Quarter, Year	County	Apartment	House	Mobile Home Lot	Mobile Home on a Lot
2nd Quarter, 2000	Lincoln	$245	$466	$158	$311
	Sublette	$433	$624	$175	$435
	Sweetwater	$367	$485	$196	$389
4th Quarter, 2000	Lincoln	$277	$417	$195	$317
	Sublette	$464	$566	$165	$325
	Sweetwater	$333	$498	$196	$401
2nd Quarter, 2001	Lincoln	$295	$464	$175	$330
	Sublette	$455	$608	$165	NR
	Sweetwater	$368	$534	$200	$439
4th Quarter, 2001	Lincoln	$292	$400	$158	$315
	Sublette	$441	$613	$175	$350
	Sweetwater	$390	$533	$201	$422
2nd Quarter, 2002	Lincoln	$285	$441	$163	$328
	Sublette	$472	$611	$200	NR
	Sweetwater	$387	$518	$202	$443
4th Quarter, 2002	Lincoln	$332	$388	$163	$304
	Sublette	$534	$655	$165	$457
	Sweetwater	$392	$516	$197	$422
2nd Quarter, 2003	Lincoln	$414	$534	$157	$403
	Sublette	$520	$769	$200	$472
	Sweetwater	$391	$539	$208	$449
4th Quarter, 2003	Lincoln	$421	$433	$183	$315
	Sublette	$611	$794	$200	NR
	Sweetwater	$412	$595	$218	$457
2nd Quarter, 2004	Lincoln	$347	$382	$163	$300
	Sublette	$647	$808	$225	$624
	Sweetwater	$427	$635	$212	$566
4th Quarter, 2004	Lincoln	$364	$387	$168	$312
	Sublette	$765	$888	$240	$600
	Sweetwater	$469	$654	$212	$546
2nd Quarter, 2005	Lincoln	$379	$407	$178	$374
	Sublette	$699	$882	$240	$590

Quarter, Year	County	Apartment	House	Mobile Home Lot	Mobile Home on a Lot
	Sweetwater	$512	$674	$214	$594
4th Quarter, 2005	Lincoln	$391	$402	$178	$390
	Sublette	$728	$1,083	$275	$595
	Sweetwater	$624	$773	$224	$619
2nd Quarter, 2006	Lincoln	$431	$484	$178	$406
	Sublette	$781	$1,195	$265	$643
	Sweetwater	$684	$816	$238	$669
4th Quarter, 2006	Lincoln	$428	$510	$220	$515
	Sublette	$750	$1,238	$275	$693
	Sweetwater	$686	$922	$253	$701
2nd Quarter, 2007	Lincoln	$466	$540	$215	$550
	Sublette	$822	$1,338	$275	$667
	Sweetwater	$709	$1,013	$261	$741
4th Quarter, 2007	Lincoln	$570	$787	$228	$586
	Sublette	$860	$1,387	$275	$674
	Sweetwater	$751	$1,074	$283	$774
[1] Source: WDAI, 2007c and 2008.					

The Wyoming Rental Vacancy Survey is administered and analyzed semiannually by the Wyoming Housing Database Partnership (Table 3.5-21). Vacancy rates are extrapolated based on a sampled population each June or July (denoted ‘a’) and December (denoted ‘b’). Second home growth can be attributed to some vacant units, especially in Sublette County (U.S. Census Bureau, 2007). According to the 2000 Census, in Sublette County 930 of 1,181 vacant housing units were vacant for seasonal, recreational, or occasional use (U.S. Census Bureau, 2007).

Table 3.5-21
Semiannual (Year with a and b) Rental Vacancy Survey for Southwest Wyoming from 2001 to 2007[1]

Year	County	Sample	Total Units	Vacant Units	Percent Vacancy Rate
2001a	Lincoln	13	287	26	9.0
	Sublette	4	41	2	4.9
	Sweetwater	16	821	67	8.2
2001b	Lincoln	9	132	19	14.4
	Sublette	2	39	NR[2]	NR[2]
	Sweetwater	19	1,083	49	4.5
2002a	Lincoln	8	114	10	8.8
	Sublette	3	41	NR[2]	NR[2]
	Sweetwater	20	1,060	65	6.1
2002b	Lincoln	7	151	22	14.6
	Sublette	5	37	2	5.4
	Sweetwater	21	1,439	65	4.5
2003a	Lincoln	7	106	7	6.6
	Sublette	7	50	2	4.0
	Sweetwater	24	1,620	34	2.1
2003b	Lincoln	11	201	11	5.5
	Sublette	6	55	2	3.6
	Sweetwater	33	1,942	18	0.9
2004a	Lincoln	9	176	12	6.8
	Sublette	6	59	1	1.7
	Sweetwater	29	1,369	12	0.9
2004b	Lincoln	8	270	46	17.0
	Sublette	9	75	4	5.3
	Sweetwater	28	1,264	20	1.6
2005a	Lincoln	10	208	14	6.7

Year	County	Sample	Total Units	Vacant Units	Percent Vacancy Rate
	Sublette	12	96	4	4.2
	Sweetwater	24	1,440	34	2.4
2005b	Lincoln	14	137	14	10.2
	Sublette	13	154	7	4.6
	Sweetwater	27	923	22	2.4
2006a	Lincoln	9	317	6	1.9
	Sublette	13	159	3	1.9
	Sweetwater	29	1,290	24	1.9
2006b	Lincoln	12	306	11	3.6
	Sublette	11	157	1	0.6
	Sweetwater	30	1,433	9	0.6
2007a	Lincoln	19	402	7	1.7
	Sublette	9	131	3	2.3
	Sweetwater	30	1,416	17	1.2

[1] Source: Wyoming Housing Database Partnership, 2007.

According to local sources, finding a place to rent in Sublette County can be difficult (Sublette SE, 2007). Residential rentals continued to be at or near full occupancy through early 2008. In May 2008, rents in Pinedale averaged $850 for a one-bedroom home, $1,472 for a two-bedroom home, and $1,564 for a three-bedroom home (Wigginto, 2008). In addition to residential rental units, "non-traditional" housing, (*e.g.* RV campgrounds, motels and worker camps), plays a large role in Southwest Wyoming's housing supply. Relying on these facilities to accommodate wellfield workers is not without controversy. In 2006, Farson local residents defeated a proposal to construct a camp for Jonah Field workers in that Sweetwater County community. In January 2008, the BLM approved construction of a camp large enough to accommodate 350 workers on public land just south of the Jonah Field in Sweetwater County.

The market is responding to increased demand for housing in Southwest Wyoming. Building permits issued for new residential construction increased across the region between 2000 and 2007 (Table 3.5-22).

Table 3.5-22
Building Permits and Valuation for Southwest Wyoming from 2000 to 2007[1]

Year	County	Authorized construction in permit issuing areas				
		Single-family Units	Duplex Units	Tri- and Four-plex Units	Multi-family Units	Total Units
2000	Lincoln	145	0	0	0	145
	Sublette	54	0	0	0	54
	Sweetwater	36	0	0	5	41
2001	Lincoln	214	0	4	0	218
	Sublette	72	4	0	0	76
	Sweetwater	38	0	0	0	38
2002	Lincoln	192	0	4	8	204
	Sublette	74	6	8	0	88
	Sweetwater	48	0	0	0	48
2003	Lincoln	180	0	0	0	180
	Sublette	83	4	8	0	95
	Sweetwater	63	0	0	0	63
2004	Lincoln	206	2	4	0	212
	Sublette	77	12	4	0	93
	Sweetwater	216	0	0	0	216
2005	Lincoln	253	8	0	0	261
	Sublette	179	0	0	6	185
	Sweetwater	260	0	0	0	260

Year	County	Authorized construction in permit issuing areas				
		Single-family Units	Duplex Units	Tri- and Four-plex Units	Multi-family Units	Total Units
2006	Lincoln	232	4	7	0	243
	Sublette	232	0	0	6	238
	Sweetwater	236	0	8	24	269
2007	Lincoln	177	20	4	6	207
	Sublette	257	6	0	0	263
	Sweetwater	438	8	0	26	472

[1] Source: U.S. Census Bureau, 2008.

Sublette County has a relatively limited supply of existing housing, which reflects its historically low population. Historically, Sublette County's housing market has generally followed trends in the county's population. Figure 3.5-10 compares changes in the county's population with changes in the number of housing units. It shows that changes in the housing market are not as dramatic as population changes, and tend to lag behind population growth. Changes in Sublette County's supply of housing may be constraining future growth; between 2000 and 2007, Sublette County's population increased 30 percent while its housing stock increased by 22 percent.

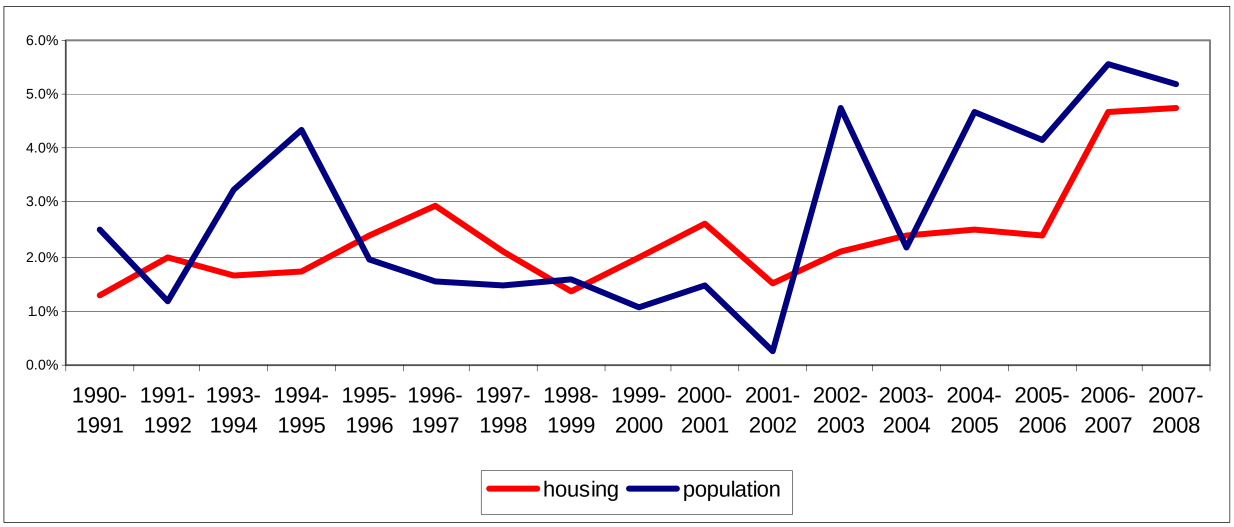


Figure 3.5-10
Annual Change in Sublette County's Population and Number of Housing Units
(Sources: WDIA, 2007b and U.S. Census Bureau, 2008)

Residential sales are another indicator of population pressures (Figure 3.5-11). Throughout the 1990s, the number of houses sold annually in Pinedale and Sublette County remained relatively flat. High-end homes accounted for a large portion of the sales. Between 1990 and 1999, the average residential sale price increased 168 percent in Sublette County (from $55,896 to $149,920) and 174 percent in Pinedale (from $43,360 to $118,782). The county's housing market began to swing upward in 2000. Between 2000 and 2007, the number of annual residential sales in Sublette County increased 153 percent, and the county-side average residential sale price increased 117 percent, from $142,338 to $309,265. During this time, the number of annual home sales in Pinedale increased 99 percent, and the average residential sale price in Pinedale increased 148 percent, from $116,972 to $287,640.

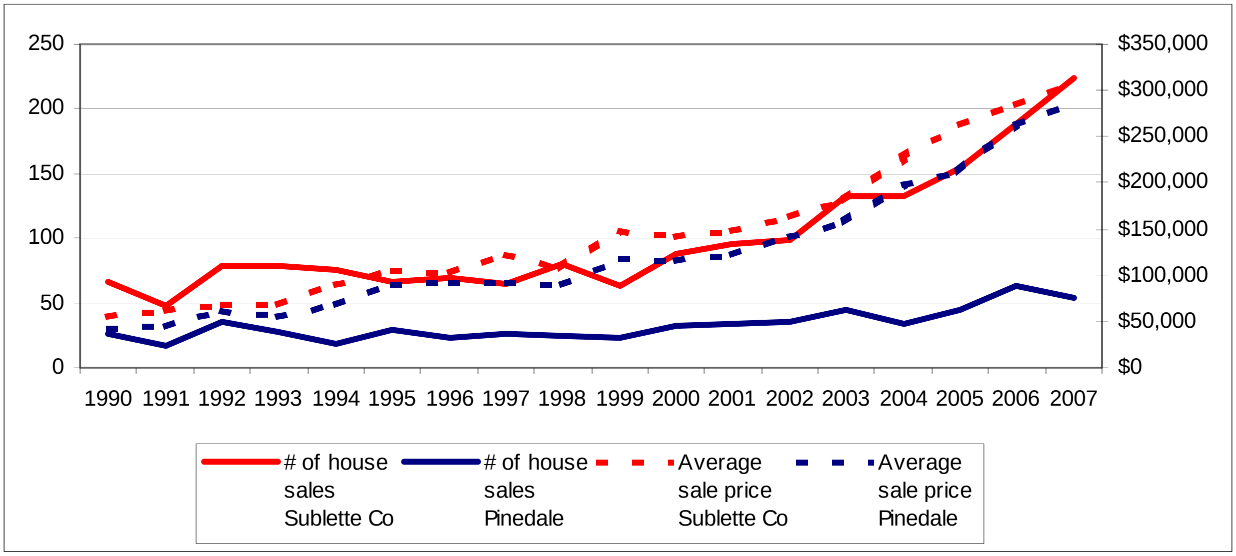


Figure 3.5-11
Residential Sales in Sublette County and Pinedale, 1990 - 2007
(Source: Sublette County Assessor's Office, 2008) – new reference

In Sublette and Sweetwater counties, the median sale prices of single-family homes have increased at paces exceeding the statewide trends (Sublette SE, 2007 and Economic Research Group, 2008). Many of the houses sold in Sublette County are financially out-of-reach for the average wage-earner in the county. The U.S. Department of Housing and Urban Development estimates the median family income in Sublette County to be about $59,000. Given a 30-year mortgage at 7 percent interest, a family at this income level with good credit and few debts can afford a house in the $225,000 price range (Sublette SE, 2007 and Economic Research Group, 2008). In 2006, 42 percent of the 201 houses that were sold (84 units) in Sublette County cost $225,000 or less (Figure 3.5-12).

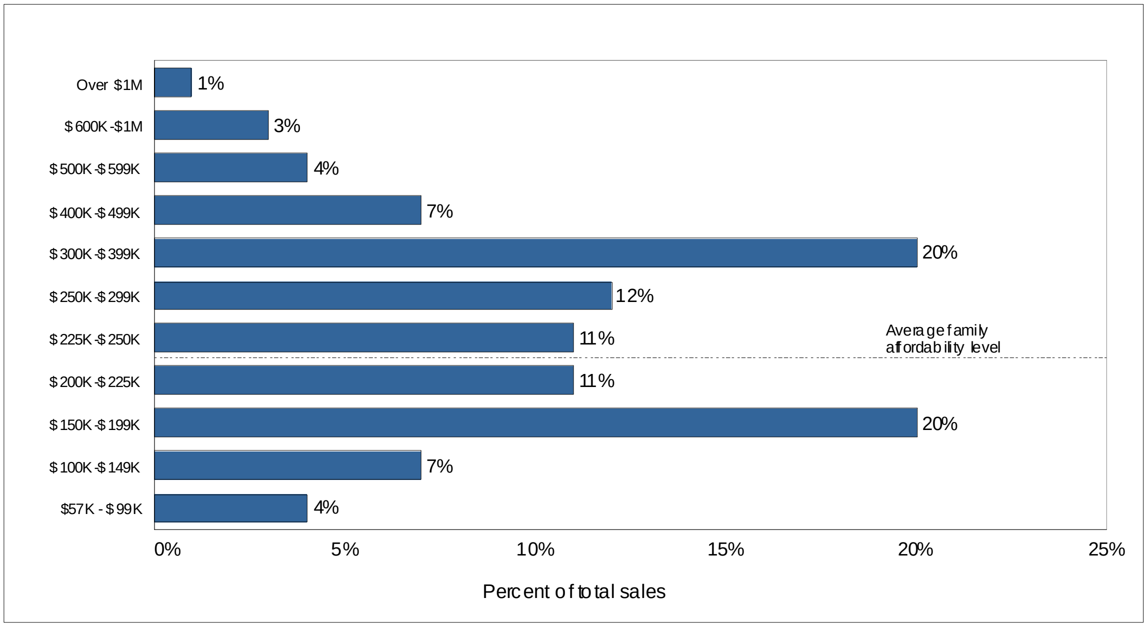


Figure 3.5-12
2006 Home Sales in Sublette County by Price Range
(Source: Sublette County Assessor's Office, reported in Jacquet, 2007)

3.5.7 Infrastructure

Southwest Wyoming covers 19,469 square miles (4,089 square miles in Lincoln County, 4,883 square miles in Sublette County, and 10,497 square miles in Sweetwater County). Sweetwater County is transected east and west by Interstate 80. Rock Springs and Green River are located 19 miles apart on I-80. Pinedale is located 100 miles northwest of Rock Springs on U.S. Highway 191. Kemmerer is located 70 miles northwest of Green River on U.S. Highway 30.

3.5.7.1 Transportation

Rock Springs is serviced by two commercial airlines providing daily flights to and from Denver International Airport. Kemmerer is serviced by one commercial airline providing daily flights to and from Salt Lake City International Airport. Sublette County is serviced by two private airports. Alpine and Afton are each serviced by one private airport. Rock Springs is serviced by two bus lines, four car rental services, and two taxi services.

3.5.7.2 Fire Protection Services

Fire protection is provided by four fire departments in Lincoln County, three fire departments in Sublette County, and ten fire departments in Sweetwater County (Capitol Impact, 2007). The 24-member Pinedale Volunteer Fire Department (PVFD) serves the PAPA (Mitchell, 2006). The PVFD purchased a new rescue truck in 2003 with town funds (drawing on tax revenues from the PAPA). The PVFD brought a hazardous materials trailer into use in the summer of 2006. The fire-fighting emergency response capabilities have been adequate to meet demands from the PAPA to date (Mitchell, 2006). The Operators are responsible for responding to fires that occur in the PAPA, while the PVFD is responsible for maintaining a buffer perimeter around the fire (Mitchell, 2006).

3.5.7.3 Law Enforcement

First-call police services to the PAPA are provided by the Sublette County Sheriff's Department. Sublette County is the only county in Wyoming that has sheriff services with no local police services. Since 2000, the Sheriff's office has added eight officers and detectives. There are currently 32 officers in Sublette County (Wyoming Attorney General, 2007). The county is trying to add more officers to handle vacancies, mostly created due to officers who are in the military reserves. The Sheriff's Department experiences high employee attrition because wages and benefits paid by the oil and gas operators are higher than county wages (Hanson, 2007). Sublette County Commissioners are sensitive to this issue and are working to raise wages. The Sheriff's Department's current staffing is adequate to handle county traffic control including drunken driving issues. Traffic problems, drunk driving, domestic issues, and bar fights have been increasing with the increase in population. The greatest increases have been for drug-related offenses (Table 3.5-23). The Sublette County Sheriff's Department runs more patrols of oil fields and has greater visibility in the community than it had prior to 2000, because of increased staffing. The PAPA does not pose as difficult a patrolling challenge as the Jonah Field Project Area because the PAPA is closer to Pinedale; however, in winter the response time is longer because the gates are closed. An emergency medical service/fire response building that will house a paramedic response truck is under construction. This will cut down on response time to the fields. The Sublette County Sheriff's Department is equipped to meet its current responsibilities (Hanson, 2007).

Table 3.5-23
Adults Arrested by Sublette County Sheriff's Department for Select Offenses, 1999-2006[1,2]

	1999	2000	2001	2002	2003	2004	2005	2006
Simple Assaults: No weapon used/no serious injury	19	33	41	32	30	36	45	50
Drug Abuse Violation: Possession	21	14	13	14	36	33	64	35
Driving Under the Influence	75	63	47	59	84	110	117	69

[1] Source: Wyoming Attorney General, 2007.
[2] An arrest is counted for each separate occasion an individual is taken into custody, and although several charges may be placed against an individual, only one arrest is counted each time.

Law enforcement providers in Sweetwater and Lincoln counties have also felt the effects of growth in the PAPA. According to McConkie (2006), the Kemmerer Police Department has experienced increased demand for police services since 2000 due to regional growth in oil and gas activity. The City of Kemmerer has responded by providing budget increases to pay for additional officers to keep up with the demands. In the City of Rock Springs, the police department has noticed an increase in oil and gas personnel who work in the PAPA but live and recreate in Sweetwater County (Keslar, 2007). In addition to a rise in index crimes (Sublette SE, 2007), there are increases in petty crimes, such as drunkenness in public and traffic control issues, that consume a large portion of officers' time (Table 3.5-24). Recent data indicate that index crimes increased more than historical data would have predicted (Sublette SE, 2007). Rock Springs recently received approval to add six officers to its current roster of 44, but finding individuals and providing adequate training has proven difficult (Keslar, 2007). Of the 44 officers on payroll, 38 operate independently on patrol.

Table 3.5-24
Adults Arrested by Rock Springs Police Department for Select Offenses, 1999-2006[1,2]

	1999	2000	2001	2002	2003	2004	2005	2006
Simple Assaults: No weapon used/no serious injury	51	48	61	49	84	81	104	109
Drug Abuse Violation: Possession	61	57	102	87	199	196	296	239
Driving Under the Influence	156	147	246	195	172	241	283	281

[1] Source: Wyoming Attorney General, 2007.
[2] An arrest is counted for each separate occasion an individual is taken into custody, and although several charges may be placed against an individual, only one arrest is counted each time.

Drug use, in particular methamphetamine use, is an increasingly difficult and prevalent problem in Southwest Wyoming. Southwest Counseling Service in Rock Springs is the drug treatment facility that serves the region (Schmid, 2006). In fiscal year 2003-2004, the number of diagnoses made for methamphetamine dependence exceeded the number of alcohol dependence diagnoses for the first time in the agency's history. Eighty percent of arrests in Sweetwater County are associated with methamphetamine use (Schmid, 2006). The Wyoming legislature has responded to the methamphetamine problem with additional laws and funding. In 2005, $9 million was allocated for community efforts to combat methamphetamine distribution and addiction.

3.5.7.4 Medical Services

The Sublette County Rural Health Care District provides first call emergency medical services to the PAPA (McGinnis, 2006). The Rural Health Care District serves as the umbrella organization for the Sublette County Emergency Medical Services (Sublette County EMS) and the Pinedale and Marbleton-Big Piney clinics. Sublette County EMS encompasses three divisions: Pinedale, Big Piney, and Sand Draw (which will open soon). Pinedale and Big Piney have three ambulances each, and Sand Draw will have one. In 1999, the District's emergency medical crews were volunteers but now it has full-time paid medics and partially compensated volunteers. There is funding for a total of twelve medics, but they only have eight. The lack of medics is reported to stem from an inability to find affordable housing. Three of the medics live outside Sublette County. Services will be stretched even tighter when the Sand Draw facility opens and staff will be spread thinner; however, this facility is considered necessary as the volume of calls coming from that direction has been increasing and the facility will allow them to reduce response time by about 30 minutes. Sublette County EMS used to see seasonal fluctuations, but now it is more consistent across the year, averaging 70 runs a month (Figure 3.5-13). Patients requiring emergency medial care receive treatment at the Pinedale Clinic, the Memorial Hospital of Sweetwater County located in Rock Springs, and St. John's Medical Center in Jackson (Gay, 2007).

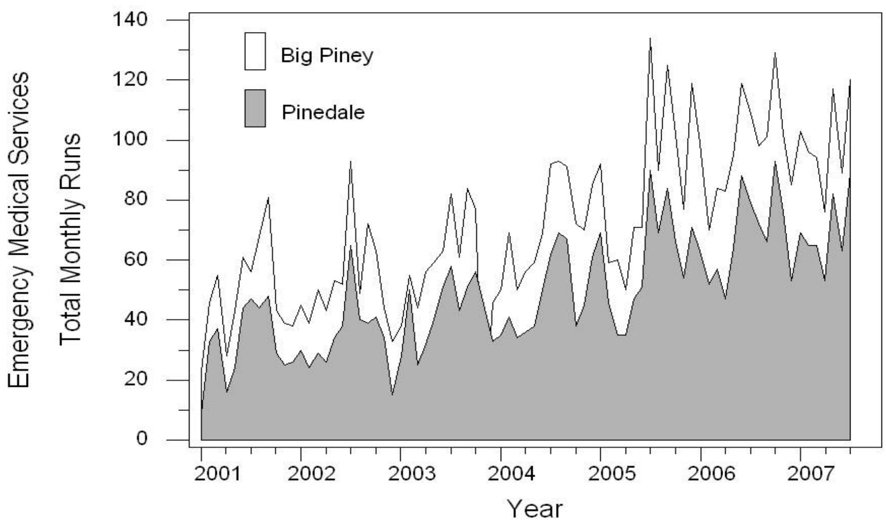


Figure 3.5-13
Sublette County EMS Monthly Runs from Pinedale and Big Piney, 2001-2007
(Source: Sublette County EMS, 2007)

Trauma-related transports by Sublette County EMS increased from 101 in 2000 to 308 in 2006 (Ostby, 2007). Trauma victims from the PAPA are transported to hospitals in Salt Lake City by the Memorial Hospital of Sweetwater County's helicopter.

The Pinedale Clinic sends dozens of referrals per week to the Memorial Hospital of Sweetwater County (Beltran, 2007). Trauma incidents referred to Memorial Hospital did not increase between 2000 and 2005 and the hospital is equipped to meet its current demand. Most of the referrals from the PAPA to Memorial Hospital are broken bones, bruises, and lacerations. Minor trauma and emergency room visits have increased in the past two years. Although Memorial Hospital is not experiencing a strain on its emergency services provision, it is currently doubling its emergency room capacity with new construction (Beltran, 2007).

Sublette County is the only county in Wyoming that does not have a hospital. Medical services include two public clinics; seven independent physicians; two physician assistants; four dentists; emergency medical services with ambulances and trained medics; and a nursing home with 107 rooms (Wyoming Healthcare Commission, 2006). The Pinedale Medical Clinic serviced (including during and after office hours) approximately 13,203 patients in 2005 (Sublette County Rural Health Care District, 2006). This represents a 9 percent increase from the 12,000 patients serviced in 2003 (BLM, 2006e). A new clinic building is under construction. The Marbleton-Big Piney Clinic serviced approximately 6,000 patients in 2005 (Sublette County Rural Health Care District, 2006). These two clinics are administered by physicians under contract with the Sublette County Rural Health Care District. There is also a private clinic in Marbleton (Sublette SE, 2007).

The main center for medical services in Sweetwater County is Memorial Hospital of Sweetwater County with a 99-beds that provided 22,000 days of emergency room care, 2,900 days of in-patient care, and 2,400 days of out-patient care in 2005, and 21,660 days of emergency room care and 2,347 days of in-patient care in 2006 (Beltran, 2007). Memorial Hospital coordinates emergency care services for Southwest Wyoming. There are 40 consulting physicians affiliated with the hospital. Seven dentists practice in Rock Springs. In Green River, the Castle Rock Medical Center coordinates care with four physicians and four physician’s assistants. There are three nursing homes in Sweetwater County.

In Lincoln County, two medical centers coordinate primary and urgent-care services. The South Lincoln Medical Center in Kemmerer has a 16-bed hospital facility which provided 1,023 patient-days of care in 2005. There were 16,352 clinic visits and 2,439 emergency room visits in 2004 (up from 2,039 emergency room visits in 2003). There were 12,984 clinic visits, 2,739 emergency room visits, and 569 patient-days of care in 2006 (Moffet, 2007). There are two satellite clinics, two family practice physicians, one physician’s assistant, and one family nurse practitioner located in southern Lincoln County. In the northern part of the county, the Star Valley Medical Center has a 24-bed hospital facility. There are six independent physicians in Afton and Alpine has one clinic staffed by a family nurse practitioner. There are two nursing homes in Lincoln County.

3.5.7.5 Lodging

Hotel and motel accommodations in Lincoln County include 16 hotels and motels with 350 rooms, three guest ranches, and one bed and breakfast. In Sublette County, there are 23 hotels and motels (total of 629 rooms) five RV parks (total of 83 spaces), three bed and breakfasts, and 11 guest ranches. In Sweetwater County, there are five convention facilities (with a total capacity of 4,660 persons), 31 hotels/motels (1,680 total rooms), an RV park (50 spaces), and several mobile home parks.

Most of the lodging accommodations in Sublette County are located in Pinedale. Pinedale has 13 motels and at least two bed and breakfast accommodations. Several lodges and guest ranches, catering to summer visitors, are also located in the vicinity of Pinedale. Additional lodging facilities near the project area include three motels and one RV campground in Marbleton, two motels in Big Piney, and two motels and three RV campgrounds in Marbleton. (MountainmanCountry, 2008.). According to the Wyoming Department of Revenue (2007), lodging taxes collected in Sublette County increased from $9,000 in 2001 to $235,000 in 2006. This marked increase coincides with the county’s influx of oil and gas workers (Ecosystem Research Group, 2007). Historically, occupancy levels at lodging facilities in Sublette County have varied seasonally, with the highest occupancy levels occurring during the summer tourist season. In recent years, however, hotels and motels are typically booked to capacity throughout the drilling season (Ecosystem Research Group, 2007).

3.5.7.6 Libraries

Each county has a library system. The Lincoln County Public Library has four branches with 112,452 volumes total. The Sublette County Public Library, located in Pinedale, with one branch in Big Piney, has 80,000 volumes total. There has been an increase in demand for services over the past couple of years, but even more so in the past year. This includes a demand for library cards, as well as increases in circulation, the use of public internet computers, and requests for items in languages other than English. The two meeting rooms are booked constantly. The Pinedale location is constructing a new wing, which will add another meeting room as well as a conference room (Platts, 2007). The Sweetwater County Public Library has nine branches with 207,000 volumes total.

3.5.7.7 Schools

There are five school districts in Southwest Wyoming. Table 3.5-25 shows trends in school enrollments between 2000 and 2007 across the region. Schools in Sublette County are experiencing increasing enrollments.

Table 3.5-25
Trends in School Enrollment in Southwest Wyoming between 2000 and 2007[1]

	10/1/2000	10/1/2001	10/1/2002	10/1/2003	10/1/2004	10/1/2005	10/1/2006	1/29/2007
Lincoln #1	789	724	668	669	622	629	627	630
Sublette #1	639	630	671	689	701	767	841	861
Sublette #9	569	587	571	592	591	617	646	642
Sweetwater #1	4,665	4,401	4,264	4,193	4,197	4,240	4,413	4,399
Sweetwater #2	2,928	2,774	2,688	2,650	2,620	2,582	2,551	2,522

[1] Source: Wyoming Department of Education, 2007.

The decision process regarding school facilities involves the Wyoming School Facilities Commission, which was established by the 2002 Legislative session. The Commission oversees school facilities, including planning, assessing, financing, construction, and maintenance (Wyoming School Facilities Commission, 2007a).

Lincoln County has recently closed one elementary school but it could be reopened. Two of their buildings are seismically unsound and will be rebuilt; based on current projections, they are not being built with room to expand (Chaulk, 2006). In a few years, they will be building additions to the Kemmerer Middle and High Schools (Wyoming School Facilities Commission, 2007b).

Sweetwater County School District #2 (Green River) recently closed three elementary schools. Even with these closures, they have capacity for 100 additional elementary school students. Green River High School was built in 1996 for 1,400 students. With a current enrollment of 693, it has considerable room for expansion in the 7th through 12th grades (VanMetre, 2006). Sweetwater County School District #1 (Rock Springs) has seen recent increases in numbers of kindergarten through 6th grade students. They are nearing capacity in their elementary schools. Construction on a new elementary school in LaBarge began in August 2007 (Wyoming School Facilities Commission, 2007b). LaBarge also has ample capacity to expand in their 7th through 12th grade schools. There were 980 high school students enrolled at the end of the 2005-2006 school year in a building that held 1,200 students in the 1990s (Lopiccolo, 2006).

Both Sublette County school districts report effects on their enrollments from the development in the PAPA (Anschutz, 2006 and McAdams, 2007). Sublette County School District #1 is constrained for space in the middle school; its expansion is currently under construction, and a new middle school is in the long range plan. Elementary schools are constrained for space and are using modulars; they will need to build a new elementary school within 5 years. The biggest increase during the 2006-2007 academic year was in the elementary school population, which was considerably up, with an average daily membership of 380. The high school has space to expand. There were 232 enrolled students at the end of the 2005-2006 school year, and they expect 260 students for 2006-2007, but up to 300 could be accommodated (McAdams, 2007). Sublette County School District #9 has experienced no growth in middle school or high school enrollments but is seeing growth in elementary school populations. They are short of space in their elementary school buildings (Anschutz, 2006).

3.5.7.8 Communications

Communications in Southwest Wyoming include three weekly newspapers in Lincoln County, two weekly newspapers in Sublette County, and one weekly and one daily newspaper in Sweetwater County. There are two radio stations in Lincoln County, two in Sublette County and six in Sweetwater County.

3.5.8 County and Local Government Revenues

Sales tax is a foundational source of revenue for Southwest Wyoming. The State of Wyoming imposes a base sales tax rate of 4 percent in all counties. The State keeps approximately 70 percent of sales tax revenues and about 30 percent is returned to the county in which the sale occurred. Sales tax returns are distributed to county governments and municipalities based on population.

Counties and municipalities can also impose a general and/or specific purpose tax up to a maximum of 1 percent for each tax; these are returned by the State, minus an administrative fee. A lodging tax of up to 4 percent can be imposed, which is also returned to the county or municipality of origin, minus an administrative fee (WDAI, 2007a).

Lincoln County imposes a 1 percent general purpose tax. Kemmerer levies a 2 percent lodging tax. In 2005, sales tax collections from mining ($2.3 million) represented 16 percent of total (state and local tax) collections in Lincoln County ($14.7 million). In 2006, the total sales tax collection from mining was $3.5 million.

Sublette County has no general or specific purpose tax, although it does impose a lodging tax of 3 percent. In 2006, the largest source of sales tax revenue in Sublette County was from mining (51 percent), while the total (state) mining collection was $24.6 million. This differs markedly from the rest of Wyoming, where retail sales account for 36 percent of sales tax revenue. In Sublette County, 13 percent of sales tax revenues were from retail sales and 14 percent were from wholesale sales.

Sweetwater County has a 1 percent general purpose tax, and a 2 percent lodging tax. In 2006, total (state and local) sales tax collection from mining ($19 million) represented 24 percent of total collections in Sweetwater County ($79.4 million). This represents sales tax collection on sales by the mining sector, not the sales tax paid by the mining industry.

Sublette County and its municipalities receive portions of two types of tax revenues based on oil and gas production in the PAPA: ad valorem taxes, and severance taxes. Municipalities also receive a portion of federal mineral royalties.

An ad valorem tax is a tax on property that applies to all minerals in Wyoming. Ad valorem taxes go directly to the county in which the commodity is produced. They are divided into production taxes, which are levied on assessed valuation (Table 3.5-26), and property taxes. The total 2005 assessed valuation in Sublette County was $2.9 billion, a six-fold increase since 2000.

Table 3.5-26
Production and Sales of Oil and Gas from the PAPA

Year	2000	2001	2002	2003	2004	2005	2006
Production[1]							
Gas (MSCF)	10,587,252	21,701,861	61,747,523	109,864,089	180,398,607	237,909,623	284,789,614
Oil (barrels)	100,405	210,127	550,857	881,926	1,424,753	1,869,043	2,201,685
Sales/production Ratio[2]							
Gas	88.2%	88.2%	88.2%	88.2%	88.2%	88.2%	88.2%
Oil	100%	100%	100%	100%	100%	100%	100%
Sales:							
Gas (MSCF)	9,337,956	19,141,041	54,461,315	96,900,126	159,111,571	209,836,287	251,184,440
Oil (barrels)	100,405	210,127	550,857	881,926	1,424,753	1,869,043	2,201,685

[1] Source: WOGCC, 2007.
[2] Source: Wyoming Department of Revenue, 2007 and WOGCC, 2007.

A severance tax is an excise tax imposed on the value of the gross product. The mineral severance tax is collected and distributed by the Wyoming Department of Revenue. The base oil and gas rates are each 6 percent. Of the 6 percent, 0.25 percent is returned to counties and 0.75 percent to cities and towns (Wyoming Business Council, 2007). In 2006, Sublette County received $72,775 in severance tax distribution, Pinedale received $65,891, Marbleton received $33,599, and Big Piney received $19,039 (Lummis et al., 2007).

Estimated ad valorem and severance tax distributions from PAPA natural gas wells between 2000 and 2006 are presented in Table 3.5-27.

Table 3.5-27
Estimated Ad Valorem and Severance Tax Revenue from PAPA, 2001 to 2006[1]

Year [1]	2001	2002	2003	2004	2005	2006
Ad Valorem Tax[2]						
Rate on Gas (per MSCF)	$0.17	$0.18	$0.10	$0.20	$0.25	$0.32
Rate on Oil (per barrel)	$1.64	$1.27	$1.34	$1.60	$2.11	$2.74
Ad valorem Gas	$1,799,833	$3,906,335	$6,174,752	$21,972,818	$45,099,652	$76,131,079
Ad valorem Oil	$164,664	$266,861	$738,148	$1,411,082	$3,006,229	$5,121,178
Ad valorem Total	$1,964,497	$4,173,196	$6,912,901	$23,383,899	$48,105,881	$81,252,257
Severance Tax						
Rate on Gas (per MSCF)	$0.14	$0.15	$0.09	$0.18	$0.23	$0.30
Rate on Oil (per barrel)	$1.39	$1.11	$1.22	$1.52	$1.95	$2.58
Severance Gas	$1,435,631	$3,283,492	$5,551,102	$20,127,101	$42,014,836	$72,491,062
Severance Oil	$139,242	$233,493	$670,558	$1,336,735	$2,778,126	$4,814,094
Severance Total	$1,574,873	$3,516,985	$6,221,661	$21,463,836	$44,792,961	$77,305,156

[1] Source: Wyoming Department of Revenue, 2007.
[2] Tax revenue for ad valorem and severance tax is based on the previous year's production and prices.

A mineral royalty is the amount of money paid to the owner of the mineral resource by the mineral producer. Wyoming receives a base royalty of 16.7 percent of the value of production from state-owned minerals. The federal government receives a royalty of 12.5 percent of the value of production for federally-owned minerals. Federal mineral royalties (FMR) paid to the State of Wyoming from PAPA natural gas wells are shown in Table 3.5-28. Fifty percent of FMR are returned to the state, minus a 1 percent administration fee, a portion of which is distributed to municipalities (counties do not receive FMR). In 2006, Pinedale received $154,000 in federal mineral royalties; Marbleton received $86,000; and Big Piney received $55,000 (Lummis et al., 2007).

Table 3.5-28
Federal Mineral Royalties Paid to the State of Wyoming from PAPA Natural Gas Wells[1]

Source	2001	2002	2003	2004	2005	2006
Rate on gas (per MSCF)	$0.29	$0.13	$0.20	$0.16	$0.25	$0.31
Rate on Oil (per barrel)	$1.41	$0.99	$1.33	$1.54	$1.84	$2.68
FMR – Gas	$6,271,838	$7,718,440	$22,412,274	$28,863,777	$59,477,406	$88,854,360
FMR – Oil	$295,859	$547,001	$1,168,552	$2,195,544	$3,446,515	$5,893,911
FMR – Total	$6,567,697	$8,265,441	$23,580,826	$31,059,321	$62,923,921	$94,748,270
[1] Source: Minerals Management Service, 2007.						

The federal government manages 49 percent of land in Wyoming, including 75 percent of Lincoln County, 77 percent of Sublette County, and 69 percent of Sweetwater County. Federal lands are not subject to property taxes that support county governments and education. In 1976, Congress authorized federal land management agencies to share income with states and counties through its Payment In Lieu of Taxes (PILT) program. In 2006 in Lincoln County, $817,726 was returned to the county on 1,952,608 acres enrolled in the PILT program, an effective payment of $0.42 per entitlement-acre. In 2006 in Sublette County, $491,999 was returned to the county on 2,431,285 acres enrolled in the PILT program, an effective payment of $0.20 per entitlement-acre. In 2006 in Sweetwater County, $1,699,067 was returned to the county on 4,611,015 acres enrolled in the PILT program, an effective payment of $0.37 per entitlement-acre (Foulke et al., 2007).

3.5.9 Natural Gas Prices

Increases in natural gas prices are an important factor influencing Operator's decisions regarding the number of wells to drill and the level of production from existing wells. From 2000 to 2006, the average wellhead price paid for Wyoming natural gas increased (Table 3.5-29).

Table 3.5-29
Average Prices Paid at the Wellhead in Wyoming 2000 to 2006[1]

Year	Price $/MCF
2000 annual average	$3.42
2001 annual average	$3.66
2002 annual average	$2.09
2003 annual average	$4.41
2004 annual average	$5.17
2005 annual average	$7.19
2006 through June	$5.97
[1] Source: Bentley and DeBruin, 2007.	

3.6 TRANSPORTATION

3.6.1 Natural Gas Development in the PAPA

The primary route to the PAPA is U.S. Highway 191. The main route through the PAPA is State Highway 351 (Map 2.3-2 in Chapter 2). Before issuance of the PAPA ROD (BLM, 2000b), access within the PAPA was limited to a few county roads, BLM roads, oil and gas roads, and a number of two-track roads. Numerous local and resource roads have been constructed throughout the PAPA in conjunction with natural gas development since issuance of the PAPA ROD. Most collector roads existing prior to issuance of the PAPA ROD have been upgraded and/or expanded, and one new collector road has been constructed (North Anticline Road).

Collector roads provide primary access in the PAPA and generally receive the highest traffic volume of the three classes. Local roads provide access to multiple well locations while resource roads provide access to individual well locations and receive the lowest traffic volume. As of November 2006, there were 185.6 miles of roads in the PAPA as a result of wellfield activities. Of this, 61.6 miles are collector roads, 57.7 miles are local roads, and 66.3 miles are resource roads.

3.6.1.1 Traffic Volume

Vehicle traffic volumes within and adjacent to the PAPA have increased since 2000. For example, daily traffic on State Highway 351 was estimated at 640 vehicles per 24 hours (with 110 trucks per 24 hours) in 2000. By 2006, traffic volume had more than tripled to 2,230 vehicles per 24 hours, while truck traffic increased to 540 trucks per 24 hours (Wyoming Department of Transportation – WDOT, 2007a). Likewise, traffic on U.S. Highway 191, measured near the junction with Wenz Airport Road, increased from 1,700 vehicles per 24 hours (180 trucks per 24 hours) in 2000 to 3,150 vehicles per 24 hours (330 trucks per 24 hours) in 2006. Traffic on U.S. Highway 189 measured near the junction with Airport Road increased from 1,400 vehicles per 24 hours in 2000 (130 trucks per 24 hours) to 4,070 vehicles per 24 hours (740 trucks per 24 hours) in 2006 (WDOT, 2007a). Table 3.6-1 summarizes average vehicles per day estimated for different road sections near the PAPA in 2000 and in 2006.

According to WDOT (Roadifer, 2006), all sections of U.S. Highway 191 are rated Level of Service C based upon current traffic volumes. In WDOT's 2005 analysis of U.S. Highway 191, there was an increase of 58 percent of overall traffic with a 90 percent increase in truck traffic between 2002 and 2005. The volume increase caused the downgrade to a Level of Service C. Similar analysis has not been done by WDOT for State Highway 351. WDOT tries to maintain all roads at a Level of Service C or higher. Anything below a Level of Service C would necessitate road improvements (Roadifer, 2006).

Table 3.6-1
Average Number of Vehicles Per Day on Highways Used to Access the PAPA[1]

Section Description	Section Milepost		Pre-ROD (before July 2000)		Post-ROD (as of November 2006)	
	Begin	Length (miles)	All Vehicles	Trucks	All Vehicles	Trucks
U.S. Highway 191						
Sweetwater – Sublette County Line	51.62	21.33	1,500	240	3,340	840
Jct. Speedway Road	72.81	3.95	1,500	240	2,830	640
Jct. Route 1801 (WY 351)	76.75	7.75	1,300	160	2,280	240
Jct. Fish Hatchery Road	84.50	3.30	1,200	150	2,570	270
Jct. Route 1804 (WY 353)	87.80	4.99	1,600	170	2,610	280

Section Description	Section Milepost		Pre-ROD (before July 2000)		Post-ROD (as of November 2006)	
	Begin	Length (miles)	All Vehicles	Trucks	All Vehicles	Trucks
Jct. Wenz Airport Road	92.80	2.70	1,700	180	3,150	330
Jct. County Road 221 East & West	95.50	3.00	1,800	190	3,560	360
Jct. County Road 121 East	98.50	0.49	1,900	210	4,270	380
Pinedale South Corp Limits	98.99	0.40	3,100	230	5,190	370
Jct. Fremont Lake Road	99.39	0.89	4,600	240	7,070	370
Pinedale West Corp Limits	100.27	0.76	3,000	230	6,690	360
Jct. County Road 144 North	101.03	4.51	2,400	240	3,890	330
Jct. Route 352 (WY 352)	105.54	4.93	1,900	230	2,590	250
U.S. Highway 189						
Lincoln-Sublette County Line	85.92	3.88	900	160	1,490	240
Jct. County Road 139 East	100.16	2.57	1,000	190	1,530	250
Jct. County Road 134 West	102.73	1.89	1,250	200	2,450	520
Big Piney South Corp Limits	105.81	0.13	2,150	240	4,180	800
Jct. Route 1800 (WY350)	105.94	0.37	3,800	350	5,930	870
Big Piney North Corp Limits	106.32	0.61	4,100	270	6,190	680
Marbleton South Corp Limits	106.93	0.54	2,950	210	5,000	690
Marbleton North Corp Limits	107.47	0.50	1,850	150	4,520	830
Jct. Airport Road	107.97	1.41	1,400	130	4,070	740
Jct. Route 1801 (WY 351)	109.38	18.0	980	100	1,430	280
State Highway 351						
Jct. Route 11 (U.S. 189)	0	12.91	640	110	2,230	540
Jct. County Road 136 North	12.91	11.27	280	40	1,620	500
Jct. Route 13 (U.S. 191)	0	6.70	400	50	550	30
[1] Source: WDOT, 2007a.						

Comparable traffic volume data before and after issuance of the PAPA ROD (BLM, 2000b) are not available for wellfield roads within the PAPA; however, several monitoring studies at various sites and times throughout the PAPA indicate an increase in traffic volume. For example, Ingelfinger (2001) recorded 12 vehicles per day on the Mesa Road during May and June, 1999. Holloran (2005) measured traffic by axle counts: 113 axles per day (57 vehicles per day if all had 2 axles, 38 vehicles per day if all had 3 axles) on the Mesa Road in 2001. The next year (2002), traffic volume on the Mesa Road decreased, as well as in subsequent years compared to predevelopment volumes (i.e., 22 axles per day in 2002). Most likely, after 2001, wellfield traffic (113 axles per day in 2001) was using the newly constructed North Anticline Road instead of the Mesa Road, portions of which have been reclaimed.

Holloran (2005) also recorded traffic volumes on the Jonah North Road from mid-March through mid-May, which indicated that traffic volume on this road has been increasing since 2001: 59 axles per day in 2001, 73 axles per day in 2002, 125 axles per day in 2003, and 257 axles per day in 2004.

The PAWG Transportation Task Group recommended traffic monitoring to the BLM in September 2005, and the BLM provided funds for a traffic monitoring site within the PAPA. A radar sensor was installed to collect traffic volume data, although data are not yet available. In August and September 2005, WDOT installed multiple pneumatic traffic counters throughout the

PAPA and Jonah Field Project Area. An estimated average of 1,763 vehicles traveled the combined field road network on each of 2 days sampled, with estimates of 1,141 passenger vehicles, 226 single-unit trucks, 328 single-trailer trucks, and 68 multi-trailer trucks.

Winter 2005-2006 was the first time traffic volume was monitored during winter drilling and well production in the PAPA. Traffic information was gathered from November 15, 2005 through April 30, 2006 at the ASU access station (BLM, 2005b) located 400 feet south of the Pinedale/Gobblers Knob Compressor Station (SW¼ NW¼ Section 2, T. 31 N., R. 109 W.), at the main entry point to well field facilities on the Mesa. As each vehicle passed the station, the attendant identified it by specific type: light vehicles including cars, pickup trucks, SUVs and vans, while heavy vehicles were buses, tankers, dump trucks, semi-tractor trailers, among other types. Monthly average traffic volume per day, beginning November 15, 2005 and ending April 30, 2006, is summarized in Table 3.6-2.

Table 3.6-2
Average Number of Vehicle Types Per Day
Passing the ASU Access Station During Winter 2005-2006

Vehicle Type	November	December	January	February	March	April	Period Average
Light Vehicles	206.8	191.0	149.0	191.0	156.7	165.3	173.4
Heavy Vehicles	136.4	96.2	79.0	96.2	69.8	72.9	87.4
Total Vehicles	**343.2**	**287.2**	**228.0**	**287.2**	**226.5**	**238.2**	**260.8**

In 2006, Questar funded a traffic study, beginning in mid-January and lasting through March. Forty-four traffic counters were placed on the Mesa, including resource roads to individual well pads, local roads to several well pads, and collector roads, including several locations along the North Anticline Road. Some counters were placed on local and resource roads leading to well pads with liquids gathering systems, while other counters were placed on roads to well pads without liquids gathering systems. Counters documented traffic volume to well pads where there was winter drilling by several operators. All traffic data was reported as the median number of vehicles (hits) counted per day during the functional period of each counter (Western EcoSystems Technology, 2006).

Traffic counters placed on the North Anticline Road at various distances from the junction with the Paradise Road show diminishing traffic volumes with increasing distance from the junction (Table 3.6-3). Counters farther from the junction recorded traffic to fewer well pads (assuming all traffic to those destination pads accessed the Mesa from Paradise Road). Traffic related to winter drilling is evident by comparing vehicle round trips (Table 3.6-3) from the counter at 6.93 miles from Paradise Road (21 daily round trips to access 25 well pads) to data from the closer counter, 5.54 miles from the junction (60 daily round trips to access 37 well pads).

Traffic volumes associated with winter drilling and the influence of liquids gathering systems on daily traffic are evident from traffic counters placed on local roads and, especially, on resource roads (Table 3.6-4). Average daily traffic to well pads with liquids gathering systems is half the traffic to pads without.

Table 3.6-3
Traffic Counter Locations, Traffic Volumes, and Wellfield Components Accessed Beyond each Counter on the North Anticline Road from mid-January through March, 2006

Distance from Counter to Paradise Road (miles)	Median Vehicle Round Trips per Day [1]	Pads Accessed [2]	Producing Wells Accessed [3]	Pads with Liquids Gathering Systems [4]	Wells with Liquids Gathering Systems [4]	Pads with Winter Drilling [5]	Maximum Wells Drilled in Winter [6]
0.62 [7]	253	106	228	53	125	7	60
1.87 [8]	175	82	185	53	125	6	54
5.54 [8]	60	37	82	36	79	2	10
6.93 [8]	21	25	52	24	51	0	0

[1] Round trips are assumed to be half of the vehicles counted by traffic counters or the actual vehicle count at the access station.
[2] Total number of well pads digitized in 2005 that were beyond each counter's location, assuming all vehicle access was from south to north.
[3] Total number of producing wells from WOGCC (2007).
[4] Questar (Wexpro) pads and wells were assumed to have a liquids gathering system; other Operators were not.
[5] Winter drilling by Questar, Anschutz, Shell, and Ultra.
[6] Maximum wells drilled based on all APDs on winter-drilled pads reported by WOGCC.
[7] Data reported by the access station for mid-January through March, 2006.
[8] Western EcoSystems Technology, 2006.

Table 3.6-4
Comparisons of Vehicle Traffic to Well Pads With and Without Liquids Gathering Systems and the Effects of Winter Drilling on Traffic Volume[1]

Resource Road to Well Pad	Sample Size	Averaged Median Vehicle Round Trips per Day	Average Producing Wells Accessed	Vehicles per Day per Producing Well
Without Liquids Gathering System	3	2.67	1.67	1.60
With Liquids Gathering System	8	1.31	2.00	0.66
With Liquids Gathering System and Winter Drilling	2	66.25	4	16.56

[1] Source: Western EcoSystems Technology, 2006.

The traffic study was replicated in 2007 with 45 traffic counters installed on resource, local, and collector roads beginning in mid-January, extending through mid-March (Western EcoSystems Technology, 2007). Traffic counters were again placed on the North Anticline Road at various distances from the junction with the Paradise Road and traffic counts showed a decrease with distance from the junction, similar to the pattern described in Table 3.6-3. Data collected in 2007 on local and resource roads leading to well pads with and without liquids gathering systems also showed a similar distinction to that collected in 2006 (Table 3.6-4); there were, on average, more vehicle round trips per day to well pads without a liquids gathering system (1.6 round trips per day per pad) than to well pads with a liquids gathering system (1 round trip per day per pad).

As in 2006, traffic volumes related to winter drilling in 2007 far exceeded traffic volumes associated with production activities on well pads. Median daily traffic on three resource roads leading to pads with wells drilled during winter 2007 averaged 44.2 round trips per day (vehicles entering and leaving a pad each day). The evaluation period varied from 38 to 55 days depending on the pad. Traffic to one well pad where well completion(s) took place in 2007 averaged 12 round trips per day for 70 days. Traffic volume during any given day in that period was highly variable, ranging from less than 5 to over 65 round trips per day (Western EcoSystems Technology, 2007).

3.6.1.2 Vehicular Crashes

The total number of vehicular crashes and people injured or killed in Sublette County has increased annually from 2000 through 2006 (Table 3.6-5). In 2000, there were 271 total crashes, three fatalities, and 90 persons injured, compared to a total of 316 crashes, 11 fatalities, and 162 persons injured in 2006. Table 3.6-5 summarizes the data collected from 2000 through 2006 for vehicular crashes on U.S. Highway 189 from MP 0.0 to MP 131.45, U.S. Highway 191 from MP 0.0 to 110.05, and State Highway 351 from MP 0.0 to 24.18.

On U.S. Highway 191 between Rock Springs and Daniel Junction, crashes increased 39 percent from 142 in 2001 to 197 in 2006. A 130 percent increase in crashes was recorded along State Highway 351, connecting U.S. Highway 189 and U.S. Highway 191, where nine crashes were reported in 2001 and 21 crashes were reported in 2006. From Interstate 80 to Daniel Junction, there were 547 crashes reported by the WDOT from 2001 through 2006 on U.S. Highway 189. Crash frequency along this section of road has remained fairly constant over the 5 years.

Table 3.6-5
Number of Vehicular Crashes on Roads Adjacent to the PAPA[1]

Year	Persons Injured	Persons Killed	Property Damage Only	Injury Crashes	Fatal Crashes	Total Crashes
2000	90	3	207	62	2	271
2001	87	6	201	60	5	266
2002	91	3	222	58	2	282
2003	100	8	217	70	8	295
2004	95	5	233	67	5	305
2005	106	8	259	74	7	340
2006	162	11	224	83	9	316

[1] Source: WDOT, 2007b.

Although the total number of crashes has increased on U.S. Highway 191 and State Highway 351 over the past 5 years, the crash rate (total number of crashes/daily vehicle miles) has remained constant. For State Highway 351, the average crash rate is 1.22, slightly lower than the statewide average 1.62 for a Class 07 (major collector - rural) road. The average crash rate on U.S. Highway 191 is 1.66, slightly higher than the statewide average of 1.51 for a Class 2 (principal arterial) road. Additionally, the average crash rate for U.S. Highway 189 is 1.44, slightly lower than the statewide average of 1.51 for a Class 6 (minor arterial –rural) road (WDOT, 2007b).

WDOT (Carpenter, 2006) has recorded multiple wildlife-vehicle collisions. Since 1999, most vehicular collisions have been with mule deer though some pronghorn and fewer moose and elk have been killed on area highways including U.S. Highway 191, U.S. Highway 189, and State Highway 351 (see Wildlife and Aquatic Resources, Section 3.22).

3.6.1.3 Maintenance

Increased traffic volume on roads within and adjacent to the PAPA has resulted in a greater need for road repairs and upgrades, including additional lanes and widening of roads and shoulders. As a result, maintenance expenditures have increased since 2000 (WDOT, 2006). WDOT is responsible for maintaining U.S. Highways 191 and 189 and State Highway 351, all of which are used to access the PAPA. Although maintenance requirements on these highways increased (Table 3.6-6), WDOT's funding levels remained constant from 2000 to 2005. Sublette

County maintains the county roads servicing the PAPA. The Operators are responsible for preventive and corrective maintenance of all BLM roads within the PAPA.

Table 3.6-6
Highway Maintenance
Expenditures (dollars) from 2000 through 2005[1]

Year	U.S. Highway 191	U.S. Highway 189	State Highway 351
2000	15,564	18,000	17,500
2001	21,500	23,000	28,500
2002	20,400	36,700	34,400
2003	19,200	25,000	54,700
2004	27,900 [2]	21,200	204,300 [2]
2005	156,300 [2]	28,100	65,800

[1] Source: WDOT, 2006.
[2] Includes chip sealing projects but not asphalt patching and snow plowing.

3.6.2 Pipeline Corridors and Gas Sales Pipelines

A regional network of federal, state, county, local, and rural roads provides the basic transportation infrastructure for access to the proposed corridor/pipeline alignments. Many of the local/rural roads have been improved and are maintained by oil and gas operators. North-south trending U.S. Highways 189 and 191 provide principal access to the northern half of the proposed corridor/pipeline alignments (Map 2.4-1 in Chapter 2). In addition to federal and state highways, access to the corridor/pipeline alignments and the New Fork River crossing north of State Highway 351 would be via the Paradise Road and South Boulder Road that parallel the New Fork River on the north and south sides, respectively.

The proposed BCC, RVII pipeline, and PBC pipeline alignments cross the east-west aligned State Highway 351. Access to the proposed corridor/pipeline alignments south of State Highway 351 would be via numerous BLM and local/rural roads, including BLM Road 5406, Burma Road, BLM Road 5410, Sublette County Road 139, Reardon Draw Road, County Line Road bordering Sweetwater and Sublette County, Sweetwater County Road 8, the Farson Cutoff Road, Sweetwater County Road 52, and BLM Road 4202.

The BFGC and Segment 2 of the RVII Pipeline alignments south of the Green River would be accessed via State Highway 372, U.S. Highway 30 and BLM, county, and local/rural roads. Access to the proposed corridor/pipeline alignments between the Granger Gas Processing Plant and the Blacks Fork Processing Plant would be via State Highway 375, Sweetwater County Road 16 (Granger Road), Old Little America Road, Uinta County Road 233 (Granger Road), and other local/rural roads. Access routes from the proposed OPC and Opal Loop III Pipeline alignment south of the Green River to the Pioneer and Opal gas processing plants would be via U.S. Highway 30, State Highway 240, and BLM Road 4209.

Some existing roads are parallel or adjacent to portions of the proposed corridor/pipeline alignments; this is not the case for most of the alignments. The local/rural roads are principally graveled or surfaced with native material and typically support low traffic volumes, with the exception of the roads used to access areas of oil and gas development. These rural areas and the roads accessing these areas are more remote than access from more frequently traveled routes, which may impede rapid emergency detection and response (Goehring and Sundeen, 1999).

3.7 LAND USE AND RESIDENTIAL AREAS

3.7.1 Natural Gas Development in the PAPA

3.7.1.1 Land Use/Land Cover

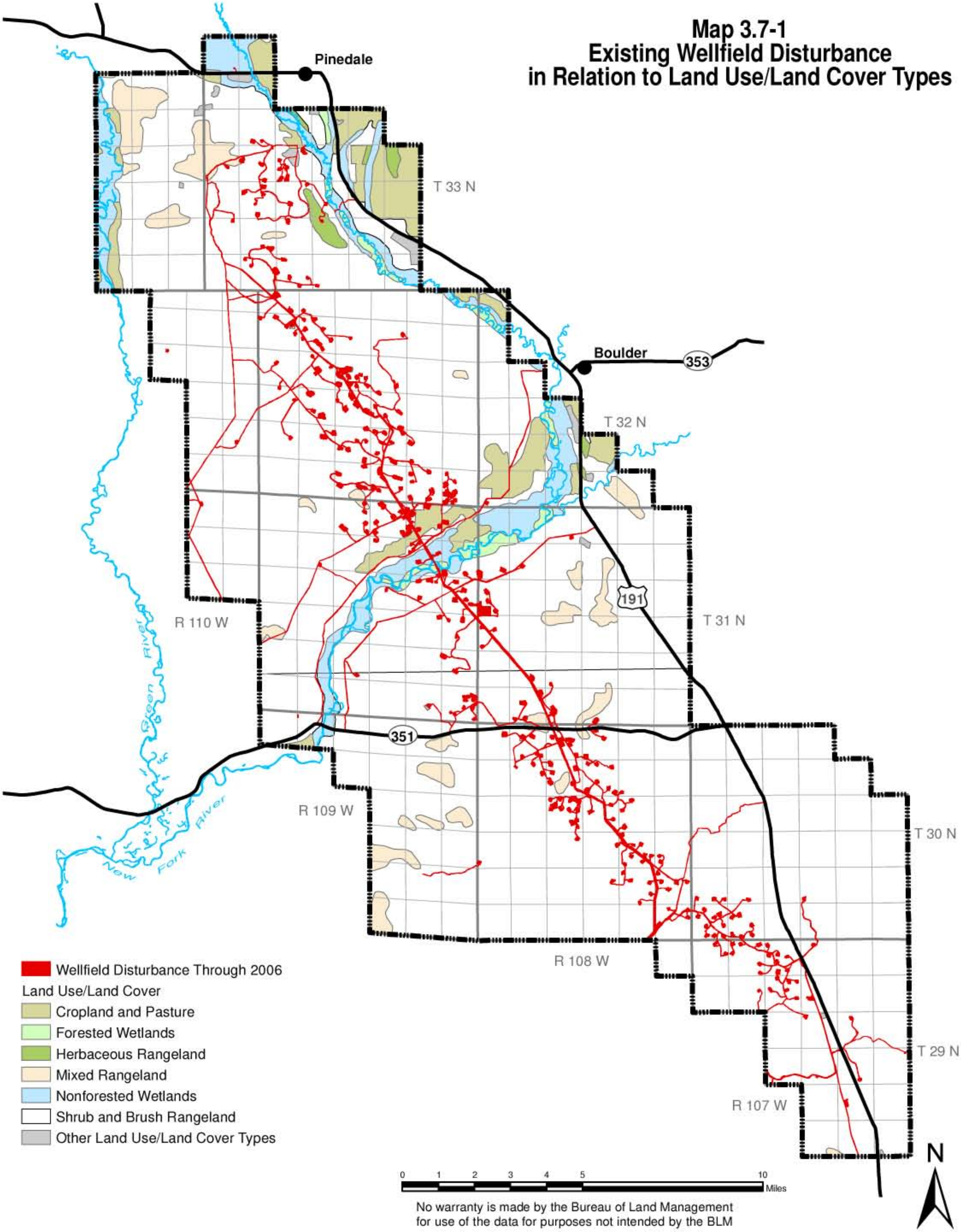
Present land use and land cover in the PAPA was categorized using the United States Geological Survey (USGS) classification system (Anderson et al., 1976), the same system used in the PAPA DEIS (BLM, 1999a). There are 13 categories of USGS classified land uses in the PAPA (Map 3.7-1). Table 3.7-1 provides the total surface area of each land use/land cover type defined within the PAPA and included in the PAPA DEIS.

Shrub and Brush Rangeland and Mixed Rangeland are the predominant land use/land cover types in the PAPA, with a combined total of over 178,200 acres. The Cropland and Pasture type is mostly on bottomlands of the Green and New Fork rivers. Most Non-forested Wetlands are associated with riparian areas or are otherwise proximate to rivers and are mostly on private land.

Existing surface disturbance associated with natural gas development in the PAPA is shown in Table 3.7-1. In the USGS classification system, land uses associated with wellfield components would convert an otherwise undisturbed land use category in Table 3.7-1 to be either Transportation, Communications, Utilities (roads, and pipelines) or Industrial (well pads and other wellfield ancillary facilities). Natural gas related surface disturbance has changed land use/land cover types in the PAPA in approximate proportion to their pre-1999 extent (Table 3.7-1). Land uses have not been reclassified using the USGS system since the issuance of the PAPA ROD (BLM, 2000b). Most wellfield development in the PAPA has been in the Shrub and Brush Rangeland land use type which represents approximately 96 percent of the PAPA.

Table 3.7-1
Existing Wellfield Disturbance in Relation to Land Use/Land Cover Types

Land Use/Land Cover Type	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Cropland and Pasture	7,595	55.4	7.7	63.1
Forested Wetlands	1,542	0.1	6.6	6.7
Herbaceous Rangeland	855	0.0	5.6	5.6
Industrial	70	31.2	9.2	40.4
Mixed Rangeland	6,278	43.6	0.0	43.6
Non-forested Wetlands	8,965	0.8	39.0	39.8
Reservoirs	23	0.0	0.0	0.0
Residential	180	0.0	0.0	0.0
Sandy Areas Other than Beaches	97	0.0	3.9	3.9
Shrub and Brush Rangeland	172,007	4,008.3	621.6	4,629.9
Mines, Quarries and Gravel Pits	167	1.6	0.0	1.6
Transitional Areas	32	0.0	0.0	0.0
Transportation, Communication, Utilities	226	0.0	0.0	0.0
Total	**198,037**	**4,141.0**	**693.6**	**4,834.6**



Map 3.7-1
Existing Wellfield Disturbance
in Relation to Land Use/Land Cover Types
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
Land Use/Land Cover
Cropland and Pasture
Forested Wetlands
Herbaceous Rangeland
Mixed Rangeland
Nonforested Wetlands
Shrub and Brush Rangeland
Other Land Use/Land Cover Types
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
N

3.7.1.2 Sublette County Comprehensive Plan and Zoning

Wyoming State Statutes (Title 9-8-301 and Title 18-5-202) provide for the development of county-level comprehensive plans. The statutes also encourage county planning coordination with federal land and resource management agencies. These locally developed, adopted, and implemented county plans apply to the unincorporated areas within the county and may address public health, safety, moral, and general welfare issues.

The Sublette County Comprehensive Plan was completed in 2003 and revises the 1978 plan. The 2003 plan solidifies contemporary versions of the county's vision, goals, and formal land use policies but allows for future revisions and amendments. The purpose of the County Plan is to provide a consistent and clear direction for future land use decisions and development guidelines for officials and policy makers to craft "socially, economically and ecologically sound" decisions (Sublette County, 2003). Key components of the County Plan include:

- The County's unique culture - characterized by a rural, "Wyoming" essence - shall be preserved and enriched through a thriving private business sector, a healthy working family-based environment, and friendly, crime-free communities.
- Economic freedom shall pervade and provide diverse opportunities through reasonable taxation, low cost of living, limited regulation, and wise development of natural resources.
- The natural environment shall reflect the high value residents place on clean air and water, wide open and rural landscapes, and a healthy, diverse base of natural resources including water, land, minerals, oil, gas, plants, and animals.
- The county shall remain free of excessive land use regulation and protect private property rights.

The Sublette County Zoning and Development Regulations (Sublette County, 2002) were revised in 2007. The regulations aid in implementing the Sublette County Comprehensive Plan, provide for orderly and well-planned development within the County, protect the various land uses and zones from harmful encroachment by incompatible uses, and ensure that land allocated to a zoning district is not usurped by inappropriate uses. Detailed descriptions of the PAPA's 11 zoning districts (Map 3.7-2) are provided in the PAPA DEIS (BLM, 1999a) and the Sublette County Zoning and Development Regulations.

Table 3.7-2 provides the total area and existing wellfield disturbance within the PAPA in each zoning district. The Resource Conservation Zoning District, in which development is limited in order to protect and conserve environmentally sensitive areas, encompasses approximately 75 percent of the PAPA (Sublette County, 2002). Most of the area within the PAPA which is designated as Resource Conservation is on federal lands and minerals ownership. As of November 2006, over 3,800 acres had been disturbed in the Resource Conservation Zoning District, which is nearly 80 percent of all wellfield disturbance in the PAPA (Table 3.7-2).

While Sublette County has included BLM-administered public lands in their zoning districts, normally the county has no jurisdiction on these lands. The Sublette County Comprehensive Plan advocates that land use plans developed by the BLM and other federal agencies be coordinated and consistent with the Sublette County Comprehensive Plan and the Sublette County Conservation District Natural Resource Statement.

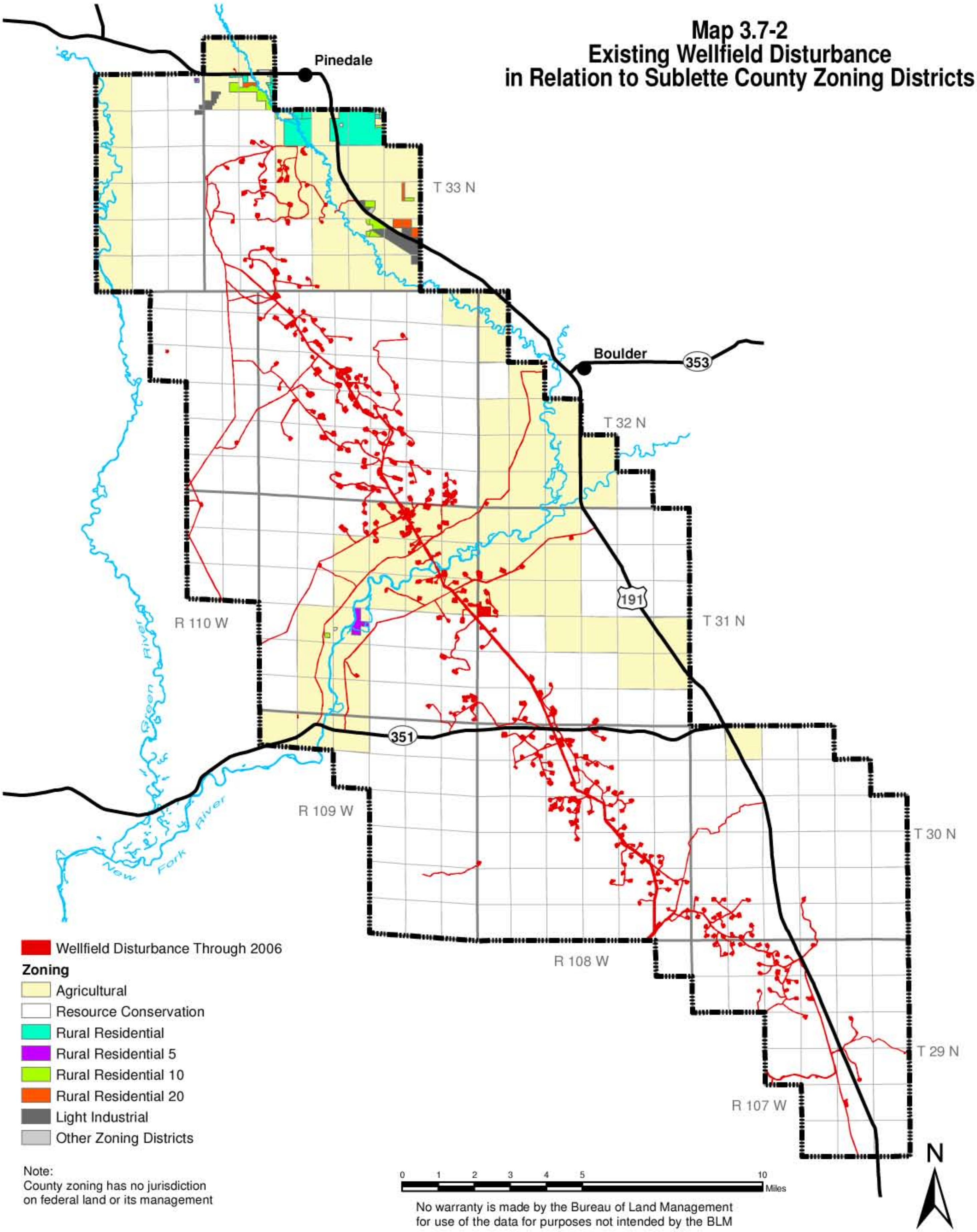

Map 3.7-2
Existing Wellfield Disturbance
in Relation to Sublette County Zoning Districts
Pinedale
Boulder
353
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
191
351
Green River
New Fork River
Wellfield Disturbance Through 2006
Zoning
Agricultural
Resource Conservation
Rural Residential
Rural Residential 5
Rural Residential 10
Rural Residential 20
Light Industrial
Other Zoning Districts
Note:
County zoning has no jurisdiction
on federal land or its management
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
N

Table 3.7-2
Existing Wellfield Disturbance in Relation to Sublette County Zoning Districts

Sublette County Zoning District	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Agricultural	46,528	779.9	222.8	1,002.7
Highway commercial	33	0.0	0.0	0.0
Heavy industrial	37	0.0	0.0	0.0
Light Industrial	457	0.0	0.0	0.0
Rural residential	1,398	0.0	0.1	0.1
Rural residential 10	364	0.0	0.0	0.0
Rural residential 20	167	0.0	0.0	0.0
Rural residential 5	128	0.0	0.0	0.0
Rural residential mobile/manufactured home 10	34	0.0	0.0	0.0
Resource Conservation	148,875	3,361.1	470.7	3,831.8
Rural mixed	16	0.00	0.00	0.0
Total	**198,037**	**4,141.0**	**693.6**	**4,834.6**

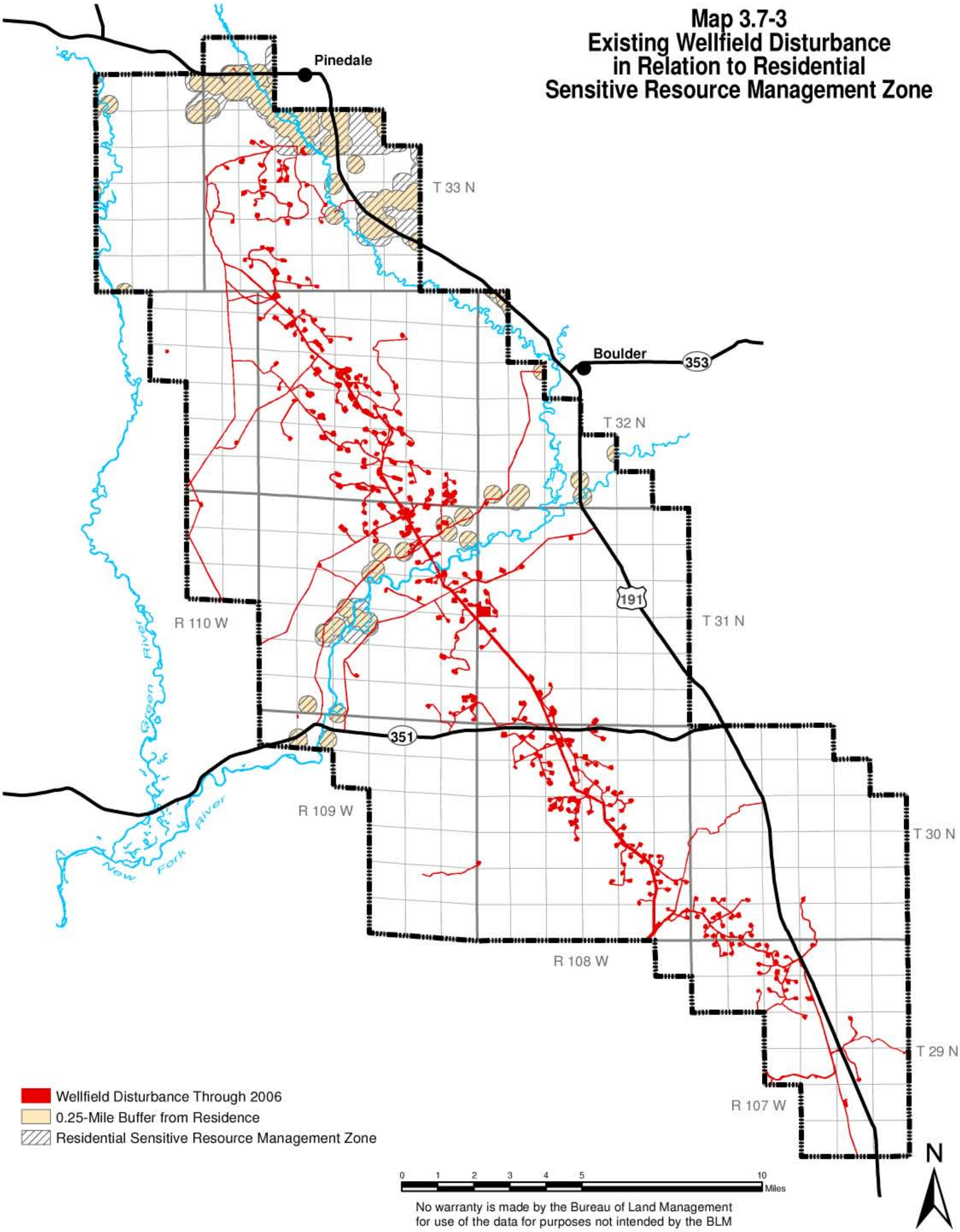
3.7.1.3 Residential Areas and Subdivisions

Most land in the PAPA that is zoned for residential use by Sublette County is concentrated in the northern portion of the PAPA Residential areas represent an estimated 2,091 acres of the PAPA and are primarily within or adjacent to Pinedale and Boulder. According to Sublette County Planning and Zoning data, there are 43 subdivisions in or overlapping the PAPA, with eight subdivisions added since issuance of the PAPA ROD (BLM, 2000b).

The PAPA DEIS (BLM, 1999a) established the Residential SRMZ that was defined to be within 0.25 mile of existing residences and areas zoned primarily for residential use around portions of the PAPA (Map 3.7-3). The SRMZ does not include residences constructed after July 2000. Approximately 94.7 acres of the Residential SRMZ (as defined in the PAPA ROD) have been disturbed by wellfield development, through November 2006.

3.7.2 Pipeline Corridors and Gas Sales Pipelines

The proposed corridor/pipeline alignments traverse rural, nonurban areas in Sublette, Sweetwater, Lincoln, and Uinta counties. All four counties are primarily rural and tied to traditional natural resource-based industries. Agricultural and mineral extraction industries, particularly oil and gas, are principal land uses. The proposed corridor/pipeline alignments through Sublette County are primarily within the Resource Conservation Zoning District. Areas in Sweetwater County crossed by the proposed corridor/pipeline alignments are zoned agricultural with some areas of minerals development. Areas in Lincoln County crossed by the proposed corridor/pipeline alignments are zoned rural. The proposed pipeline alignment in Uinta County parallels existing pipeline rights-of-way in the immediate vicinity of the Blacks Fork Plant.


Map 3.7-3
Existing Wellfield Disturbance
in Relation to Residential
Sensitive Resource Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
0.25-Mile Buffer from Residence
Residential Sensitive Resource Management Zone
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
N

3.8 RECREATION RESOURCES

3.8.1 Natural Gas Development in the PAPA

3.8.1.1 Recreational Activities

A brochure promoting Sublette County recreation opportunities claims that the county is "Better than Yellowstone! Breathtaking, Wild, Uncrowded" (Sublette County Joint Tourism Promotion Board, 2006). Sublette County's location as a gateway community for travelers en route to Yellowstone and Grand Teton National Parks is important, though the county has amenities that make it an attractive final destination.

Most recreation use in the PAPA is related to fishing on the New Fork and Green rivers and hunting. The Upper Green River Valley is also a popular destination for people seeking the benefits associated with river floating, camping, off-highway vehicle (OHV) use, hiking, horseback riding, and more. The PAPA also serves as an important outlet for locals to bike, horseback ride, walk, and generally revel in the signature scenery. These activities are common in the northern part of the PAPA, near Pinedale, the region's largest population center. Riverboat fishing and wade fishing are also popular activities, especially on the New Fork River in the central area of the PAPA, where the river bottoms and surrounding benches coincide with scenic BLM Visual Resource Management (VRM) Class II viewsheds.

Aside from a broad spectrum of tourist and residential recreation opportunities, Sublette County also has the highest population growth rate in the state. The increasing regional population and changing demographics as a result of natural gas development, retirement, and new businesses have contributed to the expanding demand for outdoor recreation access and use. Since the onset of natural gas development, and with the influx of oil and gas workers, more residents are seeking recreation opportunities and facilities on public land (BLM, 2003a). The BLM has noted marked increases in dispersed recreation, such as camping and OHV use since 2000 (Hudson, 2007 and Vlcek, 2007). Widespread OHV use is often difficult to manage and can impact an array of other resources, such as cultural and historic, grazing, wildlife, and vegetation.

Additionally, natural gas development in the PAPA affects large areas that in the past have been used for dispersed, benefits-based recreation (recreation that contributes to the users' relaxation, sense of adventure, family experiences, appreciation for the outdoors, sense of well-being, and more). It is generally assumed that areas once commonly used for benefits-based recreation will be avoided when the landscape and its qualities are changed by development. Noise, odor, increased traffic, dust, changes in setting, and other competing factors from development are typically considered intrusive and recreationists will usually avoid such areas.

The BLM Recreation Management Information System (RMIS) data for the PFO Administrative Area show that there were 200,567 total recreation days (one day spent by one person recreating) in 2006, distributed among 13 recreation activities. Table 3.8-1 summarizes the RMIS data for the years 2004, 2005, and 2006. The most common recreation uses in the region are boating and fishing, with major increases in these activities occurring in 2006. In projecting future recreation patterns, resource managers recognized that RMIS data are best professional estimates based on 30 years of general knowledge of use, and standardized collection methods are not always used. Recorded data related exclusively to the PAPA are not available (Hudson, 2007). The PAPA comprises about 21 percent (198,037 acres) of the total PFO Administrative Area (approximately 930,000 acres).

Table 3.8-1
Recreation Days in the BLM Pinedale Field Office Administrative Area[1,2]

Activity	Recreation Days 2004	Recreation Days 2005	Recreation Days 2006
Motorized Boating	292	263	282
Nonmotorized Boating	81,477	81,206	89,564
Camping and Picnicking	20,855	22,274	22,151
Driving for Pleasure	1,993	1,728	2,338
Fishing	46,832	45,941	50,798
Hunting	5,019	5,555	6,190
Interpretation, Education & Nature Study	2,899	2,710	2,943
Nonmotorized Travel	15,463	15,246	16,228
Off-Highway Vehicle Travel	1,081	1,183	1,392
Snowmobile & Other Motorized Travel	4,508	3,955	4,085
Specialized Nonmotorized Sports & Activities	1,791	2,206	2,196
Swimming & Other Water Based Activities	870	883	950
Winter Nonmotorized Activities	1,349	1,364	1,450
Total	**184,429**	**184,514**	**200,567**

[1] Source: BLM, 2007b
[2] Years are measured in the fiscal range, October 1 through September 30.

Additionally, big game hunting (pronghorn, elk, moose, and mule deer) is a major recreational activity in the PAPA. WGFD manages harvest of big game by Hunt Areas, several of which may cover big game populations' herd units. WGFD has collected hunter and harvest data needed to compute recreation-days in each of the big game Hunt Areas that coincide with or are in the immediate vicinity of the PAPA (Table 3.8-2). In 2001, there were 27,747 recreation-days of hunting in these Hunt Areas. In 2006, fewer hunters spent less time hunting resulting in 21,967 recreation-days within the same Hunt Areas. Since 2002, there has been a general declining trend in hunter recreation-days devoted to big game harvest in the Hunt Areas surrounding the PAPA. The RMIS data for general hunting recreation days show a slight increase in recent years and cover the entire PFO Administrative Area, while the WGFD data are specific to Hunt Areas.

Various game bird species, including ducks, geese, mourning doves, and greater sage-grouse, are also hunted within the PAPA and vicinity. Wildlife viewing (e.g., mule deer on winter range) on the Mesa is another local recreational activity because it is readily accessible from Pinedale.

Table 3.8-2
Resident and Non-Resident Recreation-Days of
Hunting Big Game in the Vicinity of the PAPA from 2000 to 2006[1]

Hunter Category	2000	2001	2002	2003	2004	2005[2]	2006[2]
Antelope (Pronghorn) Hunt Areas 87 and 90:							
Residents	1,776	1,454	1,760	1,771	1,784	1,366	1,901
Non-Residents	795	681	649	545	830	917	1,249
Total	**2,571**	**2,135**	**2,409**	**2,316**	**2,614**	**2,283**	**3,150**
Mule Deer Hunt Areas 138, 139, 140:							
Residents	5,810	7,380	8,819	7,137	4,943	4,683	4,674
Non-Residents	908	137	1,498	1,308	852	1,071	758
Total	**6,718**	**7,517**	**10,317**	**8,445**	**5,795**	**5,754**	**5,432**

Hunter Category	2000	2001	2002	2003	2004	2005[2]	2006[2]
Elk Hunt Areas 96, 97, and 98:							
Residents	13,610	14,094	15,019	12,612	11,021	9,981	10,631
Non-Residents	2,991	3,801	3,676	1,305	2,886	3,220	2,626
Total	**16,601**	**17,895**	**18,695**	**13,917**	**13,907**	**13,201**	**13,257**
Moose Hunt Area 4:							
Residents	253	193	237	293	126	357	104
Non-Residents	29	7	31	336	33	17	25
Total	**282**	**200**	**268**	**629**	**159**	**374**	**129**
Total Net Economic Value of Hunting, Residents and Non-residents							
	$1,308,389	**$1,410,381**	**$1,575,935**	**$1,330,593**	**$1,090,314**	**$1,608,239**	**$1,634,656**

[1] Sources: WGFD 2000-2007 Annual Reports of Big and Trophy Game Harvest; BLM, 1988b; USDI et al., 2003.
[2] Estimates from Frost, 2007; Clause, 2007a, 2007b, and 2007c.

The USFWS collects state-level data on fishing, hunting, and wildlife-viewing every 5 years. The most recent surveys, in 1996, 2001, and 2006, were used to estimate the rate of change in recreation demand for Wyoming (Table 3.8-3). Days spent hunting and fishing in Wyoming have decreased over the past decade, while wildlife viewing activities have increased.

Table 3.8-3
Recreation-Days Spent Fishing, Hunting, and Wildlife Viewing in Wyoming for 1996, 2001, and 2006 [1,2]

Recreation Day Activity	Total Days 1996	Total Days 2001	Total Days 2006	Percent Change 1996-2006
Fishing	2,415,000	2, 497,000	1,743,000	27.8
Hunting	1,443,000	1,304,000	894,000	38.1
Nonresidential Wildlife Viewing Activities (away from home)	2,875,000	3,924,000	3,078,000	7.1

[1] Source: USFWS, 1998, 2003a and 2007a.
[2] For U.S. population 16 years old and older.

As noted, detailed recreation data specific to the PAPA does not exist.

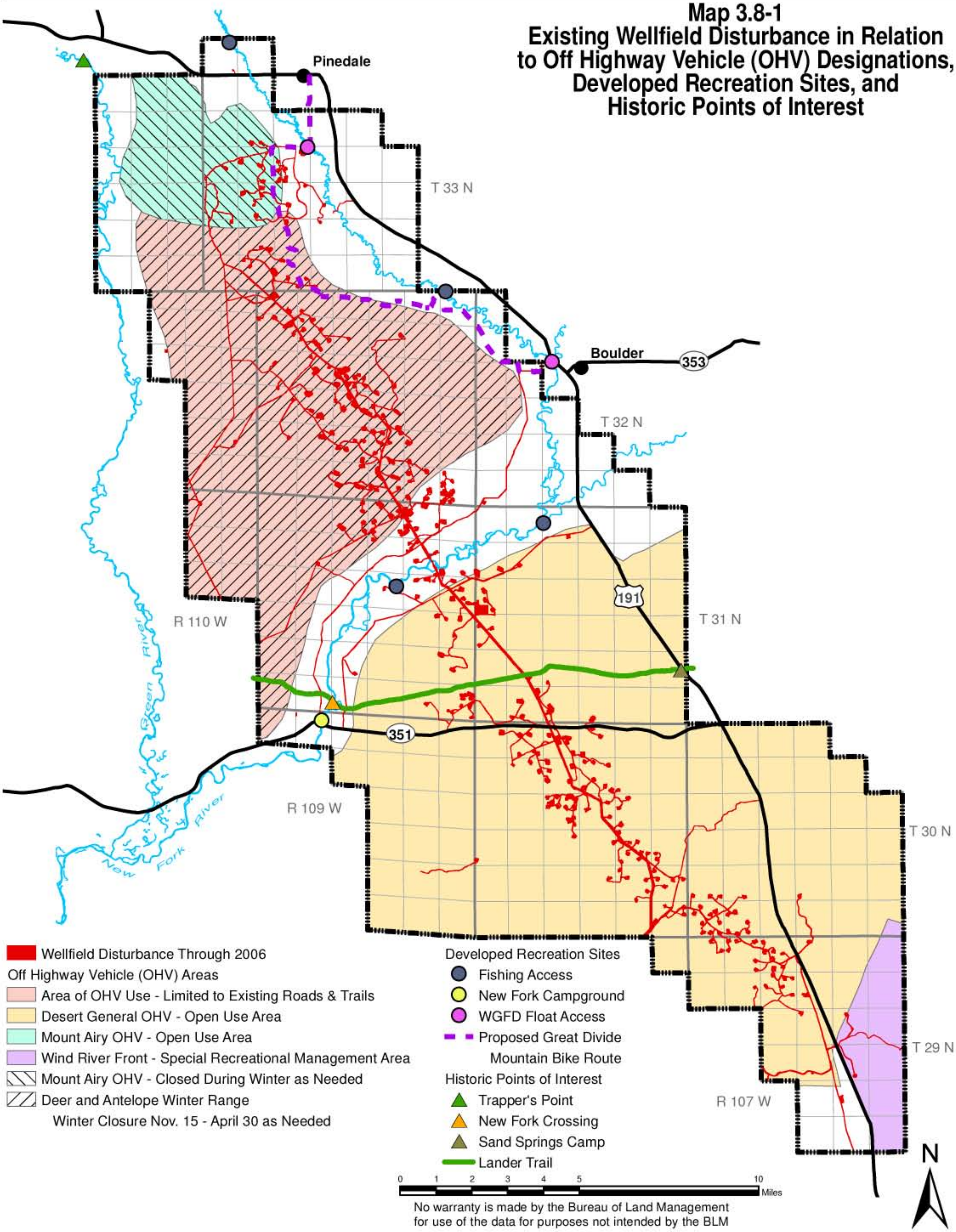
3.8.1.2 Recreation Sites and Facilities

There are several developed and undeveloped recreation facilities and sites located in the PAPA which are described in detail in the PAPA DEIS (BLM, 1999a). For most sites, the area within 0.25 miles of each is included in the Recreation SRMZ.

Adventure Cycling has proposed a route through the PAPA from Pinedale to Boulder which would be part of a 4,000 mile Great Divide Mountain Bike Route (Map 3.8-1). Currently, BLM has not authorized this route and it has been removed from Adventure Cycling's guide map and brochure. There is a network of bike trails in the PAPA, called the Mesa Mountain Bike Trail; however, BLM has not finalized the maps and brochures for these trails (Hudson, 2006).

Both the New Fork and Green rivers flow through the PAPA. The current Pinedale RMP (BLM, 1988b) requires that federal lands along these rivers be managed to provide fishing and floating opportunities. The WGFD's Basin Management Plans (WGFD, 2006a) include three stream segments on the New Fork River and one on the Green River that flow through the PAPA. On the New Fork River, from Green River to East Fork River, anglers find brown trout, rainbow trout, and some dwindling populations of Colorado River cutthroat. On the East Fork River to Pine Creek, anglers find brown trout and rainbow trout and on the Pine Creek to New Fork Lake

Map 3.8-1 Existing Wellfield Disturbance in Relation to Off Highway Vehicle (OHV) Designations, Developed Recreation Sites, and Historic Points of Interest



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segment, anglers find brown trout and brook trout. Locations for camping, fishing access, and boating access along the New Fork and Green rivers are included in Map 3.8-1.

Currently, river floaters and anglers drive through major development areas of the PAPA to public and private access areas on the New Fork River. River access points also have direct visual exposure to natural gas development, and indirect contact with construction by way of traffic and noise. On the river segment through the central part of the PAPA, floaters pass through areas where recreationists can see, smell, and hear development. Well pads, pipeline corridors, and roads are visible from these areas which also include VRM Class II and III viewsheds.

An area in the north end of the PAPA, near Mount Airy was identified by BLM as a possible OHV use area prior to 1999. Currently, it is not being managed as an open OHV area and it has had very little use for its intended purpose. It is anticipated that the forthcoming Pinedale RMP (due for release in 2008) will greatly reduce the size of the OHV area. An OHV plan was not officially developed for the Mount Airy site, and there has been no progress in its designation (Map 3.8-1). Its inclusion in this Final SEIS provides for consistency with the PAPA ROD.

The current Pinedale RMP restricts travel on the Mesa during the winter to protect mule deer and pronghorn on winter ranges (BLM, 1998a). Other travel is limited to existing roads and trails. Seasonal use restrictions could also apply to the Mount Airy OHV Area, if needed. The Pinedale RMP designated the area south of the New Fork River a general OHV open area, and it has been open year-round to OHV use (Map 3.8-1).

A 5,141-acre area of the southeastern part of the PAPA coincides with the Wind River Front Special Recreation Management Area (SRMA) which is managed by BLM's RSFO. The portion of the SRMA in the PAPA has been managed for dispersed recreation (camping, hunting, and fishing), with full consideration given to wildlife, cultural resources, vegetation, watershed values, and mineral development activity, as specified in BLM's Green River RMP (BLM, 1997). The entire western portion of this SRMA has been open to mineral leasing.

As of November 2006, there were approximately 32 acres of wellfield disturbance in the Wind River Front SRMA that coincides with the PAPA (Table 3.8-4). Most development has been south of the New Fork River, in the Desert General OHV Open Use Area. By November 2006, there were over 2,300 acres of wellfield disturbance in this Open Use Area, with an approximate disturbance of more than 4,100 acres of wellfield disturbance in all public recreation areas.

Table 3.8-4
Existing Wellfield Disturbance in Relation to Public Recreation and OHV-Designated Areas

Recreation Area	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Mount Airy OHV Area	9,202	172.4	21.6	194.0
OHV Areas Limited to Existing Roads, Trails	48,037	1,436.7	132.2	1,568.9
Desert General OHV Open Use Area	90,362	2,058.6	258.5	2,317.1
Wind River Front Special Recreation Management Area	5,141	30.4	1.1	31.5
Total	**152,742**	**3,698.1**	**413.4**	**4,111.5**

There are several recreation sites in the region funded in part by the Land and Water Conservation Fund (LWCF) and administered by the National Park Service. Four sites are located in Pinedale and one is in Marbleton. None of the LWCF projects have been adversely impacted by PAPA natural gas development (Moore, 2007).

3.8.2 Pipeline Corridors and Gas Sales Pipelines

BLM and U.S. Bureau of Reclamation lands that would be crossed by the proposed corridor/pipeline alignments support dispersed recreation including hiking, camping, mountain biking, fishing, river-running, sight-seeing, wildlife viewing, and hunting (Sweetwater County Joint Travel and Tourism Board, 2006). Specific destinations for recreational experiences near the proposed corridor/pipeline alignments include Fontenelle Reservoir, Seedskadee National Wildlife Refuge, and a network of historic trails.

Fontenelle Reservoir is located on the Green River 24 miles southeast of La Barge, Wyoming. The proposed OPC and Opal Loop III pipeline alignment is approximately 3.3 miles west of the Fontenelle Reservoir at its closest point. Recreation use is low volume and seasonal. Fontenelle Creek Campground has developed campsites with restrooms and running water. The creek enters the reservoir approximately 8 miles west of the OPC and Opal Loop III pipeline alignment. Three other campsites are located approximately 2 miles west of the alignment below the dam and are more primitive. Stream fishing opportunities exist on the Green River upstream and downstream from the reservoir (Sweetwater County Joint Travel and Tourism Board, 2006).

Seedskadee National Wildlife Refuge is located approximately 0.5 mile to the east of the proposed BFGC alignment along the Green River and is used by nonconsumptive recreationists (wildlife viewing). Hunters pursue numerous game species on the refuge, including pronghorn, mule deer, greater sage-grouse, and waterfowl. The Green River also offers world class trout fishing opportunities for anglers year round (Sweetwater County Joint Travel and Tourism Board, 2006). The network of historic trails in the area provides a unique recreational and historic experience for mountain bikers. The Oregon Trail, California Trail, Pony Express Trail, Mormon National Historic Trail, and the Overland Stage route are all suited to mountain biking (Sweetwater County Joint Travel and Tourism Board, 2006).

Each of the three proposed corridors and pipeline alignments crosses the Little Colorado Wild Horse Herd Management Area (HMA), which is managed by BLM's RSFO. The appropriate management level for this HMA is 100 horses. Spring and early summer are good times to watch wild horses when young foals are present (Sweetwater County Joint Travel and Tourism Board, 2006).

3.9 VISUAL RESOURCES

3.9.1 Scenic Views

The PAPA ROD (BLM, 2000b) describes the PAPA as one of "open space and solitude," with few roads and mainly void of human activity. The Mesa provides excellent views of all the mountain ranges in the area. Prior to 2000, natural gas development was limited and did not impact views across the Mesa, over the Green and New Fork river valleys, and stretching out to the Wind River and Wyoming mountain ranges. Visibility is an important component of the visual resource (Section 3.11, below).

Today the PAPA has the characteristics of a more urbanized setting. A trend is developing in which the public is becoming more sensitive to the scenic values of the area.

3.9.2 Visual Resources Management System

BLM manages visual resources in several VRM classes within the PFO Administrative Area. The PAPA contains three VRM classes; Class II, Class III, and Class IV. No lands in the PAPA are VRM Class I. These classes were developed under the Pinedale RMP (BLM, 1988b) and are subject to change under the forthcoming RMP ROD. All lands in the PAPA are rated for

VRM classification; however, only the BLM-administered public lands are managed within the VRM system. Regardless of the VRM classification, BLM policy is to mitigate impacts to visual resources where and when possible. The management objectives for each VRM class within the PAPA are described in the PAPA DEIS (BLM, 1999a) and reiterated, below:

- Class II – The objective of this class is to retain the existing character of the landscape. The level of change to the character of the landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
- Class III – The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
- Class IV – The objective of this class is to provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of the viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements found in the predominant natural features of the characteristic landscape.

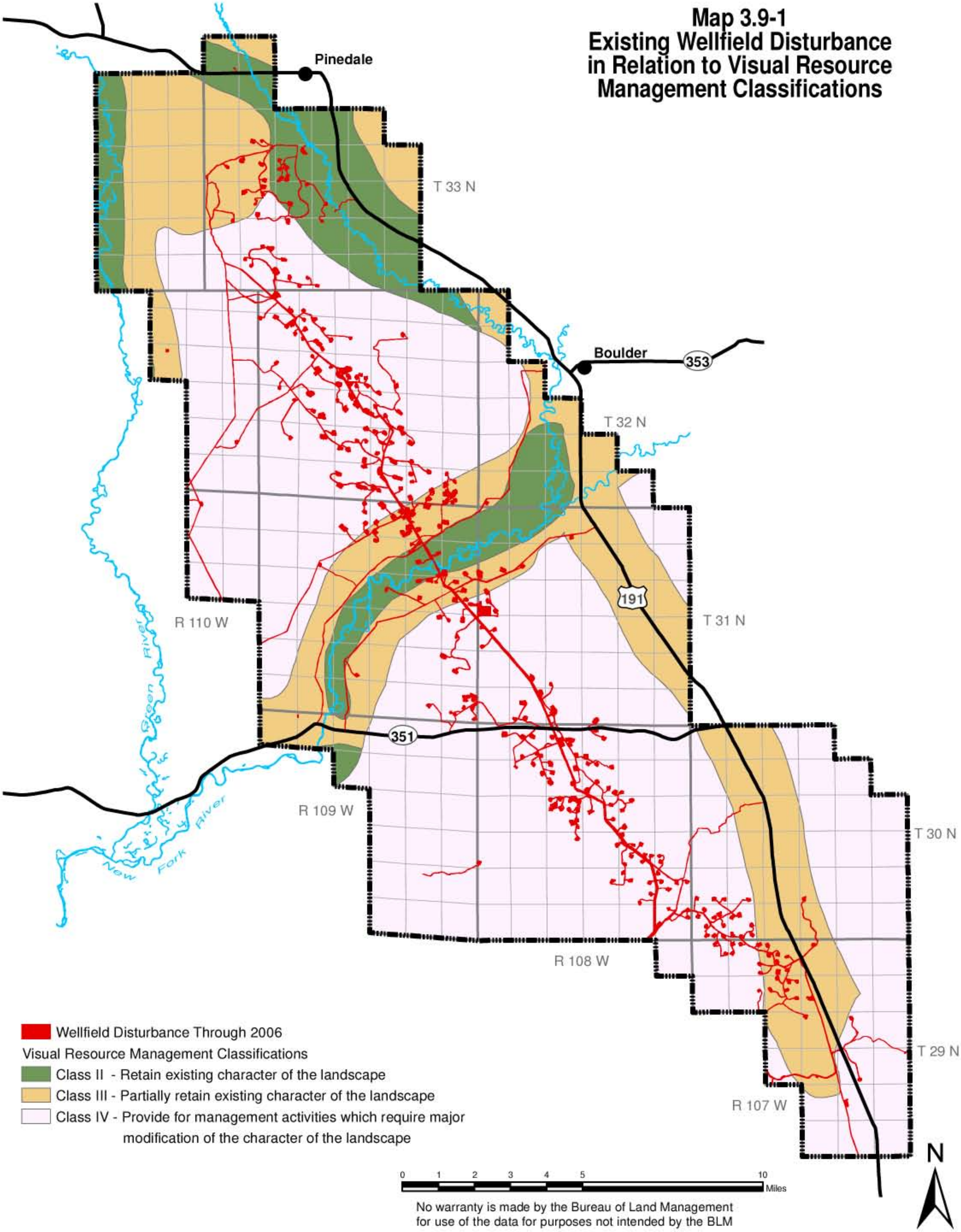
3.9.3 Natural Gas Development in the PAPA

The most extensive natural gas development in the PAPA has been in VRM Class IV, which incorporates 126,512 acres or about 64 percent of the PAPA (Map 3.9-1). As of November 2006, more than 3,400 acres in VRM Class IV had been disturbed by wellfield activities (Table 3.9-1). The least amount of wellfield disturbance is on lands in the VRM Class II designation, which accounts for a minor portion of federally-managed lands and minerals in the PAPA. These areas are located primarily along the river flood plains on private lands. Approximately 1 percent of the VRM Class II area has existing wellfield disturbance. The BLM has jurisdiction over approximately one-quarter (5,228.6 acres) of the lands classified VRM Class II. All VRM Class objectives require mitigation to the greatest extent practicable.

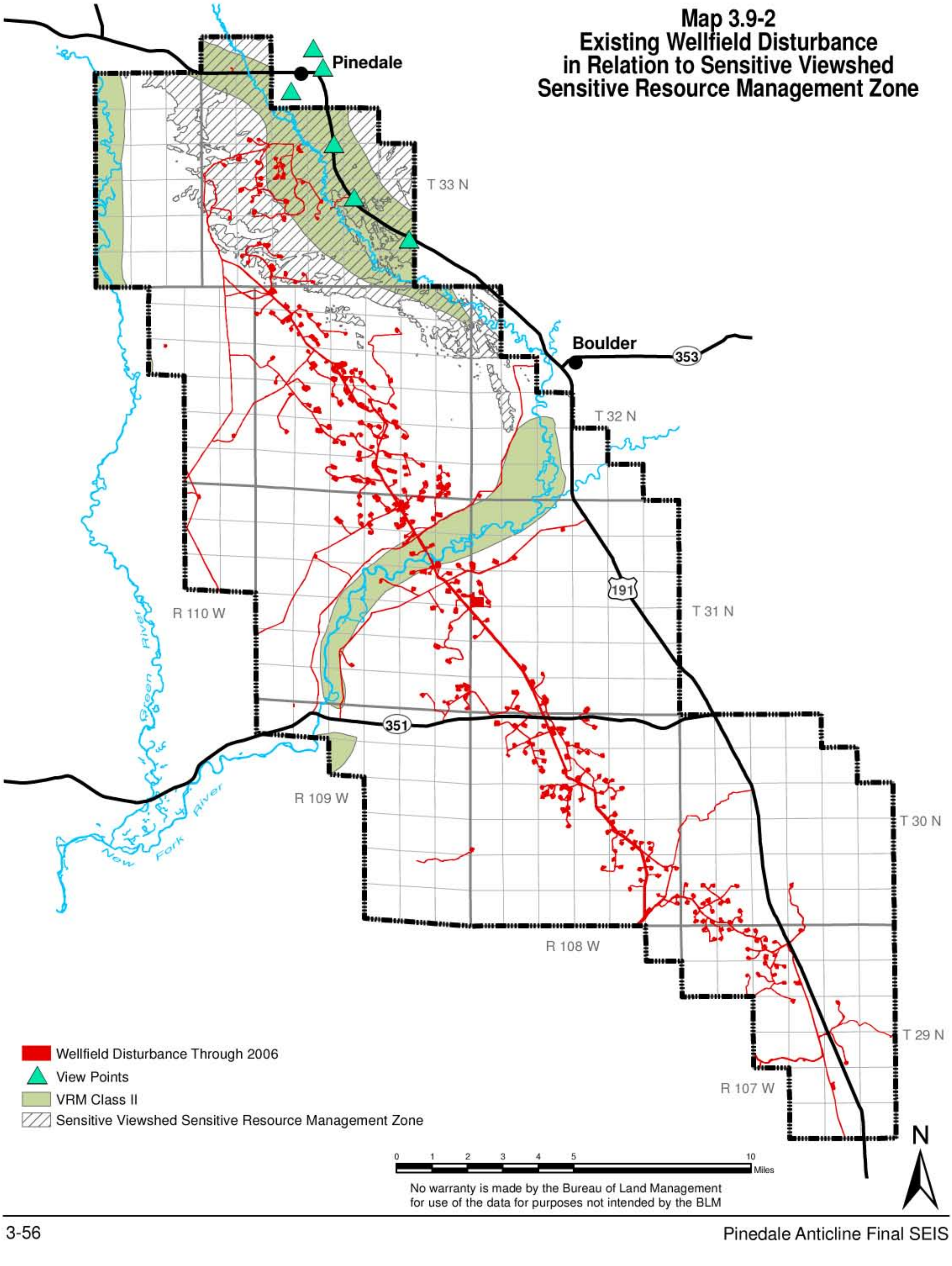
Table 3.9-1
Existing Wellfield Disturbance in Relation to Viewshed Classifications

Viewshed Class	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
VRM II	22,013	80.3	170.1	250.4
VRM III	49,512	979.8	121.8	1,101.6
VRM IV	126,512	3,080.8	401.8	3,482.6
Viewshed SRMZ	21,514	363.5	0.0	363.5

The PAPA DEIS (BLM, 1999a) established a Sensitive Viewshed SRMZ to address public concerns regarding the visual sensitivity of the portion of the PAPA visible from Pinedale and U.S. Highway 191 leading into town. Visual resource degradation in this area can impact tourism, residents, and overall economic conditions. The Sensitive Viewshed SRMZ was modeled to include areas visible from six viewpoints in and around Pinedale. Map 3.9-2 shows the SRMZ, which is visible when the six view points are combined together. The view point



Map 3.9-1
Existing Wellfield Disturbance in Relation to Visual Resource Management Classifications
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
Visual Resource Management Classifications
Class II - Retain existing character of the landscape
Class III - Partially retain existing character of the landscape
Class IV - Provide for management activities which require major modification of the character of the landscape
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM
N


Map 3.9-2
Existing Wellfield Disturbance
in Relation to Sensitive Viewshed
Sensitive Resource Management Zone
Pinedale
Boulder
353
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
191
351
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
View Points
VRM Class II
Sensitive Viewshed Sensitive Resource Management Zone
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

near the Mountain Man Museum in Pinedale was recently moved because housing development obstructs the view. The view point has been replaced with another in a location about 150 yards away.

A major portion of the Sensitive Viewshed SRMZ is classified as VRM Classes II and III and is located in the northern part of the PAPA. The SRMZ covers 21,514 acres (11,497.6 acres of federal land) in the PAPA (Table 3.9-1). As of November 2006, there were 363.5 acres of wellfield disturbance in the Sensitive Viewshed SRMZ.

MA 4 – *Sensitive Viewshed*, which is 8,686 federal acres of sensitive viewshed established in the PAPA ROD, incorporates portions of the Sensitive Viewshed SRMZ, the 'face of the Mesa', and VRM Classes II and III along the Green and New Fork rivers. The management objective of MA 4 is to retain the existing character of the landscape, where management activities may be seen but should not attract the attention of the casual observer. As part of the ongoing case-by-case visual resource analysis and mitigation, BLM can require Operators to develop Visual Resource Protection Plans in some areas of MA 4, including near Pinedale and along the New Fork River (Hudson, 2007).

Drilling rigs and heavy trucks are now common daily sights in the PAPA, especially for travelers on Paradise Road and State Highway 351. Throughout the PAPA, well pads, roads, and utility corridors can cause a high degree of visual contrast depending upon the casual observer's viewing variables such as topography, distance, light conditions, angle of observation, and length of time viewed.

3.9.4 Pipeline Corridors and Gas Sales Pipelines

The proposed corridor/pipeline alignments cross three VRM sensitivity classes (Classes II, III, and IV) and are adjacent to existing rights-of-way for pipelines, roads, or other linear features for most of the proposed lengths.

VRM Class II areas that would be crossed by the proposed corridor/pipeline alignments are associated with the Green and New Fork rivers, their valleys/flood plains, and adjacent uplands on either side of the rivers. VRM Class III areas that would be crossed are adjacent to the Class II area along the Green River and north and south of the New Fork River. VRM Class IV areas occupy the remainder of lands crossed by the proposed corridor/pipeline alignments.

3.10 CULTURAL AND HISTORIC RESOURCES

3.10.1 Natural Gas Development in the PAPA

The BLM manages cultural resources on public lands in accordance with the Antiquities Act of 1906, the National Historic Preservation Act of 1966, the Native American Graves Protection and Repatriation Act, the Archaeological Resources Protection Act of 1979, and various other codes and Executive Orders. The BLM's management process is governed by the requirements of the State Protocol Agreement between the BLM and the Wyoming State Historic Preservation Office (SHPO), which was revised in 2006 (Appendix 14). Specifically, BLM management in the PAPA focuses on identifying and protecting cultural and historical sites, as well as resolving conflicts between cultural/historic resources and other resource uses (BLM, 1988b and 1999a). An overview of cultural and historic resources and site types found in the PAPA were described in the PAPA DEIS (BLM, 1999a) and the Cultural Technical Report, appended to the PAPA DEIS.

Sites are categorized according to type of cultural resources identified in a particular survey area. In the PAPA, site types include (but are not limited to) prehistoric campsites, house pits, human burial sites, lithic procurement sites, rock alignment sites (e.g. tipi rings, medicine wheels, and cairns), the Lander Trail (which is part of the National Historic Trail System), pioneer settlements, early Euroamerican homesteading remains, stock maintenance sites, and townsites (BLM, 1999a). Sites are also described as prehistoric archaeological sites and landscapes, ethno-historic sites and landscapes, historic sites and landscapes, and historic trails (BLM, 2003b). Prehistoric sites most likely to be discovered in the PAPA will probably be related to prehistoric and historic Native American hunting and seasonal activities.

The Trappers Point area north of the PAPA is known for its rich archeological sites and is a critical stock sorting area for “The Green River Stock Drift,” a century-old seasonal stock driveway considered part of a potential Sublette County Rural Ranching Traditional Cultural Property and a potential Rural Historic Landscape. Terraces of the New Fork River and the Blue Rim Area carry significant site potential (those eligible for inclusion in the National Register of Historic Places - NRHP). Rock alignment sites are concentrated around the edges of the Mesa (Crume, 2006). Other historical resources in the PAPA include pioneer settlements such as the New Fork Townsite which is listed on the NRHP, the James Bertram Homestead, and the C.B. Faler Ranch. These sites are located on the perimeter of the PAPA, away from the Anticline Crest where most of the natural gas development has occurred. In the PAPA and intersecting the Anticline Crest are historic pioneer trails and travel routes including the New Fork Wagon Road, Lander Cut-off of the California National Historic Trail (Lander Trail), and a wagon road from Big Piney to New Fork (BLM, 1999a).

Other historic sites in the PAPA and vicinity are associated with the early fur trade, the frontier military, railroads, the mining industry, ranching, and early oil and gas development (BLM, 1997). Approximately 75 percent of the sites found in the Green River Basin are prehistoric. Prehistoric cultural materials found at these sites include stone tools, projectile points, metates (grinding slabs), and ceramics. Archeological features frequently found include individual fire hearths, hearth clusters, and an abundance of Archaic Period (8,000 to 2,000 years ago) house pits (BLM, 1997 and Vlcek, 2006). The New Fork House Pit site contains several 6,000-year old house structures with what has been preliminarily interpreted as a structure utilized for smoking meat. This site was discovered during construction of the gas sales pipeline authorized by the PAPA ROD (BLM, 2000b).

In the PAPA DEIS (BLM, 1999a), several archeological sites eligible for the NRHP were documented along the Anticline Crest and later subjected to pipeline construction after mitigative excavations. Since the issuance of the PAPA ROD (BLM, 2000b), numerous significant sites (those eligible for inclusion in the NRHP) have been identified. During excavation of a well pad near the northern end of the Mesa, a site was discovered yielding a particularly dense concentration of prehistoric features. Salvage excavations during well pad construction recovered over 70 hearths, hearth remains, and other buried archeological materials within a 5-acre study plot. In the same vicinity, expansion of a well pad in 2006 yielded archeological discoveries as well as a unique rock alignment that required a specific management strategy.

Folsom sites are among the oldest prehistoric occupations known in North America. During 2006, a Folsom projectile point estimated to be 11,500 years old was discovered at a proposed well pad site in the southeastern portion of the PAPA; however, construction of the proposed well pad was cancelled due to the probability of a dry hole. Further, wellfield development has been proposed near a natural feature considered sensitive to modern Native Americans on the southern end of the PAPA. That proposal has required ongoing Native American consultations.

3.10.1.1 Native American Concerns

Several recognized Native American Tribal groups, including the Shoshone, Bannock, Ute, Crow, Arapahoe, and Blackfoot, as well as prehistoric peoples, frequently used the lands within and surrounding the PAPA (BLM, 1999a). Within the PAPA, BLM has identified several dozen sacred sites, sites important or considered sensitive to modern day Native Americans, as well as formally recognized Traditional Cultural Properties. There is a high potential for the discovery of sacred sites and sites of interest to modern Native Americans. These will likely be rock alignments, burials, traditional use areas, and areas or locales that are identified during Native American consultation.

BLM engages in ongoing proactive consultation with affected Native Americans, in particular the Eastern Band of the Shoshone, concerning the identification and management of cultural resources (BLM, 1999a and 2003a). In 2004, consultation with the Shoshone Tribe resulted in a set of tribal guidelines for buffer zones for development near Native American sites. These guidelines, dictated from tribal elder Richard Ferris, Sr., are frequently used by BLM but stand as non-binding recommendations:

For seismic activity:

simple cairns that are stable and embedded in the soil: 300 feet is sufficient to protect these sites;

standing cairns: distance for protection will be decided upon on a case-by-case basis;

medicine wheels: case-by-case basis, 0.25 mile should be considered standard;

rock art: 0.25 mile minimum;

human burials and burial areas: 1 mile minimum, no exceptions;

fire pots: 300 feet;

receiver lines – rock art: 300 feet avoidance; and

receiver lines – complex cairns: can be laid carefully through sites, monitoring may be needed; no OHV use is permitted – foot traffic only.

For construction (well pads, roads, pipelines, etc.):

simple cairns that are stable and embedded in the soil: 0.25 mile;

standing cairns: 0.25 mile;

medicine wheels: 0.25 mile;

rock art: 0.25 mile;

human burials and burial areas: 1 mile minimum, no exceptions; and

fire pots: 0.25 mile.

For powerlines:

simple cairns that are stable and embedded in the soil: 300 feet or follow road if possible;

standing cairns: 300 feet or follow road if possible;

medicine wheels: 0.25 mile;

rock art: 0.25 mile;

human burials and burial areas: 1 mile minimum, no exceptions; and

fire pots: 300 feet.

General:

All other Tribal interests or sites and projects that are of concern to the Tribal interests can be considered on a case-by-case basis, by consultation. The Shoshone rely upon information provided to them by the BLM to determine sensitive sites, practicalities, and general project information. The Tribal recommendation is a visual inspection (on-site examination) for anything considered sensitive, not mentioned in the above guidelines. If a guideline as presented above proves not to be workable, individual consultation will be needed (Ferris, 2004).

Approximately 527 sites had been inventoried on over 5,320 acres in the PAPA prior to December 2005, and many additional sites have been inventoried since then (Vlcek, 2006 and Crume, 2006). Class III inventories were used during the investigations and are the current BLM standard. A Class III inventory is defined as a cultural resources inventory when 100 percent of the surface within the study area is surveyed using pedestrian inventory methods. It is likely that the PAPA contains many more cultural resources than those inventoried to date.

3.10.1.2 Unexpected Discoveries

Construction of access roads, well pads, pipelines, and other surface disturbances can produce unexpected cultural resource discoveries. During the first 5 years since issuance of the PAPA ROD (BLM, 2000b), there were 38 unexpected discoveries in the PAPA. Well pad and access road construction accounted for 23 discoveries, while pipeline construction resulted in 14. Some of these discoveries have been discussed in other parts of this section. Powerline construction resulted in one unexpected find (Crume, 2006). Unintentional damage occurs when development projects unexpectedly discover buried sites in sensitive archeological areas (BLM, 2003b).

3.10.1.3 Major Finds

During the first course of wellfield development in the PAPA, one especially sensitive archeological zone was revealed in the sandy bluffs on the south side of the New Fork River. Several discoveries in the sensitive zone were initially impacted by construction of well pads and other wellfield components. Sites found on the sandy bluffs overlooking the New Fork River have yielded abundant large mammal bones, lithic materials, and numerous features (firepits and component staining) indicative of prehistoric hunting and camping patterns. The extensive presence of the faunal materials suggests prehistoric exploitation of large game seasonal migrations in the area. Radio carbon dating of remains has documented use of the sandy bluffs during 5,000 to 7,000 years ago. A similar pattern of seasonal exploitation of large migratory game has been documented at the Trappers Point site (north of the PAPA) where a 6,000-year old pronghorn kill site has been excavated, a springtime exploitation coinciding with the seasonal movements of large game from Trappers Point to the New Fork River crossing.

The Mesa Breaks area is also an important sensitive location. A complicated, extensive discovery (over 70 features) was made on the SP 5-17 location. The SP 9-17 location had multiple discoveries, and also contains a rock alignment. In 2006, investigations ancillary to SP 3-28 and 7-28 locations (among others) identified complex archaeology, sensitive soils, and other cultural resources concerns (Vlcek, 2007).

3.10.1.4 Lander Trail SRMZ

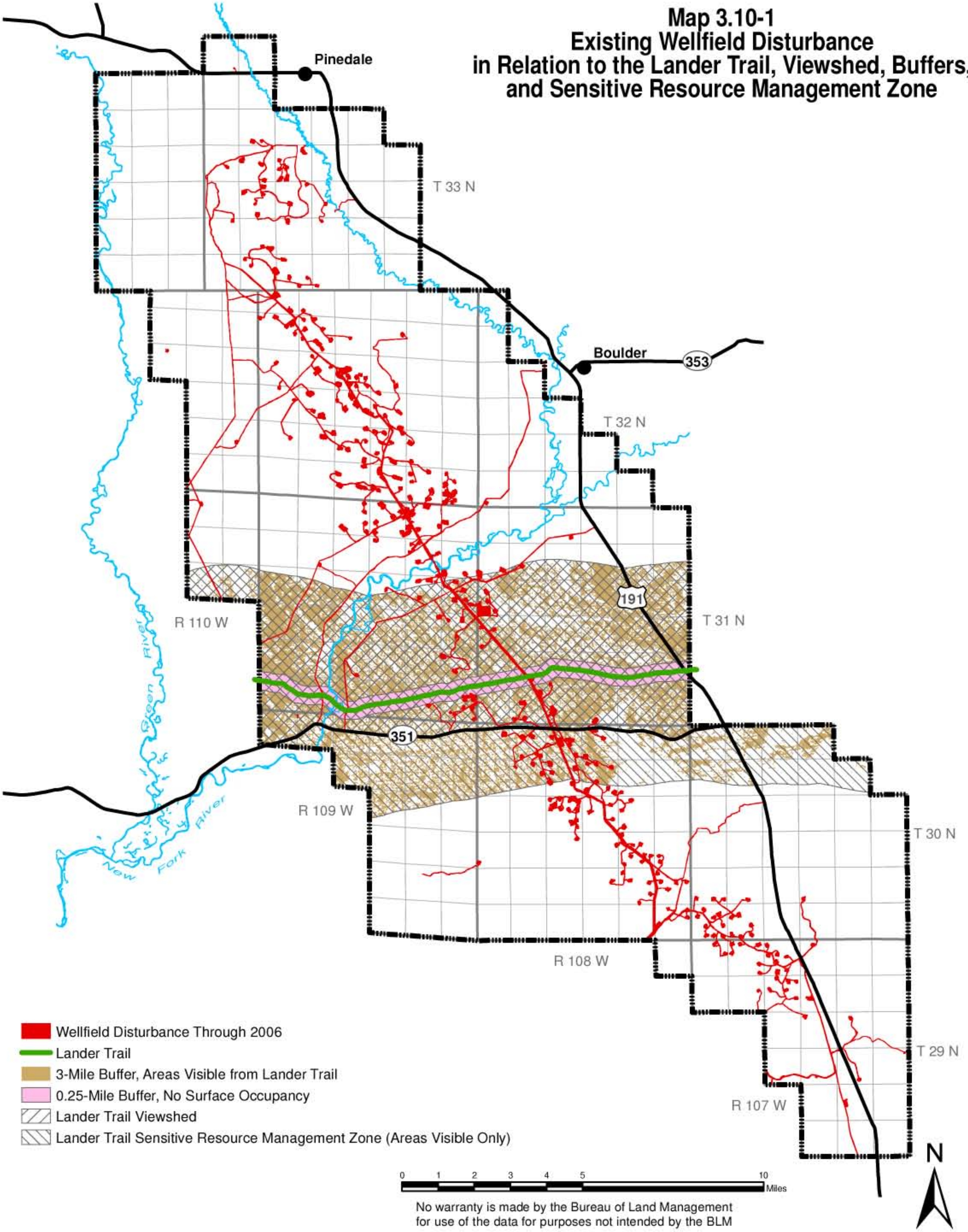
The Lander Trail Cut Off is eligible for National Register listing and is designated by Congress to be part of the California National Historic Trail System. The PAPA ROD (BLM, 2000b) established a 0.25-mile No Surface Occupancy zone from the Lander Trail within which BLM could prohibit construction activities on federally-administered public lands unless such disturbance would not be visible from the trail or would occur in an existing visual intrusion area (Map 3.10-1). This is consistent with the Pinedale RMP (BLM, 1988b) which authorized no surface disturbance to be allowed within 0.25 mile or the visual horizon (whichever is closer) of contributing segments of the historic trails. In the PAPA DEIS (BLM, 1999a), the 0.25-mile buffer and the viewshed (up to a distance of 3 miles on each side of the trail) of the Lander Trail were defined as the Lander Trail SRMZ, in which intrusions visible from approximately 3 miles of the trail's centerline could adversely affect its visual setting (Map 3.10-1). As originally conceived in the PAPA DEIS (BLM, 1999a), the Lander Trail SRMZ (Map 3.10-1) occupies approximately 22,900 acres or 12 percent of the PAPA (Table 3.10-1).

Table 3.10-1
Existing Wellfield Disturbance in Relation to the Lander Trail 0.25-Mile Buffer, SMRZ, and Viewshed

Lander Trail SRMZ Category	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Lander Trail 0.25-mile Buffer	3,978	41.2	8.6	49.8
Lander Trail SRMZ (PAPA DEIS)	22,893	412.6	43.2	455.8
Lander Trail Viewshed (PAPA ROD)	18,105	300.5	43.2	343.7

The concept of the Lander Trail SRMZ and Lander Trail viewshed were modified in the PAPA FEIS (BLM, 2000a) and PAPA ROD (BLM, 2000b) as both were incorporated into MA 1 for which the management objective is to preserve the integrity of the Lander Trail and Lander Trail Viewshed. The Lander Trail Viewshed was redefined in the PAPA ROD to include areas beyond the 0.25-mile protective buffer that would be visible up to 3 miles north of the trail and south of the trail to State Highway 351 (Map 3.10-1). To achieve this objective, BLM would require case-by-case visibility analyses to minimize visual intrusions by wellfield development to the greatest extent practicable. To that end, a pilot project was initiated in 2003 that identified ten Key Observation Points (KOPs) along 8 miles of the trail. In 2005, BLM and SHPO worked under an "Assistance Agreement" for the Lander Trail Viewshed Monitoring Project, budgeted through 2006, to include photography from each KOP. The photography was intended for future display and used to evaluate approaches to conceal wellfield developments (Vlcek, 2006 and Trautman, 2006).

As of November 2006, 455.8 acres had been disturbed within the Lander Trail SRMZ (defined in the PAPA DEIS) of which 49.8 acres were within the 0.25-mile buffer of the Lander Trail (Table 3.10-1). The disturbance includes well pads, roads (upgrading three collector roads: the Paradise Road, Boulder South Road, and Middle Crest Road), and pipelines. Through November 2006, 343.7 acres had been disturbed by wellfield activities within the Lander Trail Viewshed (defined in the PAPA ROD). Although the Lander Trail setting and viewshed have been compromised by these surface disturbances, intact portions of the trail are found immediately adjacent to the disturbances. In spring 2006, Nielson (formerly Petrogulf) constructed a well pad approximately 950 feet from the trail, altering characteristics of the trail on State of Wyoming land in Section 36, T. 31 N., R. 109 W. (Vlcek, 2006).


Map 3.10-1
Existing Wellfield Disturbance
in Relation to the Lander Trail, Viewshed, Buffers,
and Sensitive Resource Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
Lander Trail
3-Mile Buffer, Areas Visible from Lander Trail
0.25-Mile Buffer, No Surface Occupancy
Lander Trail Viewshed
Lander Trail Sensitive Resource Management Zone (Areas Visible Only)
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

3.10.1.5 Programmatic Agreements

A segment of the Lander Trail is currently managed under a PA between the BLM, the Wyoming SHPO, the Advisory Council on Historic Preservation, the Oregon California Trails Association (OCTA), Shell, and Ultra, to mitigate proposed impacts to the Lander Trail's setting, and to the extent possible, maintain the integrity of the trail (Appendix 15). Other parts of the PA require public education exhibits for the trail. These elements are currently being developed (Vlcek, 2006). The PA does not include other Operators who are developing near the Lander Trail and they are responsible for creating their individual mitigation or management plans.

The PAPA DEIS (BLM, 1999a) included the outline for a Jonah Field-Anticline-wide PA which was signed by the original PAPA Operators and resource management agencies. The PA required synthesis of archaeological data, development of a cultural resource management plan, and development of a treatment/mitigation plan for cultural resources in the PAPA, within 1 year of the signing of the PA and established deadlines for these documents. For various reasons, the Operators did not meet the deadlines set forth in the PA and it expired automatically (Vlcek, 2006).

In 2005, the Cultural/Historic Task Group of the PAWG researched the PAPA DEIS PA to assess the possibility of creating a new general PA for the PAPA. In cooperation with the BLM, the Task Group found that the revised Wyoming Protocol Agreement (Appendix 14), a document that describes how the Wyoming SHPO and the BLM will consult on cultural resource management (though not specific to the PAPA), was sufficient to protect resources in the PAPA. The Task Group determined that the Wyoming Protocol Agreement streamlines archeological resource management, but that a Memoranda of Agreement might be useful for continuing development of PAPA leaseholds (Vlcek, 2007).

Because there are several Operators in the PAPA, obtaining consensus on how to manage the extremely varied cultural resources has proven difficult (Vlcek, 2006). Further, the different geographic settings within the PAPA contain substantially different types of cultural resources. For example, the northern end of the Mesa and sensitive soils in the Mesa Breaks, which are identified in the PAPA DEIS, contain numerous Native American sites (BLM, 1999a). Cultural resources discovered near the New Fork River have been discussed, above. Leaseholds within the Blue Rim Area contain archeological and paleontological materials (Section 3.14, below). The south end of the PAPA is an area of complex archeological discoveries such as the New Fork House Pit site (48SU5084).

3.10.2 Pipeline Corridors and Gas Sales Pipelines

3.10.2.1 Cultural History Overview

Cultural resources in the areas crossed by the proposed corridor/pipeline alignments consist of sites from prehistoric and historic periods. The prehistoric period extends from approximately 12,000 years before present through 350 years before present, when Europeans began to arrive in the Green River Basin. Approximately 75 percent of the sites found in the Green River Basin are prehistoric. Artifacts from prehistoric times include projectile points, grinding slabs, pottery, and evidence of camp sites (BLM, 1997).

Historic trails to be crossed by the proposed corridor/pipeline alignments include the Oregon Trail, the Oregon Trail/Pony Express Route, the East Bank Kinney Cutoff, the Baker-Davis Road/Slate Creek Cutoff, the Sublette Cutoff, the Lander Cutoff, and the Opal Wagon Road.

3.10.2.2 Cultural Resource Inventory

Past and ongoing cultural resource inventories provide information on cultural resources present within the BCC, BFGC, and OPC (Stainbrook, 2006). Class I and III inventories for portions of the proposed BCC, BFGC, and OPC and adjacent lands, have been completed or are ongoing. The field survey of the RVII Pipeline is near completion. Eligibility testing for nomination to the NRHP has been initiated. Survey and testing of sites in temporary use areas is planned. The archaeological landscape, a secondary lithic procurement site, is documented along the proposed corridor/pipeline alignments. The landscape is not eligible for listing in NRHP.

Previously identified sites between the Pinedale/Gobblers Knob and Paradise compressor stations and the Bird Canyon Compressor Station include 17 not eligible, 10 eligible, and six unevaluated prehistoric camps; seven not eligible and four unevaluated lithic scatters, one not eligible historic road, one eligible prehistoric camp historic debris scatter, and one unevaluated lithic and historic debris scatter. Also documented is the Lander Cutoff of the Oregon Trail.

Previously identified sites located between the Bird Canyon Compressor Station and the Blacks Fork Processing Plant include one railroad, 17 eligible and 37 not eligible prehistoric camps, four not eligible prehistoric archaeological landscapes, one not eligible lithic scatter, and one not eligible can scatter. Not included in the above total are five ineligible prehistoric camps destroyed by past construction. Additionally, the Sevenmile Gulch Site (48SW1673) contains prehistoric housepits that were previously discovered in the corridor and are the subject of data recovery excavations. Similar highly significant housepits are likely to be impacted by future pipelines proposed in this corridor and would require mitigation through data recovery excavations. Also documented are the Oregon Trail, the Pony Express, the East Bank Kinney Cutoff, the Baker-Davis Road/Slate Creek Cutoff, and the Sublette Cutoff of the Oregon Trail.

Previously identified sites located between the Bird Canyon Compressor Station and Opal Gas Processing Plant include three eligible historic trails (Baker-Davis Road/Slate Creek Cutoff, the East Bank Kinney Cutoff, and the Sublette Cutoff), the non-contributing segments of the eligible Opal Wagon Road, one not eligible river crossing, one not eligible historic debris scatter, eight eligible and 32 not eligible prehistoric camps, three not eligible prehistoric camps with historic debris, six not eligible lithic scatters, and one not eligible lithic and historic debris scatter. Eight not eligible sites have been destroyed, including seven not eligible prehistoric camps and one not eligible cairn.

Additional field work conducted beyond the initial Class III survey would include staging areas located outside the pipeline survey and testing for eligibility for nomination to the NRHP. Not included in the above total are 15 not eligible prehistoric camps, five lithic scatters, and one historic debris site destroyed by past construction.

3.10.2.3 Native American Concerns

Native American tribes, including the Ute, Arapahoe, Shoshone, and Shoshone-Bannock, have had tribal territories located in the general area of the proposed corridor/pipeline alignments.

3.11 AIR QUALITY

3.11.1 Air Quality Monitoring Data

The affected environment described below for air quality includes a large portion of southwest Wyoming and surrounding areas. The discussion below is for proposed development within the PAPA and for the proposed construction of the natural gas pipelines.

3.11.1.1 Greenhouse Gases

Carbon dioxide (CO_2) and methane (CH_4) are typically emitted from combustion activities or are directly emitted into the atmosphere. On-going scientific research has identified the potential impacts of greenhouse gas emissions (including CO_2; CH_4; nitrous oxide (N_2O), water vapor; and several trace gasses) on global climate. Through complex interactions on at regional and global scales, these greenhouse gas emissions cause a net warming effect of the atmosphere (which making makes surface temperatures suitable for life on Earth), primarily by decreasing the amount of heat energy radiated by the Earth back into space. Although greenhouse gas levels have varied for millennia (along with corresponding variations in climatic conditions), recent industrialization and burning of fossil carbon sources have caused CO_2 concentrations to increase dramatically, and are likely to contribute to overall climatic changes, typically referred to as global warming. Increasing CO_2 concentrations also lead to preferential fertilization and growth of specific plant species.

Global mean surface temperatures have increased nearly 1.0°C (1.8°F) from 1890 to 2006 (Goddard Institute for Space Studies, 2007). However, observations and predictive models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Data indicates that northern latitudes (above 24° N) have exhibited temperature increases of nearly 1.2°C (2.1°F) since 1900, with nearly a 1.0°C (1.8°F) increase since 1970 alone. It also shows temperature and precipitation trends for the conterminous United States. For both parameters we see varying rates of change, but overall increases in both temperature and precipitation. Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of greenhouse gases are likely to accelerate the rate of climate change.

In 2001, the Intergovernmental Panel on Climate Change indicated that by the year 2100, global average surface temperatures would increase 1.4 to 5.8°C (2.5 to 10.4°F) above 1990 levels. The National Academy of Sciences (2006) has confirmed these findings, but also indicated that there are uncertainties regarding how climate change may affect different regions. Computer model predictions forecasts indicate that increases in temperature will not be evenly or 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 is more likely than increases in daily maximum temperatures.

Currently, the WDEQ-AQD does not have regulations regarding greenhouse gas emissions, although these emissions are regulated indirectly by various other regulations for other pollutants.

3.11.1.2 Criteria Pollutants, Ambient Air Quality Standards, and PSD Increments

The Wyoming Ambient Air Quality Standards (WAAQS) and National Ambient Air Quality Standards (NAAQS) are health-based standards for the maximum concentration of air pollutants at all locations to which the public has access. Although specific air quality monitoring has not been conducted for the PAPA, air quality monitoring for the regional pollutants of concern has been determined to be representative of the PAPA. Measured air pollutants for which ambient air quality standards exist include carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than 10 microns in effective diameter (PM_{10}), particulate matter less than 2.5 microns in effective diameter ($PM_{2.5}$), and sulfur dioxide (SO_2). Monitored concentrations for these pollutants are compared to the WAAQS and NAAQS in Table 3.11-1. The PAPA is designated as attainment for all criteria pollutants.

Table 3.11-1
Air Pollutant Background Concentrations and
Wyoming and National Ambient Air Quality Standards ($\mu g/m^3$)

Pollutant	Monitoring Site	Averaging Time	Measured Background Concentration	Wyoming and National Ambient Air Quality Standards
Carbon monoxide (CO)	Yellowstone National Park[1]	1-hour	1,979	40,000
		8-hour	931	10,000
Nitrogen dioxide (NO_2)	Jonah Field [2] Boulder [3] Daniel [4]	Annual	19 [5] 8 [6] 6 [7]	100
Ozone (O_3)	Jonah Field [2] Boulder [3] Daniel [4]	8-hour [8]	139 [9] 143 [9] 135 [9]	148 [10, 11]
Particulate matter (PM_{10})	Jonah Field [2] Boulder [3] Daniel [4]	24-hour [12]	51 [5] 32 [6] 23 [7]	150
	Jonah Field [2] Boulder [3] Daniel [4]	Annual	10 [5] 9 [6] 9 [7]	50 (WAAQS)
Particulate matter ($PM_{2.5}$)	Pinedale [13]	24-hour [12]	15	35 (NAAQS)[14] 65 (WAAQS)[15]
		Annual	6	15
Sulfur dioxide (SO_2)	Craven Creek [16]	3-hour	132	1,300
		24-hour	43	365 (NAAQS) 260 (WAAQS)
		Annual	9	80 (NAAQS) 60 (WAAQS)

[1] Background data collected during 2005 in Yellowstone National Park, Wyoming, monitoring site near "Old Faithful." Monitoring site began operation during December 2002.
[2] Background data collected in the Jonah Field, approximately 40 miles northwest of Farson, Sublette County, Wyoming. Monitoring site began operation during November 2004.
[3] Background data collected approximately 5 miles southwest of Boulder, Sublette County, Wyoming. Monitoring site began operation during January 2005.
[4] Background data collected approximately 5 miles south of Daniel, Sublette County, Wyoming off Hwy. 18. Monitoring site began operation during July 2005.
[5] Values are based on a partial year of data (Jan 15, 2005 through Dec 31, 2005).
[6] Values are based on 1 year of data (April 2005 through March 2006).
[7] Values are based on 1 year of data (July 2005 through June 2006).
[8] Highest, fourth highest monitored value.
[9] Values are the 2 year average of the yearly fourth highest monitored 8-hour values collected during 2005, 2006, and 2007.
[10] Ambient Air Quality Standard is based on the 3 year average of the yearly fourth highest 8-hour concentrations. An area is in compliance with the standard if the fourth highest 8-hour ozone concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.
[11] EPA has revised the NAAQS effective May 27, 2008 from 157 ug/m^3 to 148 ug/m^3. The State of Wyoming will enter into rulemaking to revise the WAAQS.
[12] Highest, 98th percentile monitored value.
[13] Background data collected in Pinedale, Wyoming. Values are based on 1 year of data collected during July 2005 through June 2006. Monitoring site began operation in July 2005.
[14] Revised NAAQS effective December 18, 2006. An area is in compliance with the standard if the 98th percentile of 24-hour $PM_{2.5}$ concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.
[15] EPA has revised the NAAQS effective December 18, 2006. The State of Wyoming will enter into rulemaking to revise the WAAQS.
[16] Background data collected at the LaBarge Study Area/Northwest Pipeline Craven Creek site which operated during 1982-1983.

Criteria pollutants have been monitored at several sites in Sublette County adjacent to the PAPA. The locations are within the Jonah Field, at the eastern edge of the PAPA near Boulder, and southwest of Pinedale near Daniel. The Boulder site has been in operation since January 2005, the Jonah Field site began operation in November 2004, and the Daniel site began operation in July 2005. The locations of these sites in relation to the PAPA are illustrated in Map 3.11-1. Background concentrations are used as an indicator of existing conditions in the region, and are assumed to include emissions from industrial sources in operation and from mobile, urban, biogenic, and other non-industrial emission sources. The Boulder site, which is at the eastern edge of the PAPA, is considered by the WDEQ-AQD as most representative of background conditions within the PAPA. The monitoring data available for all three Sublette County sites are provided in Table 3.11-1. The data collected at the Jonah Field and Daniel sites are provided for reference purposes. Monitored background values are in compliance with ambient air quality standards (Table 3.11-1), although concentrations equal to the level of the 8-hour ozone standard have been measured at the three Sublette County sites.

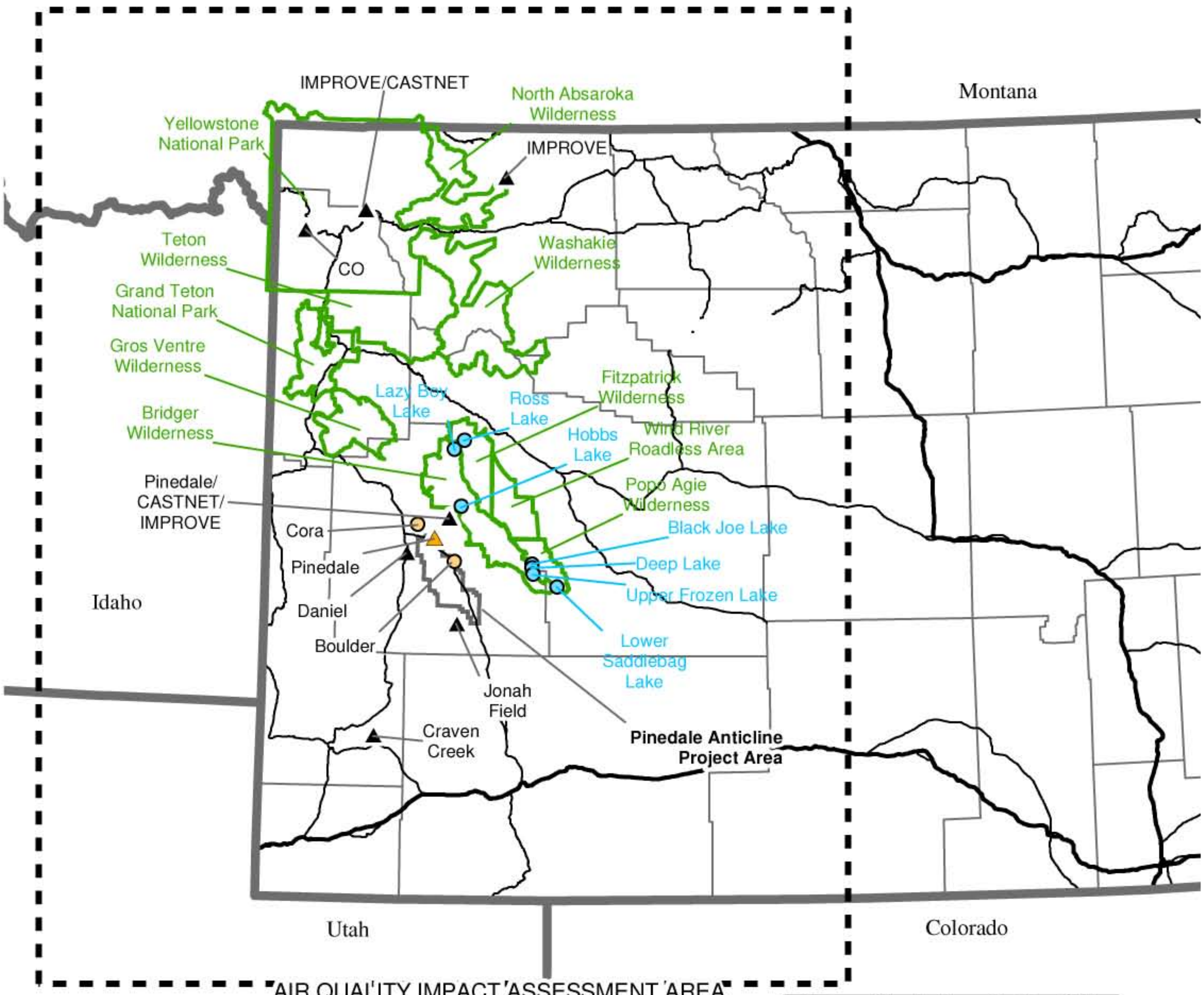
The federal ozone standard, promulgated by the EPA in 1997, is 0.08 ppm for 8 hours. Ozone is measured continuously, and running 8-hour averages are computed from hourly ozone concentrations. Each of the 8-hour averages is assigned to the first hour of the 8-hour period. For example, an 8-hour average calculated from data collected during the 8-hour period starting at 12 p.m. is assigned to 12 p.m. With complete data, there are 24 8-hour average concentrations calculated for each day. The highest of these daily 8-hour averages is identified as the maximum 8-hour concentration for the day (EPA, 1998). Effective May 27, 2008, EPA revised the federal ozone standard to be 0.075 ppm for 8 hours.

Compliance with the NAAQS and WAAQS standard is determined from analysis of monitoring data collected over three consecutive years. The highest 8-hour values over each year are obtained and the fourth highest values for each of the 3 years are averaged. An area is in compliance with the NAAQS and WAAQS for ozone if this average is equal to or less than 0.075 parts per million (ppm) or 148 micrograms per cubic meter (µg/m3).

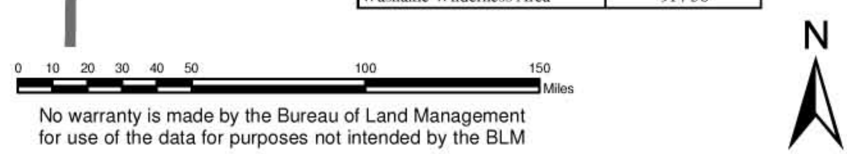
The Sublette County ambient air monitoring stations recorded elevated ozone levels during their first 3 years of operation (2005, 2006, and 2007). The average of the fourth highest 8-hour values measured over 2005 and 2006 are shown in Table 3.11-1. The four highest 8-hour values for each year are shown in Table 3.11-2. The elevated ozone levels have been recorded during the winter months, primarily in the month of February, which is atypical when compared to other areas of the country where ozone levels are elevated. Typically, ozone is thought to be a summertime problem in urban areas. Elevated ozone concentrations are uncommon during the winter months; however, they do not appear to be an anomaly because these conditions were recorded in February of each year. There are several hypotheses on the cause(s) of these elevated ozone events including stratospheric ozone intrusion, ozone transport from other areas, unique meteorological conditions acting upon local scale emissions, and instrument error.

These hypotheses have been explored through evaluations of recorded conditions of meteorological data and air pollutant data, both locally and regionally. The evaluations have resulted in the WDEQ-AQD concern that elevated ozone concentrations monitored in the winter are a result of ground-level ozone formation. The WDEQ-AQD and EPA are concerned that unique wintertime meteorological conditions acting upon local scale emissions may be contributing to ozone formation. The WDEQ-AQD has initiated further evaluation of ozone formation in the Upper Green River Basin through a field study and modeling project to better understand the cause of these monitored elevated ozone levels. These efforts are currently being conducted by the WDEQ-AQD and will likely be completed within the next 2 years. The

Map 3.11-1
Air Quality Impact Assessment Area Showing Locations of Sensitive Areas, Midfield Communities, and Monitoring Sites



Distances to Sensitive Areas at the Closest Point	
Sensitive Area	Distance to PAPA (km / mi)
Bridger Wilderness Area	11 / 7
Fitzpatrick Wilderness Area	27 / 17
Gros Venture Wilderness Area	48 / 30
Popo Agie Wilderness Area	34 / 21
Wind River Wilderness Area	34 / 21
Grand Teton National Park	96 / 59
Teton Wilderness Area	96 / 60
North Absaroka Wilderness Area	171 / 106
Yellowstone National Park	135 / 84
Washakie Wilderness Area	91 / 56



No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM

Table 3.11-2
Maximum Monitored 8-hour Ozone Concentrations for 2005, 2006, and 2007

Monitor	Rank	Ozone Concentration (ppm)		
		2005	2006	2007
Jonah Field	1st	0.097	0.092	0.070
	2nd	0.088	0.080	0.069
	3rd	0.077	0.071	0.068
	4th	0.075	0.069	0.068
Boulder	1st	0.088	0.081	0.072
	2nd	0.081	0.079	0.068
	3rd	0.080	0.076	0.068
	4th	0.079	0.072	0.067
Daniel	1st	0.070	0.082	0.067
	2nd	0.066	0.075	0.067
	3rd	0.066	0.074	0.066
	4th	0.066	0.074	0.066

results of those efforts will form the basis for WDEQ-AQD to develop strategies to manage ozone formation in the Upper Green River Basin to ensure that the area remains in compliance with air quality standards (WAAQS and NAAQS).

Since the Revised Draft SEIS was released for public comment, 2007 BACT (Best Available Control Technology) requirements have been implemented, which require full control of production emissions associated with all wells. This will reduce emission levels compared to the model inventory.

Federal air quality regulations adopted and enforced by WDEQ-AQD limit incremental emission increases to specific levels defined by the classification of air quality in an area. The Prevention of Significant Deterioration (PSD) Program is designed to limit the incremental increase of specific air pollutant concentrations above a legally defined baseline level. PSD Increments are defined for NO_2, SO_2, and PM_{10}. The incremental increase depends on an area's classification. Seven PSD Class I areas are identified as sensitive areas in the modeling domain: the Bridger, Fitzpatrick, North Absaroka, Teton, and Washakie wilderness areas, and Grand Teton and Yellowstone national parks (Map 3.11-1). Strict limitations are applied on the additional amount of air pollution in PSD Class I areas associated with major emitting facilities. The remainder of the modeling domain is classified PSD Class II, where similar but less stringent incremental air quality limits apply. The Gros Ventre and Popo Agie wilderness areas and the Wind River Roadless Area are PSD Class II areas that have been identified as additional sensitive areas occurring within the modeling domain for air quality. PSD Class I and sensitive PSD Class II areas are shown on Map 3.11-1 as sensitive areas. The PSD Class I and Class II Increments are provided in Table 3.11-3.

Table 3.11-3
Prevention of Significant Deterioration (PSD) Increments (μg/m^3)

Pollutant	Averaging Time	Incremental Increase Above Legal Baseline	
		PSD Class I	PSD Class II
Nitrogen dioxide (NO_2)	Annual	2.5	25
	3-hour	25	512
Sulfur dioxide (SO_2)	24-hour	5	91
	Annual	2	20
Particulate matter (PM_{10})	24-hour	8	30
	Annual	4	17

3.11.1.3 Air Quality Related Values

Visibility

The 1977 Clean Air Act amendments established visibility as an AQRV that federal land managers must consider. The 1990 Clean Air Act amendments contain a goal of improving visibility within PSD Class I areas. Residents of the Pinedale area consider visibility impairment to be a major concern.

There are two types of visibility impairment caused by emission sources: plume impairment and regional haze. Plume impairment occurs when a section of the atmosphere becomes visible due to the contrast or color difference between a discrete pollutant plume and a viewed background such as a landscape feature. Regional haze occurs when pollutants from diffuse emission sources mix in the atmosphere, causing a general alteration in the appearance of landscape features, changing the color or contrast between landscape features, or causing features of a view to disappear. Regional haze is caused by light scattering and light absorption by fine particles and gases.

Visibility impairment is measured in terms of change in light extinction or change in deciview (dv). Potential changes to regional haze are calculated in terms of a perceptible ("just noticeable") change in visibility when compared to background conditions. A dv change of 1.0 or 2.0 (equivalent to a 10 percent and 20 percent change in extinction) represents a small but perceptible change in visibility. The BLM considers a 1.0 dv change to be a significance threshold for visibility impairment, although there are no applicable local, state, tribal, or federal regulatory visibility standards. Other federal agencies use a 0.5 dv change as a screening threshold for significance.

Visual range, referred to as standard visual range (SVR), is the farthest distance at which an observer can see a black object viewed against the horizon sky; the larger the SVR, the cleaner the air. Visibility conditions can be measured in SVRs (miles). Visibility within the PAPA air quality modeling domain is considered very good, with an average SVR of over 93.2 miles (Malm, 2000).

Visibility is monitored within PSD Class I areas. In 1985, the Interagency Monitoring of Protected Visual Environments (IMPROVE, 2006) monitoring program was initiated to establish current visibility conditions, to track visibility changes, to establish long-term trends, and to determine the causes of visibility impairment in PSD Class I areas. The IMPROVE sites closest to the PAPA include the Bridger Wilderness Area, North Absaroka Wilderness Area, and Yellowstone National Park IMPROVE sites. Data have been collected near the Bridger Wilderness Area and Yellowstone National Park sites since 1989 and at the North Absaroka Wilderness Area since 2002. Figures 3.11-1, 3.11-2, and 3.11-3 show SVRs at the IMPROVE sites for the cleanest days (20^{th} percentile best visibility days); for 20^{th} percentile middle conditions; and for the haziest days (20^{th} percentile haziest visibility days), respectively (IMPROVE, 2006). SVRs were reconstructed from monitored aerosol (suspended liquid or solid particles) data.

Atmospheric Deposition

Atmospheric deposition refers to the processes by which air pollutants are removed from the atmosphere and deposited on terrestrial and aquatic ecosystems, and it is reported as the mass of material deposited on an area per year in kilograms per hectare-year (kg/ha-yr). Air pollutants are deposited by wet deposition (precipitation) and dry deposition (gravitational settling of pollutants). The chemical components of wet deposition include sulfate (SO_4), nitrate

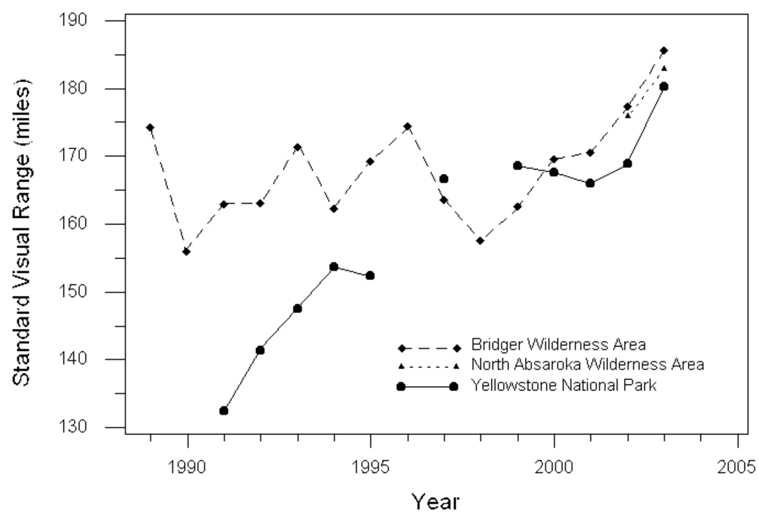


Figure 3.11-1
Standard Visual Range (SVR) for 20th % Cleanest Days, Pinedale Anticline Project Area, Sublette County, Wyoming (Source: IMPROVE, 2006)

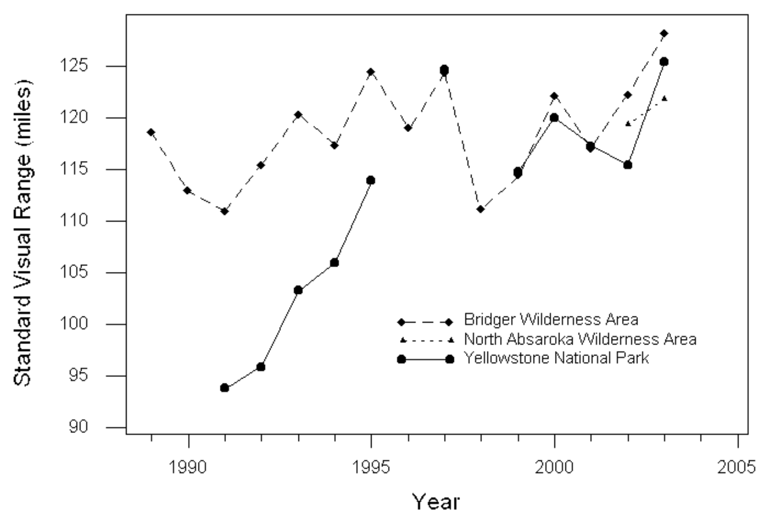


Figure 3.11-2
Standard Visual Range (SVR) for 20th % Middle Days, Pinedale Anticline Project Area, Sublette County, Wyoming (Source: IMPROVE, 2006)

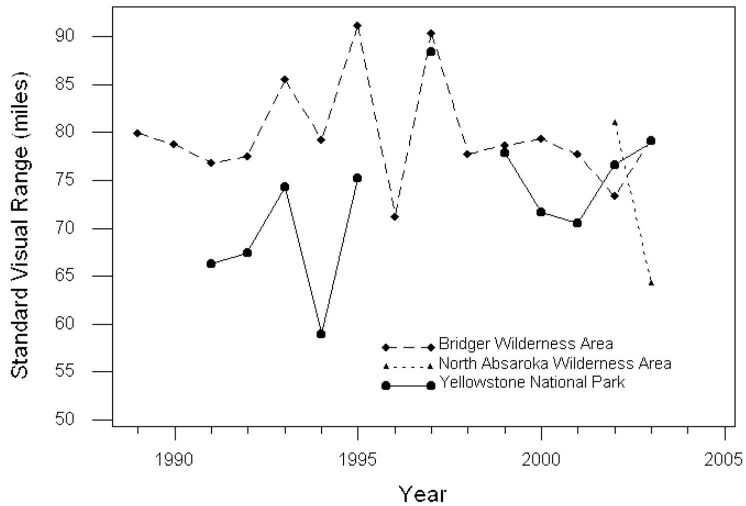


Figure 3.11-3
Standard Visual Range (SVR) for 20th % Haziest Days, Pinedale Anticline Project Area, Sublette County, Wyoming
(Source: IMPROVE, 2006)

(NO_3), and ammonium (NH_4). The chemical components of dry deposition include SO_4, SO_2, NO_3, NH_4, and nitric acid (HNO_3). Near Pinedale, the National Acid Deposition Program (NADP) and National Trends Network (NTN) station monitors wet atmospheric deposition and the Clean Air Status and Trends Network (CASTNET) station monitors dry atmospheric deposition. Figures 3.11-4 and 3.11-5 show the total annual background deposition (wet and dry) reported as total nitrogen (N) and total sulfur (S) deposition for these sites for the monitoring period of record through 2004. These figures show the contribution of each measured chemical component to the total deposition values.

Total deposition levels of concern (LOC) have been established for several areas, including the Bridger Wilderness Area (USFS, 1989). The “red line” LOC represents an estimate of the total pollutant loadings that each wilderness can tolerate. If an analysis done under the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) guidelines indicates total loadings above these values, it may suggest that the land manager recommend a reduction of emissions from new sources unless data are available to indicate that no AQRVs in the PSD Class I area are likely to be adversely affected. The “green line” LOC represents the total pollution loadings (current plus proposed new source contribution) below which a land manager can recommend that a permit be issued for a new source, unless data are available that indicate otherwise. Cumulative impacts plus background are compared to these LOCs. The Bridger Wilderness sulfur deposition red line LOC is 20 kg/ha-yr and sulfur deposition green line is 5 kg/ha-yr. The Bridger Wilderness nitrogen deposition red line LOC is 10 kg/ha-yr and nitrogen deposition green line LOC is 3-5 kg/ha-yr. The Bridger Wilderness LOCs are shown on Figures 3.11-4 and 3.11-5 to facilitate comparison with reported values from the Pinedale stations.

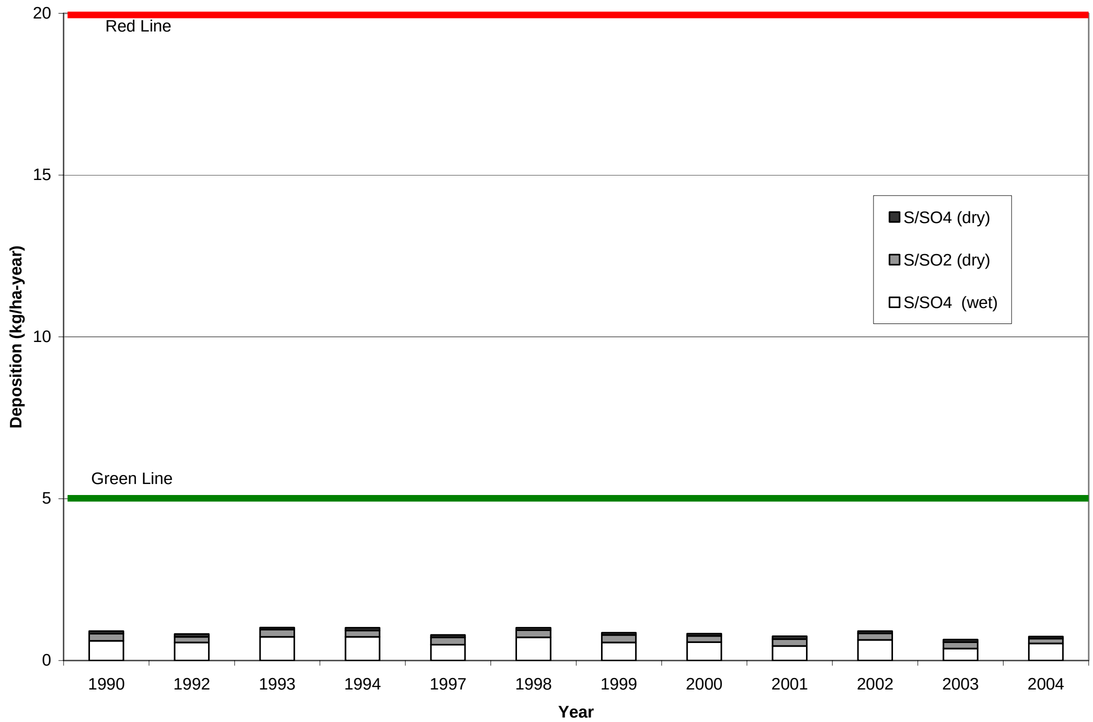


Figure 3.11-4
Mean Annual Total Sulfur Deposition near Pinedale, Wyoming

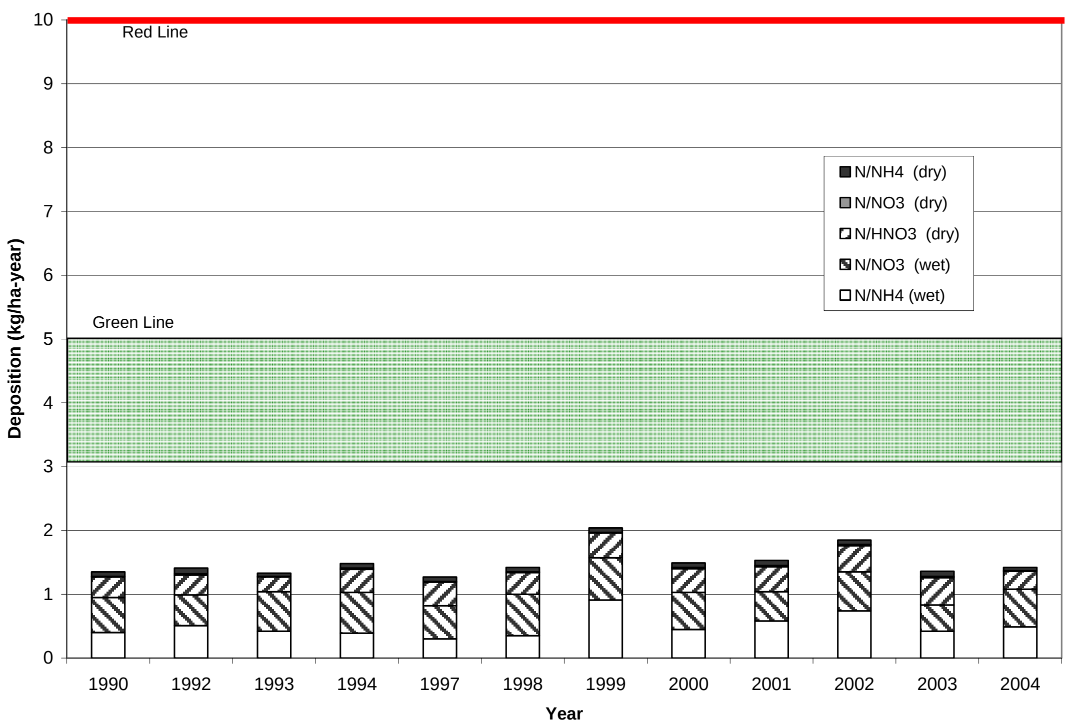


Figure 3.11-5
Mean Annual Total Nitrogen Deposition near Pinedale, Wyoming

The USFS collected site-specific lake chemistry background data (pH, acid neutralizing capacity - ANC, elemental concentrations, etc.) in several high mountain lakes in wilderness areas near the PAPA. Lakes considered sensitive to acid deposition for which background data were collected are shown on Map 3.11-1. Lake acidification is measured in terms of change in ANC, which is the lake's buffering capacity to resist acidification from atmospheric deposition of acid compounds such as sulfates and nitrates. Measured background ANC data for acid-sensitive lakes within the modeling domain are provided in Table 3.11-4.

Table 3.11-4
Monitored Background Conditions at Acid-Sensitive Lakes[1]

Sensitive Lake	Lake Location	Background ANC (μeq/l)[2]	Number of Samples	Period of Monitoring
Black Joe Lake	Bridger Wilderness Area	67.1	67	1984-2005
Deep Lake	Bridger Wilderness Area	59.7	64	1984-2005
Hobbs Lake	Bridger Wilderness Area	69.9	71	1984-2005
Lazy Boy Lake	Bridger Wilderness Area	10.8	3	1997-2004
Upper Frozen Lake	Bridger Wilderness Area	6.0	8	1997-2005
Ross Lake	Fitzpatrick Wilderness Area	53.7	49	1988-2005
Lower Saddlebag Lake	Popo Agie Wilderness Area	55.2	48	1989-2005

[1] Source: USFS, 2006.
[2] 10th percentile lowest ANC values reported.

The USFS considers lakes with ANC values greater than 25 microequivalents per liter (μeq/l) to be sensitive to atmospheric deposition and lakes with ANC values less than or equal to 25 μeq/l to be extremely sensitive to atmospheric deposition. Of the seven lakes identified by the USFS as acid-sensitive, Upper Frozen and Lazy Boy lakes are considered extremely acid-sensitive.

The USFS has identified a specific methodology to determine acceptable changes in ANC, which are used to evaluate potential air quality impacts from deposition at acid-sensitive lakes (USFS, 2000). The USFS has established a level of acceptable change (LAC) of no greater than a 1 μeq/l change in ANC (from human causes) for lakes with existing ANC levels less than or equal to 25 μeq/l. The USFS adopted a limit of 10 percent change in ANC reduction for lakes with an ANC greater than 25 μeq/l.

3.11.2 Impacts to Air Quality from Existing Wellfield Activities

Potential impacts to air quality resulting from exploration and development of natural gas in the PAPA were previously analyzed in the PAPA DEIS (BLM, 1999a). Since issuance of the PAPA ROD (BLM, 2000b), natural gas development in the PAPA has occurred at a pace greater than that analyzed in the PAPA DEIS. The PAPA ROD authorized the development of 700 producing well pads (Chapter 1, Section 1.3) and set thresholds of 376.59 tpy of NO_x emissions from compression, and 693.5 tpy of NO_x emissions from all sources in the field. The air quality impact analysis conducted in the PAPA DEIS assumed 700 producing wells and up to eight drilling rigs operating in the PAPA at any one time. As of December 2005, there were approximately 457 producing wells and over 26 drilling rigs operating in the PAPA. However, 29 of the producing wells were drilled prior to the PAPA ROD. The NO_x emissions from all sources operating in the PAPA during year-2005 were estimated at 3,512.4 tpy which exceeds the 693.5 tpy analysis threshold specified in the PAPA ROD (BLM, 2000b).

Many of the air quality monitoring data presented in Section 3.11.1 are representative of year-2005, and therefore, include some level of pollutant impacts resulting from wellfield activities that occurred in the PAPA during 2005. However, air quality impact analysis modeling has not been performed for the current level of development. Due to concerns that the monitoring network may not be sufficient for quantifying the maximum impacts that occur from the PAPA, modeling has been performed to estimate the air quality impacts of the year-2005 for PAPA wellfield activities. This analysis was performed primarily to estimate impacts to visibility (regional haze), atmospheric deposition, and ambient concentrations of NO_2, SO_2, PM_{10}, and $PM_{2.5}$. These are the AQRVs and ambient concentrations for which recent monitoring data near the PAPA are available.

An inventory of criteria pollutant and hazardous air pollutant (HAP) emissions from construction (due to potential surface disturbance by earthmoving equipment, vehicle traffic, fugitive dust, well completion and testing, and drilling rig and vehicle engine exhaust), production (production equipment, compression engine exhausts, vehicle traffic engine exhausts, and fugitive dust), and other ancillary facilities was developed for year-2005. The inventory was developed based on documented operating parameters, statistics and emission estimates for oil and gas activities in the PAPA for year-2005, and is intended to provide a summary of "actual" emissions that were emitted during 2005 in the PAPA. Criteria pollutant emissions include NO_x, CO, SO_2, volatile organic compounds (VOCs), PM_{10}, and $PM_{2.5}$. HAPs consist of n-hexane, benzene, toluene, ethylbenzene, and xylene (BTEX) and formaldehyde. Total criteria pollutant and HAP emissions from the PAPA for year-2005 are summarized in Table 3.11-5. Although emissions are quantified for all criteria pollutants and HAPs, the year-2005 modeling analysis of project emissions was only performed for NO_x, SO_2, PM_{10}, and $PM_{2.5}$ emissions. NO_x, SO_2, and PM_{10}/$PM_{2.5}$ emissions are precursors to regional haze formation, whereas NO_x, and SO_2 emissions impact acid deposition. Detailed information regarding the 2005 emission inventory and the air quality impact analyses are provided in the Air Quality Impact Analysis Technical Support Document (Air Quality TSD).

Table 3.11-5
Pinedale Anticline Project Pollutant Emissions for Year-2005

Pollutant	Summer (lb/hour)	Winter (lb/hour)	Total (tpy)
Nitrogen oxides (NO_x)	863.1	798.4	3,512.4
Sulfur dioxide (SO_2)	54.4	53.0	231.8
Carbon monoxide (CO)	723.9	624.7	2,745.7
Volatile Organic Compounds (VOCs)	580.7	568.9	2,494.3
Particulate matter (PM_{10})	532.0	145.3	1,199.0
Particulate matter ($PM_{2.5}$)	156.7	64.3	401.4
Formaldehyde	9.5	9.5	41.7
Benzene	16.6	16.6	72.7
Toluene	28.6	28.6	125.4
Ethylbenzene	8.5	8.5	37.1
Xylene	18.0	18.0	78.9
n-Hexane	8.8	8.8	38.5

The year-2005 air quality analysis utilized the 2005 PAPA emissions and the EPA CALMET/CALPUFF modeling system to predict maximum potential air quality impacts at mandatory federal PSD Class I and other sensitive PSD Class II areas (far-field locations), as well as at designated acid-sensitive lakes in these areas. The analysis includes an assessment of impacts at mid-field locations (regional communities of Boulder, Cora, and Pinedale), and at in-field locations within the PAPA. The analyzed areas are shown on Map 3.11-1.

For this analysis, 3 years (2001, 2002, and 2003) of hourly windfields were developed with the CALMET meteorological model for the modeling domain (Map 3.11-1). The CALPUFF dispersion model was used to model estimated NO_x, SO_2, PM_{10}, and $PM_{2.5}$ emissions for each year of meteorology to estimate maximum potential in-field (within the PAPA) ambient air pollutant concentrations, as well as maximum ambient air pollutant concentrations, visibility (regional haze), and atmospheric deposition impacts at the sensitive (far-field) PSD Class I and

Class II areas. Maximum visibility impacts were also determined for the (mid-field) regional communities of Boulder, Cora, and Pinedale. Detailed information regarding the modeling methodologies used in the analysis is provided in the Air Quality TSD.

Predicted pollutant concentrations were compared to applicable ambient air quality standards and to PSD Class I and Class II increments, and were used to assess potential impacts to visibility (regional haze) at PSD Class I and sensitive PSD Class II areas. Ambient background concentrations were added to modeled concentrations for comparison to ambient air quality standards. Ambient background concentrations were not added to modeled concentrations for comparison to PSD Class I and II Increments. 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.

Predicted changes in regional haze at PSD Class I and sensitive PSD Class II areas were estimated by comparing CALPUFF modeled concentration impacts to background visibility conditions representative of each PSD Class I or sensitive PSD Class II area. At the request of the BLM, WDEQ-AQD, and USFS, three separate methods were performed using two different representations of background visibility conditions. Two additional visibility methods that follow recent CALPUFF modeling guidance for Best Available Retrofit Technology (BART) analyses developed for the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) Regional Planning Organization (RPO) were also performed (VISTAS, 2006).

The BLM and USFS methods use visibility values provided in the FLAG Report for each Class I area to represent natural background visibility. The WDEQ-AQD method uses representative monitoring data, for the quarterly average of the 20 percent best visibility days that were collected from the IMPROVE network for the time period that coincides with the period used to establish “baseline conditions” under the EPA Regional Haze Rule (2000 to 2004) (EPA, 2003a). The two BART methods use background visibility conditions representative of each Class I area as provided in the Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule (EPA, 2003b).

Visibility impacts for the BLM method are presented herein compared to the BLM 1.0 dv change threshold. All other visibility impact analyses and comparisons are detailed and presented in the Air Quality TSD.

Changes in regional haze at the Wyoming regional community locations (Boulder, Cora, and Pinedale) were predicted using CALPUFF modeled impacts and recent (year 2005-2006) background visibility data collected at Boulder. Visibility impacts were compared to the BLM 1.0 dv change threshold. Visibility impacts in regional community locations are not regulated by state or federal agencies.

Impacts to nitrogen and sulfur deposition at PSD Class I and sensitive PSD Class II areas were predicted by CALPUFF and were added to background nitrogen and sulfur deposition values for comparison with total deposition LOC. The predicted nitrogen and sulfur deposition values at acid-sensitive lakes were used to estimate change in ANC for comparison with the LAC.

Table 3.11-6 presents a summary of maximum predicted impacts to air quality from wellfield development in the PAPA in 2005. The modeled impact values are provided in Appendix 16, Tables 16.1 through 16.13. The summary shown in Table 3.11-6 and the predicted impacts provided in Appendix 16 represent maximum CALPUFF modeled impacts that were predicted using 3 years (2001-2003) of CALMET meteorological data.

Table 3.11-6
Summary of 2005 Air Quality Impacts from Wellfield Development in the PAPA

Air Quality Measure	Predicted Impact Summary
Concentrations of NO_2, SO_2, PM_{10}, and $PM_{2.5}$	Predicted concentrations are in compliance with applicable NAAQS and WAAQS at all locations; predicted near-field concentrations of PM_{10} are above the PSD 24-hour PM_{10} increment, annual PM_{10} increment, and the NO_2 increment; and below the PSD increments for SO_2; predicted far-field concentrations are below PSD increments.[1]
Visibility (regional haze) at PSD Class I and sensitive PSD Class II areas (far-field)	Predicted impacts are greater than 1.0 dv threshold for a maximum of 45 days per year at the Bridger Wilderness, 5 days at the Fitzpatrick Wilderness, 1 day at Grand Teton National Park, 2 days at the Gros Ventre Wilderness, 6 days at the Popo Agie Wilderness, 6 days at the Wind River Roadless Area, and below 1.0 dv at all other sensitive areas.
Visibility (regional haze) (mid-field communities)	Predicted impacts are greater than 1.0 dv threshold for a maximum of 108 days per year at Boulder, 36 days at Cora, and 55 days at Pinedale.
Atmospheric/terrestrial deposition	Predicted Impacts from sulfur and nitrogen deposition are less than the total deposition LOC at all analyzed areas.
Sensitive lake ANC	Predicted impacts are less than the LAC at all acid-sensitive lakes.

[1] 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.

3.12 NOISE

Noise measurements taken at several locations across the PAPA prior to issuance of the PAPA ROD (BLM, 2000b) indicate that background noise is similar to EPA's category of "Farm in Valley" (EPA, 1971). The background noise levels (decibels on the A-weighted scale or dBA) for the Farm in Valley category are: daytime (39 dBA); evening (39 dBA); and nighttime (32 dBA). Local conditions such as traffic, topography, and high winds characteristic of the region can alter background noise conditions. The PAPA DEIS (BLM, 1999a) identified the following areas as being noise-sensitive: greater sage-grouse leks, crucial big game habitat during critical periods, residences within and adjacent to the PAPA, areas adjacent to the Lander Trail, ranches along both the New Fork and Green rivers, occupied raptor nest sites, and recreation areas. The PAPA ROD set noise limits on wellfield development, specifically compressor sites and "other long-term" facilities, so that distance to a dwelling or a greater sage-grouse lek would be sufficient to result in no noise level increase at the dwelling and would not result in a noise level increase greater than 10 dBA above background at the edge of a greater sage-grouse lek.

Appendix A in the Decision Record for the ASU Year-Round Drilling Demonstration Project (BLM, 2005b) set a performance-based objective for the ASU Operators to "maintain noise levels at 75 dBA or less measured 30 feet from the noise source (drilling rig, compressor, etc.)." Winter drilling was allowed under the Decision Record, and Ultra and Shell monitored noise levels. Noise was measured at each of the four principal compass points at 35 feet from the edge of each of three well pads subject to winter drilling over a 5 to 8 day monitoring period. Noise measurements included total noise from drilling by two drilling rigs per well pad, as well as noise generated by other activities associated with drilling (tripping pipe, short-tripping at casing depth, running casing, cementing, and circulating) and other equipment entering and operating on pads (high vacuum trucks, cement trucks, mud transport trucks, wireline trucks, backhoes, front-end loaders, rigging trucks, process cuttings equipment, air compressor blow down, general truck traffic with engine breaking, pipe inspection equipment, welding equipment, and grinding equipment). Because the noise monitors were located 35 feet from the edge of the well pads, it not possible to separate noise generated by drilling from noise generated by other sources.

Although the noise monitoring stations were located 35 feet from the edge of each well pad, they were much farther from the actual noise sources. The distance from the noise monitoring stations to the drilling rig engines, which produce the most consistent noise, varied from 184 feet to 811 feet (Table 3.12-1).

Table 3.12-1
Noise Measurements at Three ASU Well Pads
with Winter Drilling by Two Rigs per Pad During Winter 2006[1]

Well Pad	Measured at North Monitoring Point		Measured at South Monitoring Point		Measured at East Monitoring Point		Measured at West Monitoring Point	
	Average Noise (dBA)	Distance to nearest Engine (feet) [2]	Average Noise (dBA)	Distance to nearest Engine [2] (feet)	Average Noise (dBA)	Distance to nearest Engine [2] (feet)	Average Noise (dBA)	Distance to nearest Engines [2] (feet)
Ultra Mesa 7-34	57.2	346	62.9	237	58.4	184	54.7	811t
Ultra Mesa 9C-35D [3]	62.2	337	69.9	255	65.8	262	64.4	255
Shell Mesa 7-29	55.4	340	58.5	356	53.7	364	55.2	308

[1] ENSR, 2006a, 2006b, and 2006c.
[2] Distance from the noise monitoring point to the nearest drill rig engine was measured from scaled well pad plot plans.
[3] Engine locations were not shown on Ultra's Mesa 9C-35D pad; distance was measured to each rig location.

Distances to noise monitoring stations and the associated average noise at each monitoring station in Table 3.12-1 can be used to estimate the distance from the drilling rig engines at which the engine noise would attenuate to EPA's Farm in Valley background level of 39 dBA. Assuming that only one engine assembly generated noise on a well pad and that noise was attenuated by 6 dBA for every doubling of distance from the source, the distances at which engine noise would approximate background noise would range from 1,717 feet to 8,944 feet (Table 3.12-2). With the same assumptions, the distances at which engine noise would attenuate to 49 dBA (10 dBA above background) at noise-sensitive sites defined in the PAPA ROD (dwellings, greater sage-grouse leks) range from 543 feet to 2,828 feet.

Table 3.12-2
Distances Noise Would Attenuate to Background (39 dBA) and PAPA ROD Limits at Noise-Sensitive Locations (49 dBA) from ASU Drilling Rigs

Well Pad	Attenuation Distance from North Monitoring Point (feet)		Attenuation Distance from South Monitoring Point (feet)		Attenuation Distance from East Monitoring Point (feet)		Attenuation Distance from West Monitoring Point (feet)	
	39 dBA	49 dBA	39 dBA	49 dBA	39 dBA	49 dBA	39 dBA	49 dBA
Ultra Mesa 7-34	2,812	889	3,713	1,174	1,717	543	4,943	1,563
Ultra Mesa 9C-35D	4,871	1,540	8,944	2,828	5,732	1,813	4,748	1,502
Shell Mesa 7-29	2,246	710	3,361	1,063	1,977	625	1,989	629

Questar conducted noise monitoring at one well pad where completion operations, plug-drilling, and down-rigging occurred during December 2005. Noise from operations was combined with noise from vehicle traffic, wind, and noise from operations on other nearby pads. The study concluded that the highest noise was associated with completion operations; however, well completion also coincided with the highest traffic volume (15 vehicles per hour entering or leaving the pad) and the highest winds during the monitoring period (TRC Mariah Associates, Inc., 2006).

In the Jonah Infill Drilling Project Area, well testing (fracturing and flaring) operations were reported to produce noise levels up to 115 dBA, attenuating to 55 dBA at 3,500 feet (BLM, 2006c). Flaring (one component of completion operations) tended to be the loudest noise event. Using flowback separators reduced noise from completion operations to approximately 64 dBA at the source. Noise levels at the Falcon Compressor Station in the south of the PAPA are about 77 dBA near the compressor station and about 65 dBA about 1.0 mile to the east (BLM, 2006c).

3.13 GEOLOGY, MINERALS, AND GEOLOGIC HAZARDS

3.13.1 Natural Gas Development in the PAPA

3.13.1.1 Geology

The PAPA is located on a northwesterly to southeasterly plunging anticlinal ridge within the Green River Basin Geologic Province. The anticline trends parallel to the Wind River Range in the north of the basin where the basin converges between the Wind River and Teton ranges. The structural basin filled with thousands of feet of continental and marine deposits in Paleozoic and Mesozoic eras and with river and lake deposits during the Tertiary sub-era. The anticlinal fold formed as the basin was uplifted in the mid to late Tertiary. Principal near-surface formations in the basin are the lower Tertiary Green River, Wasatch, and Fort Union formations. Wasatch strata crop out or subcrop under Pleistocene terrace alluvium over most of the PAPA.

Pleistocene alluvium consists of glacial outwash and till terraces north of the New Fork River. Recent alluvial deposits along the river flood plains are referred to here as valley fill to distinguish them from older terrace deposits. Terrace alluvium covering the Mesa in the north of the PAPA was deposited in a fan at the head of the basin, and is an erosional remnant of more continuous deposits of the Greater Green River Basin through which the Green River subsequently cut down (Bradley, 1964; Love and Christiansen, 1985; Roehler, 1992 and 1993; and Love, et al., 1993). Eight terrace levels have been identified in this flood plain complex (BLM, 1999a), constructed mainly of well-sorted, rounded cobble gravels. The modern valley fill in intermittent drainages is fine sand and weathered shale, and in major valleys is fluvial and reworked terrace gravels.

In the south of the PAPA, the Green River Formation is represented by outliers of marginal deposits of the Eocene Lake Gosiute, which, to the distant south, has accumulations of thick marlstones, oil shale, and trona.

The Wasatch Formation consists of gray and brown fluvial shales and arkosic sandstone. Elsewhere, Wasatch sandstones form gas reservoirs for hydrocarbons originating deeper in the section; in the PAPA, the sandstones are the principal water supply aquifer. These sandstones were deposited in meandering river channels and oxbows, with some overbank splays, resulting in lenses that are typically smaller than drill hole spacing, and do not correlate between individual holes. The underlying Fort Union Formation consists mainly of shales and sandstones, with coal beds.

Deeper strata, particularly the Cretaceous Lance Formation, have yielded oil and gas throughout the Green River Basin. Natural gas is found in several reservoir formations in the geologic section, with large reserves in structural traps such as the Pinedale Anticline. The Jonah Field to the southwest of the PAPA, on an extension of the anticline, is a major gas producer. These gas reservoirs are “tight sands,” which were not commercially producible until recent advances in drilling technology and enhancements, such as hydrofracturing, which opens up communication between the wellbore and the targeted sandstone.

3.13.1.2 Minerals

A schematic geological cross section of the natural gas resources in the Green River Basin is shown in Figure 3.13-1 (Ultra Resources, Inc., 2005). The Cretaceous Lance Formation is the primary target, particularly along the crest of the faulted anticline, but deeper sandstone strata, such as the Rock Springs Formation of the Mesaverde Group, are also potential targets. The PAPA is mostly to the right (northeast) of the anticline-flanking thrust fault, and the Jonah Field Project Area is to the left (southwest). In Figure 3.13-1, the Wasatch and Fort Union formations compose the undifferentiated Tertiary strata.

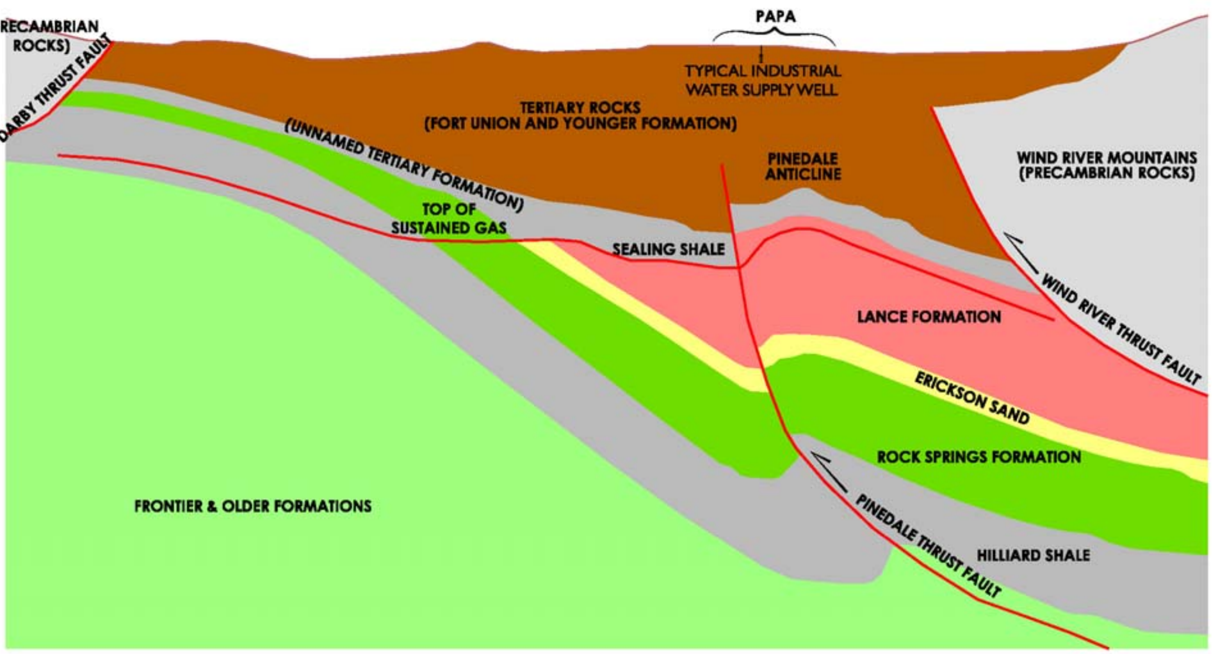


Figure 3.13-1
Geological Cross Section of the Green River Basin and Pinedale Anticline Area

USGS (Crockett et al., 2003), following Montgomery and Robinson (1997) assessed the gas potential (non-coal bed methane) in the PAPA and Jonah Field Project Area for the BLM's RMG and made the following determinations with respect to the PAPA:

- "Very High Potential Area – defined as a 1.5-mile wide band lying on the Pinedale Anticline axis including all acres 1 mile east and 0.5 mile west of the anticlinal axis with a northwest and southeast limit. This area would include over 500 additional wells per township (approximately 36 square miles)."

- "High Potential Area – defined as a 3-mile wide band lying on the Pinedale Anticline axis including all acres 2 miles east and 1 mile west of the anticlinal axis with a northwest and southeast limit. This area would include 100 to 500 additional wells per township."
- "Moderate Potential Area – defined as a 5-mile wide band lying on the Pinedale Anticline axis including all acres 3 miles east and 2 miles west of the anticlinal axis with a northwest and southeast limit. This area would include 20 to 100 additional wells."
- "Low Potential Area – includes all other areas in the PAPA and beyond. This area would include fewer than 20 additional wells per township."

3.13.1.3 Geologic Hazards

Geologic hazards are not of notable concern in the PAPA. Steep slopes in the flanks of the Mesa would be susceptible to small slides if seismically disturbed, particularly in loose alluvium-colluvium, but no slides or earthflows have been mapped in the area. Earthquake epicenters have been mapped in the immediate vicinity of the PAPA and are presumed due to movement on thrusts deep beneath the anticline. The highest recorded magnitude is III (Modified Mercalli Intensity Scale) in 1931 (Case et al., 1995). The USGS estimated that a 4.2 to 4.5 magnitude earthquake might occur somewhere in the Green River Basin every 62 years (BLM, 1999b). A widely reported magnitude 5.1 to 5.3 seismic event that occurred near Rock Springs in 1995 was found to be due to a large roof collapse in a trona mine (Pechman, 1995).

3.13.2 Pipeline Corridors and Gas Sales Pipelines

The proposed corridor/pipeline alignments cross mostly flat to gently rolling plains of the Green River Basin. Deposits of three geological formations, from oldest to youngest, the Wasatch Formation (Alkali Creek Member), the Green River Formation (Laney Member), and the Bridger Formation (Bridger A), are crossed by the proposed corridor/pipeline alignments. Overlying these formations along substantial portions of the corridors is a varying thickness of Quaternary (Recent) age alluvial, colluvial, stream terrace gravels, and wind-blown sands. The slopes along the route are rated between 7 and 10 by the Natural Resource Conservation Service (NRCS), indicating slopes that are generally less than 5 percent, with limited areas displaying slopes of 5 to 10 percent (Hamerlinck and Arneson, 2002).

The proposed BCC and RVII (Segment 1) and PBC pipeline alignments cross deposits of the Wasatch Formation (Alkali Creek Member) exposed on uplands north and south of the New Fork River. The rocks of the Wasatch Formation consist of locally conglomeratic, brown, green, and gray sandstone interbedded with siltstone, mudstone, and shale.

Just south of the dissected Blue Rim Area, which is south of the New Fork River, the topography changes from gently rolling to nearly level plateau surfaces underlain by fine-grained oil shale and mudstone of the Laney member of the Green River Formation. From here, the Laney member dominates the surface geology to just south of the Green River and underlies the initial portion of the BFGC and RVII Pipeline (Segment 2) alignments. Bluffs of the Green River Formation surround Fontenelle Reservoir.

The Eocene Bridger Formation dominates most of the surface area south of the Green River that is traversed by the proposed BFGC and RVII Pipeline (Segment 2) alignments and the OPC and Opal Loop III Pipeline alignments (BLM, 1999b). The Bridger Formation consists of olive-drab and white sandstones, claystones, and conglomerates (Langeson and Spearing, 1988) that erode into rugged badlands with small sand dune and terrace gravel inclusions up to 3 feet deep. The windblown sand deposits have been stabilized by vegetation.

Rocks of the Wasatch, Green River, and Bridger formations are overlain with younger unconsolidated sediments of Quaternary age along segments of the proposed corridor/pipeline alignments that cross river bottoms, stream terraces, and buttes. The Quaternary sediments include alluvium, colluvium, stream terrace gravels, and wind-blown sands.

Lands crossed by the proposed corridor/pipeline alignments do not show evidence of major landslides (BLM, 1999b). There are no known active faults along the proposed corridor/pipeline alignments (Wyoming State Geological Survey et al., 2000).

3.14 PALEONTOLOGICAL RESOURCES

3.14.1 Natural Gas Development in the PAPA

Paleontological resources include the remains or traces of any prehistoric organism that has been preserved by natural processes in the earth's crust. The BLM manages paleontological resources for their scientific, educational, and recreational values in compliance with the Antiquities Act of 1906, in order to protect and preserve representative resource samples in the PAPA. The Probable Fossil Yield Classification (PFYC) system, as adapted by the BLM's Regional Paleontologist, serves as a guide for classification of potential paleontological resources (BLM, 2003c). The PFYC is a classification system wherein geological units are classified according to the probability of yielding paleontological resources that are of concern to land managers (USFS, 2001). Decisions to restrict areas for resource protection are evaluated on a case-by-case basis for each proposed surface disturbing activity.

The BLM has released the Paleontology Resources Management Manual and Handbook H-8270-1 (BLM, 1998) that established a classification system:

"for ranking of paleontological areas according to their potential for noteworthy occurrences of fossils. . . . Public lands may be classified based on their likelihood to contain fossils, using the following criteria:

a. Condition 1 - Areas that are known to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. Consideration of paleontological resources will be necessary if the Field Office review of available information indicates that such fossils are present in the area.

b. Condition 2 - Areas with exposures of geological units or settings that have high potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. The presence of geologic units from which fossils have been recovered elsewhere may require further assessment of these same units where they are exposed in the area of consideration.

c. Condition 3 – Areas that are very unlikely to produce vertebrate fossils or noteworthy occurrences of invertebrate or plant sils based on their surficial geology, igneous or metamorphic rocks, extremely young alluvium, colluvium, or aeolian deposits or the presence of deep soils. However, if possible it should be noted at what depth bedrock may be expected in order to determine if fossiliferous deposits may be uncovered during surface disturbing activities.

Either Condition 1 or Condition 2 may trigger the initiation of a formal analysis of existing data prior to authorizing land-use actions involving surface disturbance or transfer of title. Condition 3 suggests that further paleontological consideration is generally unnecessary."

The BLM in Wyoming may choose to adopt a second paleontological classification scheme for the management of paleontological resources - Probable Fossil Yield Classification (PFYC). The USDA Forest Service originally developed this scheme. There are several other classification systems for ranking the sensitivity of formations for containing fossils resources.

Those formations known to contain vertebrate fossils (Condition 1, PFYC Class 4 and 5) tend to be considered the most sensitive and, hence, suffer the highest impacts from ground disturbance. Vertebrate fossils tend to be rare and fragmentary (portions of skeletons) when found, so even disarticulated remains are considered significant. Invertebrate and plant fossils, by contrast, are relatively common but are very important to the study of the Tertiary deposits in the northern Greater Green River Basin. Of the invertebrate and plant fossil-producing localities, the "type" sites (i.e., locations that have produced fossils that paleontologists have used to define extinct species) are considered among the most significant scientific resources.

Uinta Paleontological Associates Inc., as authorized by EnCana Oil and Gas (USA) Inc. as well as their partners Ultra and BP, reviewed geologic maps as well as geologic and paleontological publications for known fossil occurrences in or near the Jonah Field.

Twenty-five recorded localities occur within the PAPA (Winterfeld, 1998). A review of the institutional records by Winterfeld (1998) identifies 59 fossil localities of importance near the PAPA. A published report on the geology and paleontology of the area (West, 1973) identifies an additional 15 localities of importance.

The Green River and Wasatch formations have high potential for yielding significant paleontological resources within the PAPA. Fossils can be found where formation outcrops exist and in areas where surface disturbance exposes the formations. In general, the more accessible the area, the greater the potential for resource discovery. Fossils, as a part of the substratum, are constantly being exposed by erosion (Robinson, 1998).

The Blue Rim Area of the PAPA is especially vulnerable to exposure of paleontological resources because it contains highly erodible Wasatch soils that have little vegetative ground cover. This area was included in MA 7 (Ross Butte/Blue Rim) in the PAPA DEIS (BLM, 1999a). Objectives of this MA are to protect the paleontological resources and to avoid disturbing the outcrops of the Wasatch. As of November 2006, there were approximately 565 acres of wellfield disturbance on federal and non-federal lands in the Blue Rim Area (Table 3.17-1). Several vertebrate fossils, including turtles, crocodilians, and fish, were recorded at paleontological localities in the Blue Rim Area (Drucker, 2006) adding to the knowledge base of paleontology in the PAPA. Most recently, a fossil mammal, possibly that of an early rodent, was found during construction of a road leading to a cellular communications tower site on Ross Butte (Drucker, 2006).

Limited outcrops of the Green River Formation exist in the southeastern portion of the PAPA, near the Jonah Field Project Area. The formation is well known for its abundant fossil specimens. The lack of documented fossils in the PAPA is most likely because the areas have not been sufficiently studied (BLM, 1999a).

3.14.2 Pipeline Corridors and Gas Sales Pipelines

The exposed bedrock formations underlying the proposed corridor/pipeline alignments include the Wasatch Formation (Alkali Creek Member), Green River Formation (Laney Member), and Bridger Formation (Bridger A and B). These formations, which are exposed intermittently along the proposed corridor/pipeline alignments, produce scientifically significant fossils, have the highest paleontological potential and meet the BLM’s standards for Paleontology Condition 1 and PFYC 4 and 5 (Hanson, 2006).

Varying thicknesses of Quaternary (Recent) age sediments overlay these formations along portions of corridors crossing river bottoms and some uplands. For the most part, these sediments are too young to contain fossils; however, one locality in Quaternary sediments along Yellow Point Ridge has produced prehistoric horse remains of unknown age (Vlcek, 2005).

The Alkali Creek Member of the Wasatch Formation formed in fluvial and flood plain environments in a northwest trending band about 25 miles wide that extended from just east of the Wyoming Thrust Belt to near Pinedale. This deposit underlies the proposed BCC and the RVII Segment 1 and PBC pipelines to south of the Blue Rim Area. Fossil vertebrates are fairly common in the variegated mudstones. Fossil localities have also been recorded in the member in T. 28-32 N., R.108-112 W. (West, 1969 and 1973).

From just south of the Blue Rim Area, the proposed corridor/pipeline alignments cross exposures of the Laney Member of the Green River Formation to points just south of the Green River. Scientifically significant fossils have been known to occur in the Laney Shale Member of the Green River Formation for more than 150 years (Grande, 1984 and 1989 and Breithaupt, 1990). The first discovery of fossil fish was made by Dr. John Evans near Green River, Wyoming. The first of these specimens was sent to Joseph Leidy in Philadelphia and identified as a herring, *Clupea humilus* in 1856. The herring was renamed *Knightia eoceaena* and has subsequently become Wyoming's State fossil.

Since this early discovery, many collections of fossil fishes, other vertebrates, insects and plants have been made from the Green River Formation and the specimens are world renowned for their preservation. Collections of specimens are housed in many major museums around the world and sold in rock shops across the United States. In addition to fish, a wide variety of other fossils, including the remains of amphibians, reptiles, birds, invertebrates, and plants are known from the Laney Shale (Bradley, 1964; West, 1969 and 1973; and Grande, 1984). Plant and insect fossils are very common. The most common insect fossil is the mosquito, *Culex* sp. Other invertebrate fossils known from the Laney Shale include insects, ostracodes, mollusks, and gastropods. Numerous plant fossils occur as well, with the remains of *Plantanus* sp. (a sycamore) and *Equisetum* (scouring rush), being especially common (MacGinitie, 1969). In places, remains of algal mounds, or stromatolites, occur and may exceed a few feet in height and 15 feet across.

Among vertebrates, the most common fish in the Laney Shale include the herring genera, *Knightia*, and *Gosiutichthys*. Other vertebrates, including birds, salamanders, turtles, crocodilians, and mammals, are rarely reported. At least one complete articulated turtle and two nearly complete crocodilian skeletons are known from the member, as well as some undescribed mammalian skeletons in private collections. The remains of small perching birds, primobucconids, are also known from the Laney Shale, but the most abundant bird remains are the impressions of feathers (Olsen, 1987 and 1992).

From points just south of the Green River, the proposed corridor/pipeline alignments cross exposures of the Bridger Formation. Fossil vertebrates have been collected from the Bridger Formation for more than 135 years (Leidy, 1856) and collections of Bridger specimens are housed at nearly every major paleontological institution in the world. The abundance of fossil vertebrates in the Bridger Formation along the proposed corridor/pipeline alignments has been documented in previous project reports (EVG, 1999, 2001a, 2001b, 2002a, and 2002b). Fossil turtles and other reptiles are the most common vertebrate fossil in the Bridger Formation. Although most specimens are fragmentary, complete skeletons of mammals and reptiles (crocodiles) have been collected (McGrew, 1971 and McGrew and Feduccia, 1973).

Preconstruction field and open trench field monitoring in the multi-pipeline corridor between the Bird Canyon Compressor Station and the Granger Gas Processing Plant have been conducted frequently since 1998 (EVG, 1999, 2001a, 2001b, 2002a, and 2002b). Monitoring confirms the presence of vertebrate fossils in the surface lithology along existing pipeline rights-of-way.

3.15 GROUNDWATER RESOURCES

3.15.1 Natural Gas Development in the PAPA

Groundwater resources are important in the PAPA, with wells supplying domestic and stock water to rural residences in areas far from perennial streams. Groundwater also partially supplies drilling water to the Operators. The area is arid, and the watercourses flowing from the PAPA are generally intermittent.

A report by Geomatrix (2008) has collated information from literature and the past several years of groundwater monitoring to present a conceptual model of the PAPA hydrogeology. The complete Geomatrix report is available on the CD included in this Final SEIS and also is available on the Pinedale BLM web site at http://www.blm.gov/wy/st/en/field_offices/Pinedale/pawg/DataResults.html.

3.15.1.1 Aquifers

Most domestic and stock wells are less than 200 feet deep, and draw water from alluvium or shallow sandstone units in the Wasatch Formation. The most prolific alluvial deposits are an older remnant of outwash gravel on the Mesa, and modern river alluvium. There are several distinct alluvial systems. The oldest is the terrace outwash gravels, which were deposited as an outwash apron stretching from the Wind River Range, and cut by the New Fork River. This outwash apron is up to 150 feet thick on the Mesa. Modern river gravels occupying the flood plains of the New Fork and Green rivers are the next youngest aquifer system, and their alluvial water is directly connected to the stream flow. Valley fill alluvium in watercourses draining the PAPA is an accumulation of colluvium, probably silty with low yield. In the south of the PAPA, there is some wind drift sand cover constituting a minor alluvial aquifer.

The relationship between these formations and aquifers is shown schematically in Figure 3.13-1. Stock and domestic wells tap shallow groundwater, generally from alluvium. Drilling water supply is obtained by Operators from the Wasatch Formation. This water may also be used for stock water upon favorable results of water quality testing. Gas is currently produced from the Lance Formation. Natural gas wells and drilling water supply wells are required to be cased and cemented to isolate all water bearing zones above their particular production intervals. Fort Union groundwater is not generally used in the Green River Basin and is not well characterized (Glover et al., 1998).

3.15.1.2 Recharge

Regional potentiometric maps (Glover et al., 1998) for the Wasatch Formation indicate groundwater flow from recharge areas in the north of the Green River Basin southward, to discharge to the Green River in the area of Fontenelle Reservoir. Alluvial aquifers in the PAPA are recharged by local precipitation. The aquifers discharge to surface water directly or through valley fill alluvium in local drainages.

Annual precipitation is approximately 20 inches in the Wyoming Range (Lowham et al., 1985), and up to 30 inches in the Wind River Range, where the Wasatch Formation is apparently recharged. Because the Wasatch Formation does not crop out against the Wind River Range (as shown in the cross section of Figure 3.13-1), infiltration is likely to be less than 1 inch per year in this primary recharge area. Hamerlinck and Arneson (1998) indicate average infiltration rates within the basin (groundwater recharge from precipitation) of 0.25 to 0.6 inches per year in the Pinedale area. This range of values gives an estimate of annual recharge over the PAPA of between 4,000 and 10,000 acre-feet/year. Map 3.15-1 shows estimated recharge rates over the area from the Geomatrix Report (2008).

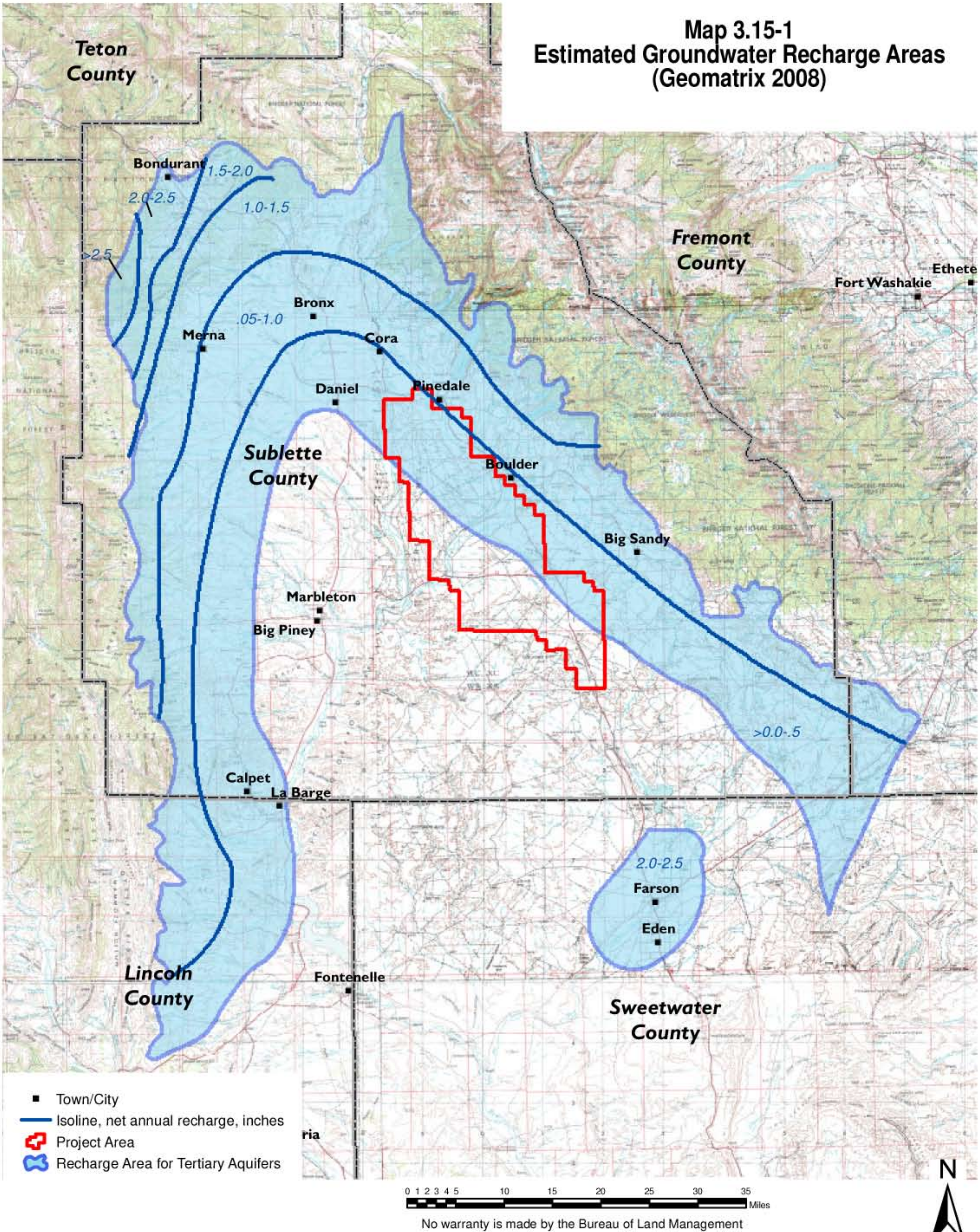
Probably less than half the local recharge in the PAPA is to groundwater that is used for stock and domestic supply. Most of the remaining recharge discharges from alluvium to surface water. A small fraction of the recharge passes through the alluvium into the Wasatch Formation aquifer. Potentiometric data indicate that the Wasatch Formation aquifer discharges some groundwater to the New Fork River in the reach crossing the PAPA. The smaller streams south of the New Fork River do not show this apparent connection between surface water and groundwater. Map 3.15-2 which is taken from the Geomatrix Report (2008) is based on SCCD monitoring data shows potentiometric contours in the Wasatch Formation.

3.15.1.3 Groundwater Quality

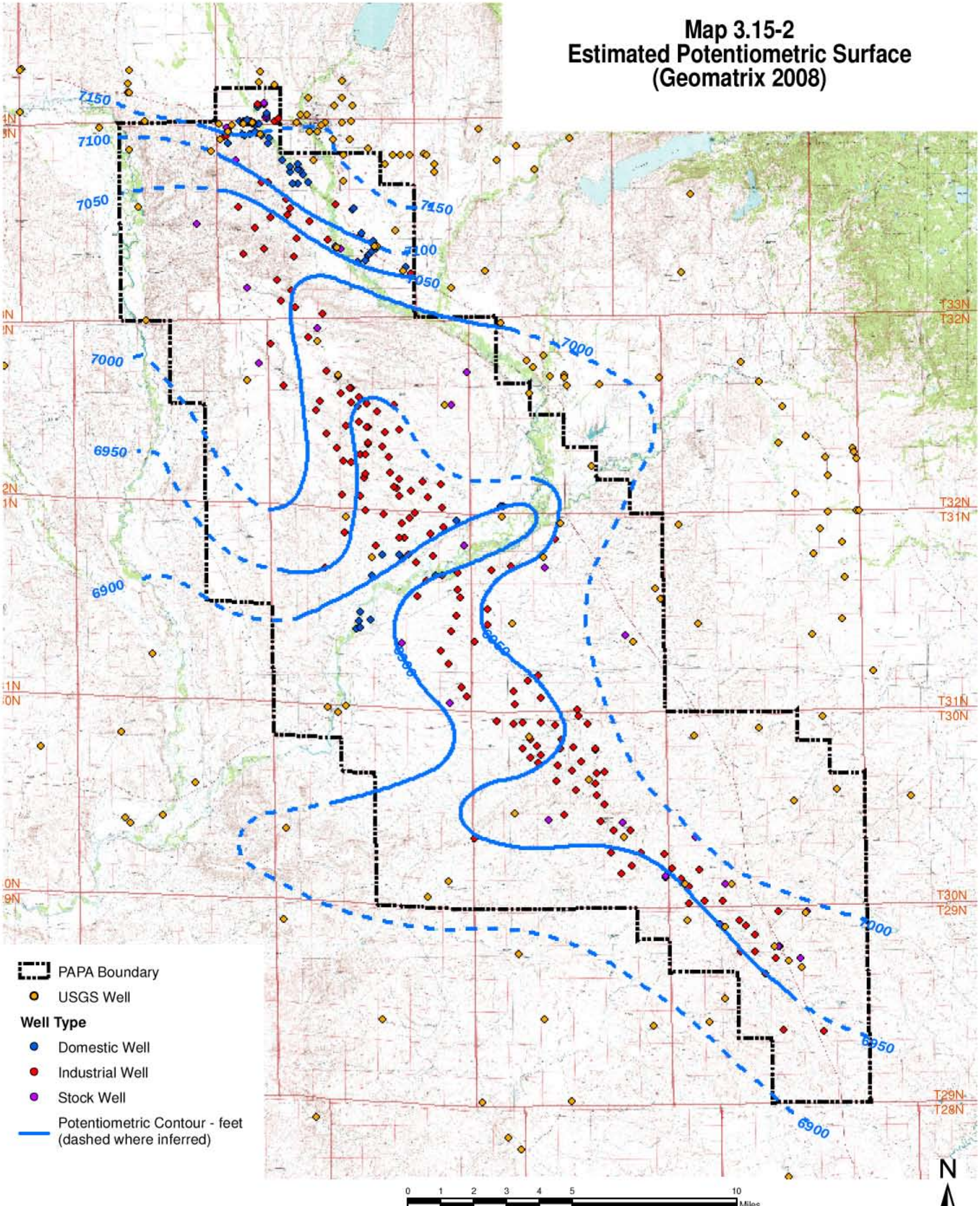
The terrace alluvium aquifer has Class I quality water (WDEQ, 2005a), which means that total dissolved solids (TDS) are less than 500 milligrams per liter (mg/L), and no constituent concentration exceeds drinking water standards. Predominant ions are calcium and bicarbonate.

The Wasatch Formation contains many discontinuous sand lenses with variable connectivity and variable water quality. Sand lenses typically cannot be correlated between drill holes because they are smaller than drill hole spacing. Therefore, the Wasatch Formation aquifer can only be discussed in a statistical manner. This complicates discussion of its hydraulic properties (yield, flow patterns) and water quality. The lumped Wasatch Formation groundwater quality ranges from a sodium bicarbonate type (sodium and bicarbonate are the dominant ions), with TDS less than 500 mg/L, to sodium sulfate-bicarbonate type with TDS up to 1,500 mg/L. Thus, the classification ranges from Class I (TDS less than 500 mg/L, suitable for domestic use) to Class III (suitable for stock use) (WDEQ, 2005a). Sulfate increases with TDS, but there is no evident geographic trend in TDS or any ionic constituent.

Sulfate and TDS data from Wasatch Formation monitoring wells are plotted in Figure 3.15-1, showing concentrations with low-salinity sodium-bicarbonate, and low to moderate salinity sodium-sulfate. The pH of Wasatch Formation groundwater has two modes (frequency peaks, at 8.2 and 9.7), as shown in Figure 3.15-2. The pH does not correlate with TDS, depth, or any other measured parameter, and has been suspected to be due to cement leakage in some of the sampled water supply wells. However, other studies have measured regional pH in the Wasatch Formation aquifer commonly between 8.5 and 9.5 (Chafin and Kimball, 1992). Wasatch Formation water quality ranges from Class I (drinking water) to Class III (stock water) (WDEQ, 2005a). Any Wasatch Formation water is suitable for drilling, but water with higher salinity may not be appropriate for cementing.


Map 3.15-1
Estimated Groundwater Recharge Areas
(Geomatrix 2008)
Teton County
Fremont County
Sublette County
Lincoln County
Sweetwater County
Bondurant
Bronx
Merna
Cora
Daniel
Pinedale
Boulder
Big Sandy
Marbleton
Big Piney
Calpet
La Barge
Fontenelle
Farson
Eden
Fort Washakie
Ethete
1.5-2.0
2.0-2.5
1.0-1.5
>2.5
.05-1.0
>0.0-.5
2.0-2.5
Town/City
Isoline, net annual recharge, inches
Project Area
Recharge Area for Tertiary Aquifers
0 1 2 3 4 5 10 15 20 25 30 35
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

Map 3.15-2
Estimated Potentiometric Surface (Geomatrix 2008)



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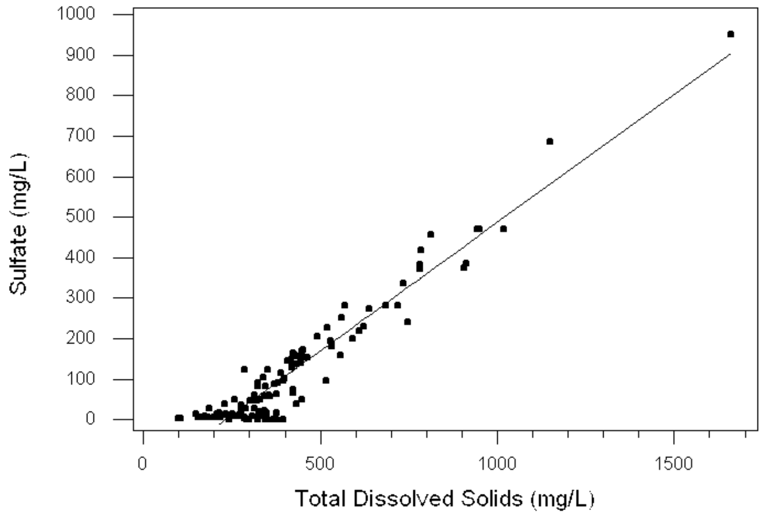


Figure 3.15-1
Relationship of Sulfate Concentrations to Total Dissolved Solids in Wasatch Groundwater

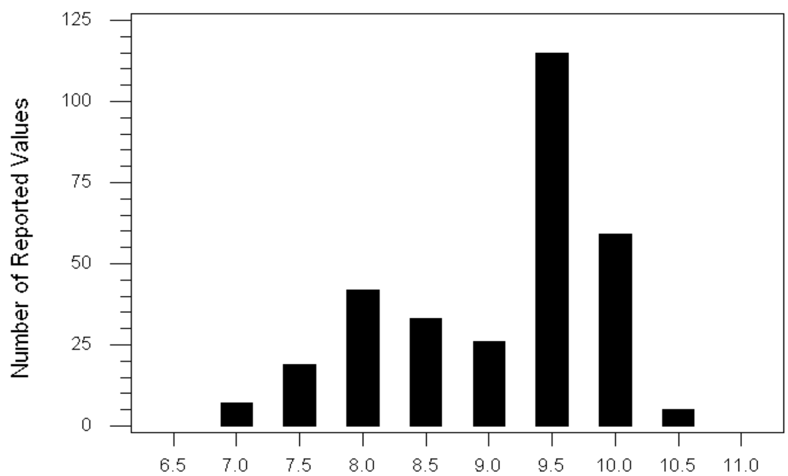


Figure 3.15-2
Distribution of pH in Wasatch Groundwater

Fort Union Formation sandstones generally contain water with salinity greater than 2,000 mg/L (Glover et al., 1998), which may be adequate in some places for stock and drilling uses. Most Class 2 wastewater injection wells in the vicinity inject into the Fort Union Formation. Because this water has TDS values above 3,000 mg/L (criteria for aquifer exemption), an aquifer exemption has been obtained for each of the injection wells.

PAPA valley fill alluvium groundwater is a mix of surface water, Wasatch Formation water, and alluvial water. The valley's water quality is expected to reflect the calcium-sodium bicarbonate composition of the source waters. Currently, there are no monitoring wells in the valley fill alluvium to provide accurate water quality information.

Produced water from the gas-producing interval of the Lance Formation has high salinity and some dissolved organic constituents. Produced water is discussed in Appendix 7 and in Section 3.16 - Surface Water. The Lance Formation has poor water quality although it could be treated to meet discharge or use standards.

Groundwater monitoring has disclosed occurrences of organic constituents, notably benzene, in a number of drilling supply wells. This contamination is believed to be anthropogenic and does not change the class of use. It is described further in Section 3.15.1.5, below.

3.15.1.4 Groundwater Quantity

Historically, groundwater development in the PAPA consisted of stock and domestic wells completed in terrace or river alluvium. Some bedrock wells exist south of the New Fork River where alluvium is thin. Alluvial wells furnish Class I water, with water levels typically less than 50 feet.

Natural gas exploration and production has required water for drilling, in the quantity of approximately 20,000 bbl per gas well. Most of this drilling water has been obtained from water supply wells installed in the Wasatch Formation aquifer ranging from approximately 300 to 1,000 feet in depth. Water for drilling is also obtained from recycled produced water. Wyoming State Engineer's Office (SEO, 2006) water rights database shows approximately 4,000 adjudicated points of use, of which 414 are for industrial use (gas production). Many of these records are duplicates of registered wells because each point of use acquires its own record. Rationalizing this database and others at USGS and WDEQ-WQD has been attempted (Dynamac, 2002), but a complete and verified list of wells in the PAPA and their construction and survey details has not been completed.

Some groundwater is used for dust control. The quantity of water used varies widely between Operators, with estimates for 2006 ranging from 10,000 to 20,000 barrels per day (bbl/day). Use of groundwater for dust control is seasonal and depends on road surfaces in a particular work area, the amount of traffic, and the extent to which the Operator uses treated produced water for dust control. Some treated produced water has been used on a trial basis, with reverse osmosis added to the treatment to remove trace metals.

The dominant flow direction in alluvial terrace deposits and Wasatch Formation water-bearing units north of the New Fork River is toward the New Fork River, which cuts across the PAPA. Again, supply wells in the Wasatch Formation average the Wasatch Formation potentiometric level (the elevation at which water stands in a well), and many individual observations do not follow the pattern, but the overall potentiometric gradient (the flow direction) in the Wasatch Formation is to the south as indicated in regional maps (Glover et al., 1998). Where the New Fork River crosses the PAPA, potentiometric contours converge on the New Fork elevations. This indicates that the groundwater is flowing to the river which means that the river is gaining by groundwater discharge in that reach. Groundwater discharge to stream baseflow north of the New Fork River occurs principally in watercourses via valley fill alluvium. Exposed springs are not common in the PAPA.

South of the New Fork River, where relief is lower, the Wasatch Formation groundwater appears to flow toward the Green River, bypassing ephemeral watercourses draining east and west. There is less infiltration to groundwater south of the New Fork River where there is lower precipitation (Lowham, et al., 1985) and finer-grained soils.

Depths and water bearing zone thicknesses for drilling supply wells in the PAPA monitored in 2005 are plotted in Figure 3.15-3. Well depths range from 300 to 1,000 feet, confirming that they are Wasatch Formation wells. The thickness of the water bearing interval is typically less than 200 feet.

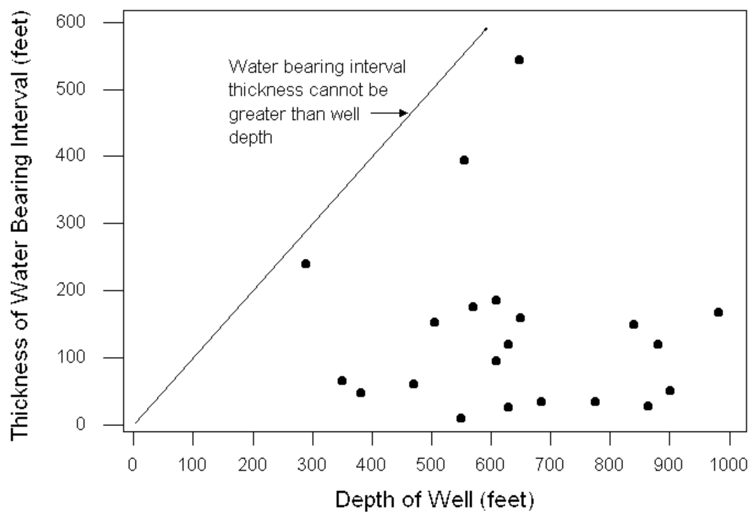


Figure 3.15-3
Data from Drilling Supply Wells in the PAPA

The nature of the local watercourse alluvium north and south of the New Fork River is not known, but it is expected to be predominantly accumulated colluvium, fine-grained, and of low yield. These deposits are of interest primarily as conduits for sub-flow of groundwater to surface water.

3.15.1.5 Groundwater Monitoring

Groundwater monitoring for baseline characterization began following issuance of the PAPA ROD (BLM, 2000b). The PAPA ROD required that "… The Operators conduct a survey and a complete water analysis (e.g. static water level, alkalinity, salinity, benzene, oil, etc.) of all water wells within a 1 mile radius of existing and proposed development, and annually monitor and maintain a complete record of water analysis of all new water supply wells drilled in the PAPA to evaluate the quality of source options in the event some mitigation is required." Some sampling was conducted prior to 2002.

Since July 2001, the Sublette County Conservation District (SCCD) has inventoried water wells within 1 mile of existing or proposed natural gas wells in the PAPA. SCCD sampled groundwater in over 230 wells from August 23, 2004 through June 30, 2007 on behalf of PAPA Operators. Many, if not most of these wells, have uncertain open intervals and they are completed across various sands of the Wasatch Formation. Because these sands are lenticular ancient river channel deposits in low permeability shales, sands cannot readily be correlated between borings and generally different units are intersected in every well (well spacing is typically greater than the width of a channel deposit). The Wasatch Formation is therefore characterized by this baseline program as a compound aquifer system with variable chemistry.

The monitoring program established by the PAPA ROD (BLM, 2000b) detected benzene and other hydrocarbons in four PAPA drilling water supply wells in late 2006. As a result, WDEQ-WQD required Operators to analyze samples from water supply wells connected to a tank, tank truck, or reserve pit for BTEX and total petroleum hydrocarbons (TPH). As of October 2007, benzene and other volatiles have been detected in an additional 84 wells, of which 14 showed exceedances of drinking water standards (maximum contaminant levels or MCL defined in the Safe Drinking Water Act). In some instances where detections are above the MCL, the contamination is believed to be related to drilling pit water siphoning back into the well and to backflow from transportation trucks. Check valves are now required on all new water supply wellheads. Other possible sources could include pipe dope, inadequately cleaned casing materials, cross contamination between pits for holding water for water well drilling and gas production well drilling, malicious contamination by persons hostile to gas production, and natural causes (such as leakage of organics from lower gas target strata). Map 3.15-3, taken from Geomatrix (2008), shows locations of wells with detections and exceedances of standards of organics. Table 3.15-1 details organic concentrations reported in the wells.

3.15.2 Pipeline Corridors and Gas Sales Pipelines

Most of the proposed corridor/pipeline alignments cross outcrop and colluvium-covered subcrop of Tertiary-age rocks, although they also cross alluvium in river valleys, and some thin eolian sands. Quaternary aquifers are thin and low-yielding except for where they are in direct contact with rivers. Tertiary aquifers are lenticular sands of the Wasatch Formation and, in the south, fractured siltstones of the Green River Formation. The potential for groundwater contamination is low to medium except along the river drainages (Hamerlinck and Arneson, 1998). Groundwater in the Green River Basin is used for agricultural, municipal and domestic, and industrial purposes (States West Resources Corporation, 2001).

There are existing water wells near the proposed corridor/pipeline alignments, primarily in the area surrounding Granger and near the Granger Gas Processing Plant (BLM, 2004c). Well yields from the Wasatch Formation aquifer are between 20 and 500 gallons per minute (gpm).

Groundwater quality varies by location and by aquifer (Hahn and Jessen, 2001) in the proposed corridor/pipeline alignments. The concentration of TDS exceeds the secondary drinking water standard in more than half of the wells sampled, and sulfate exceeds the secondary drinking water standards in about one third. Although the water quality of these higher TDS and sulfate waters does not necessarily prevent their use, it limits their suitability. The quality of groundwater at several locations is considered poor, and would require extensive treatment to produce suitable drinking water. Hahn and Jessen (2001) reported that there was insufficient data available to assess whether alternative groundwater sources of better quality might be accessible in areas crossed by the proposed corridor/pipeline alignments.

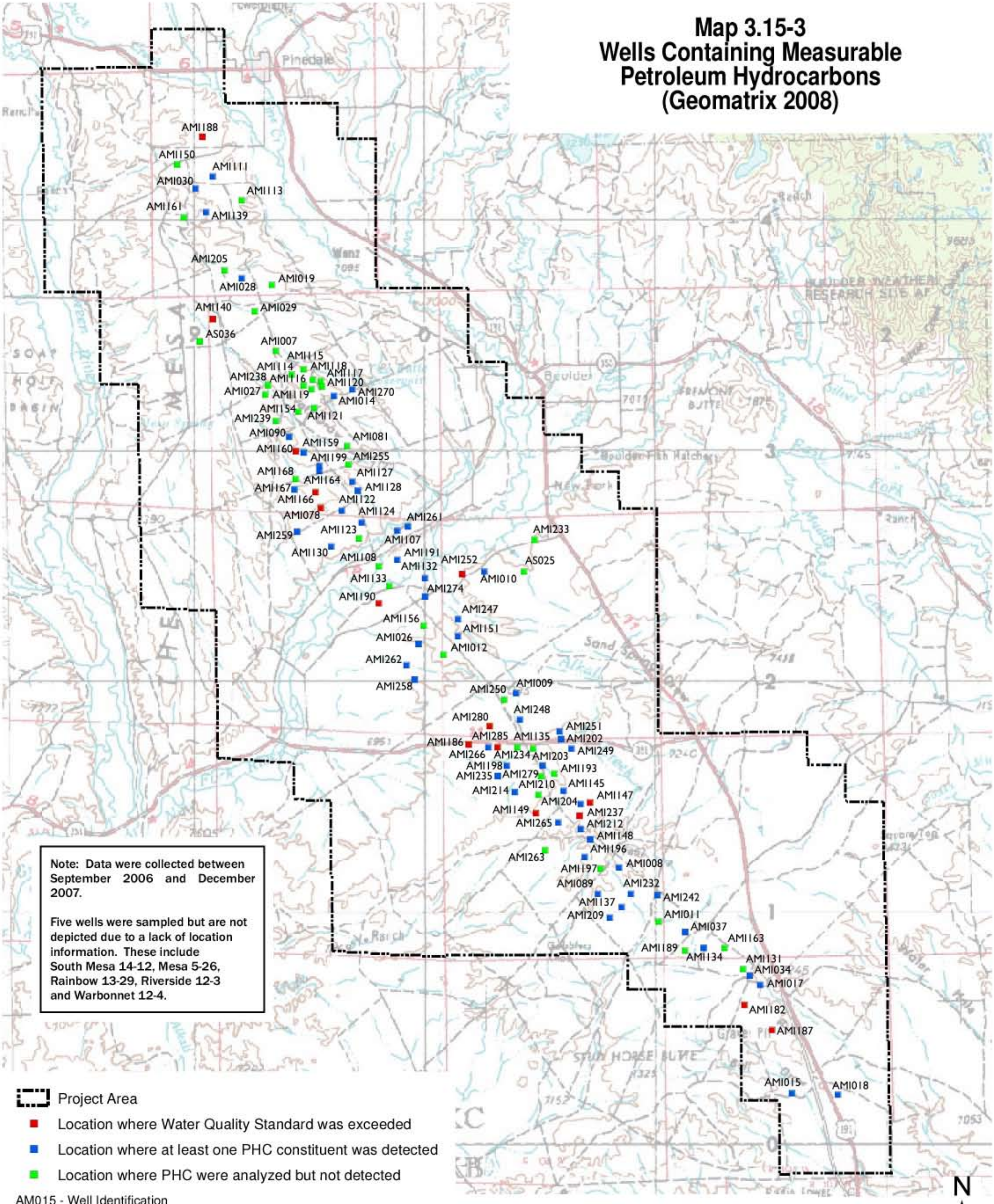
3.16 SURFACE WATER

3.16.1 Natural Gas Development in the PAPA

The major streams in the PAPA are the Green and New Fork rivers. The New Fork River originates in the Wind River Range north and east of the PAPA, and cuts across the PAPA to join the Green River, which originates in the Wyoming and Wind River ranges to the north and northwest. These rivers are fed mostly by snowmelt, with runoff rising from April to peak flow in June. Groundwater feeds baseflow in streams from October through March, during which time there is little precipitation except for headwater snowpack accumulation. There are several reservoirs on New Fork tributaries that provide flood control, supply water to irrigation, and are recreational and fish and wildlife resources. Ephemeral streams south of the New Fork River drain the PAPA to the Green River in an area of low relief and salty soils.

The Green and New Fork rivers have high quality water above the PAPA, with TDS typically less than 100 mg/L in headwaters. Salinity in the New Fork River actually decreases along the northeast flank of the PAPA due to dilution by very low TDS streams entering from the east. In the Green River and in the New Fork River from Boulder to the Green River, salinity increases downstream are due to contributions from irrigation return flow, groundwater discharge, and runoff from salty soils in the lower reaches. These two rivers are prime sport fishing waters over their entire lengths.

Map 3.15-3 Wells Containing Measurable Petroleum Hydrocarbons (Geomatrix 2008)



No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM

Table 3.15-1
Reported Organic Concentrations in Wells[1]

DEQ Water Quality Standard		5 ug/L	1000 ug/L	700 ug/L	1000ug/L	1000ug/L	1000ug/L	7.3 (mg/L)	1.1 (mg/L)
Well ID	**Sample Data**	**Benzene (ug/L)**	**Toluene (ug/L)**	**Ethylbenzene (ug/L)**	**m+p Xylenes (ug/L)**	**o-Xylene (ug/L)**	**Xylenes (total) (ug/L)**	**GRO (mg/L)**	**DRO (mg/L)**
AM1078	9/22/2006	ND	ND	ND	ND	ND	NR	ND	NM
AM1078	1/16/2007	< 1	22	< 1	NM	NM	< 3	0.1	5.2
AM1078	1/16/2007	< 1	22	< 1	NM	NM	< 3	< 0.1	5.2
AM1078	11/28/2007	< 0.5	19	< 0.5	0.61	< 0.5	NR	0.08	< 1
AM1140	9/7/2006	290	4400	1200	16000	3000	19000	46	NM
AM1140	9/18/2006	21	640	240	2300	560	2800	8.42	NM
AM1140	10/25/2006	6.9	83	14	NM	NM	325	NM	NM
AM1140	2/15/2007	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	NR	< 0.036	< 1
AM1140	7/16/2007	< 0.5	< 0.5	< 0.5	1.6	< 0.5	NR	< 0.036	< 1
AM1140	11/7/2007	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	NR	< 0.036	< 1
AM1147	1/19/2007	< 1	43	< 1	NM	NM	< 3	< 0.1	230
AM1147	5/10/2007	ND	ND	ND	ND	ND	NR	ND	NM
AM1149	11/5/2007	4.8	13	ND	ND	ND	NR	0.052	ND
AM1149	11/5/2007	5.2	13	ND	ND	ND	NR	0.051	ND
AM1160	11/13/2006	< 0.5	69	< 0.5	0.85	< 0.5	NR	< 0.103	7.4
AM1160	2/14/2007	< 0.5	8.5	< 0.5	0.97	< 0.5	NR	< 0.036	3.4
AM1160	10/26/2007	< 0.5	0.95	< 0.5	2.1	< 0.5	NR	< 0.036	< 1
AM1166	1/16/2007	< 1	< 5	< 1	NM	NM	< 3	< 0.1	1.7
AM1166	12/11/2007	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	NR	< 0.036	< 1
AM1182	12/6/2006	5.9	< 0.5	< 0.5	< 0.5	< 0.5	NR	< 1	0.052
AM1186	9/29/2006	3.4	27	3.8	54	12	66	0.358	NM
AM1186	10/4/2006	< 0.5	2.4	< 0.5	NM	NM	4.35	NM	NM
AM1186	10/4/2006	0.5	2.4	0.5	3.6	0.75	4.35	ND	NM
AM1186	7/16/2007	< 0.5	< 0.5	< 0.5	0.55	< 0.5	NR	< 0.036	< 1
AM1186	11/6/2007	< 0.5	45	< 0.5	3.7	1	NR	< 0.204	1.8
AM1187	5/10/2007	2.9	ND	ND	ND	ND	NR	ND	NM
AM1187	6/8/2007	25	1.3	ND	ND	ND	NR	0.078	NM
AM1188	11/17/2006	6.6	63	1.7	17	4.3	NR	0.12	< 2.4
AM1188	2/12/2007	5	48	1.3	13	3.3	NR	0.094	< 1
AM1188	2/12/2007	5.58	58	1.53	14	3.44	17.7	0.209	0.31
AM1188	6/5/2007	ND	ND	ND	ND	ND	NR	ND	NM
AM1188	7/16/2007	< 0.5	1.7	< 0.5	< 0.5	< 0.5	NR	< 0.036	< 1

DEQ Water Quality Standard		5 ug/L	1000 ug/L	700 ug/L	1000ug/L	1000ug/L	1000ug/L	7.3 (mg/L)	1.1 (mg/L)
Well ID	**Sample Data**	**Benzene (ug/L)**	**Toluene (ug/L)**	**Ethylbenzene (ug/L)**	**m+p Xylenes (ug/L)**	**o-Xylene (ug/L)**	**Xylenes (total) (ug/L)**	**GRO (mg/L)**	**DRO (mg/L)**
AM1188	10/26/2007	< 0.5	0.92	< 0.5	< 0.5	< 0.5	NR	< 0.036	< 1
AM1190	1/16/2007	< 1	< 5	< 1	NM	NM	< 3	< 0.1	7.4
AM1190	1/16/2007	< 1	< 5	< 1	NM	NM	< 3	< 0.1	7.6
AM1190	12/11/2007	< 0.5	4.4	< 0.5	< 0.5	< 0.5	NR	0.08	< 1
AM1237	1/18/2007	52	93	2	NM	NM	18	0.33	< 0.1
AM1237	6/1/2007	85	95	2.4	18	2.5	NR	0.696	NM
AM1237	6/25/2007	77	92	2.4	18	2.4	NR	0.648	NM
AM1252	1/16/2007	< 1	110	< 1	NM	NM	< 3	0.35	2.8
AM1252	1/16/2007	< 1	110	< 1	NM	NM	< 3	0.31	4
AM1280	11/13/2006	< 0.5	12	< 0.5	< 0.5	< 0.5	NR	< 0.036	3.9
AM1280	2/13/2007	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	NR	< 0.036	< 1
AM1280	2/13/2007	< 1	< 1	< 1	< 2	<1	< 3	< 0.05	< 0.25
AM1280	10/30/2007	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	NR	< 0.036	< 1
AM1285	10/30/2007	28	25	0.63	5.2	< 0.5	NR	0.193	< 1
AM1285	11/26/2007	3	2.4	<0.5	0.55	< 0.5	NR	0.074	< 1

[1] Source: Geomatrix, 2008.
[2] ND-Not Detected, NM-No Measurement, NR-Not Reported.

Three other perennial streams passing through the PAPA are Duck Creek, East Fork River, and Pine Creek. These are all tributaries to the New Fork River. Most of the PAPA is drained by numerous ephemeral streams, each of which collect and drain water from small sub-watersheds within the PAPA. These streams also receive some seepage from groundwater, although it is insufficient to sustain surface flow throughout the year. For most, if not all ephemeral streams in the PAPA, runoff peaks during snowmelt. Thunderstorms can also generate sporadic stream flow.

There are 21 sub-watersheds (Hydrologic Unit Code level 6 in USGS classification) draining the PAPA (Map 3.16-1); ten of these are only on the margins of the PAPA. The largest sub-watershed complex, flowing to the New Fork River in the eastern portion of the PAPA, includes drainage from Duck Creek, Sand Springs Draw, and several unnamed draws and ditches. On the west side of the PAPA, Tyler Draw and a few other unnamed draws in the northwest portion of the PAPA are intermittent. North Alkali Draw and Sand Draw drain to Alkali Creek, which is tributary to the Green River from the southwest portion of the PAPA. The Green River is not present in the southwest portion of the PAPA. Water Hole Draw, Mud Hole Draw, Bull Draw, and other small drainages discharge to the Big Sandy River in the southeast portion of the PAPA.

3.16.1.1 Colorado River Basin Salinity Considerations

The PAPA is in the upper Colorado River Basin, for which special regulation has been enacted to control and mitigate river water salinity, in order to fulfill treaty obligations with Mexico. Congress enacted the Colorado River Basin Salinity Control Act, Public Law 93-320 1974 Title II – Water Quality Program for Salinity Control, and the 1984 Amendment, Public Law 98-569, directing the BLM to implement a comprehensive program to minimize salt loading in the Colorado River Basin. The BLM coordinates salinity control activities with the Colorado River Basin Salinity Control Forum (CRBSCF), the U.S. Bureau of Reclamation, and the NRCS. The BLM, U.S. Bureau of Reclamation, and NRCS receive Congressional funding for salinity control. Other federal agencies that have a stake and participate in the CRBSCF Work Group meetings include EPA, USFWS, and the USGS.

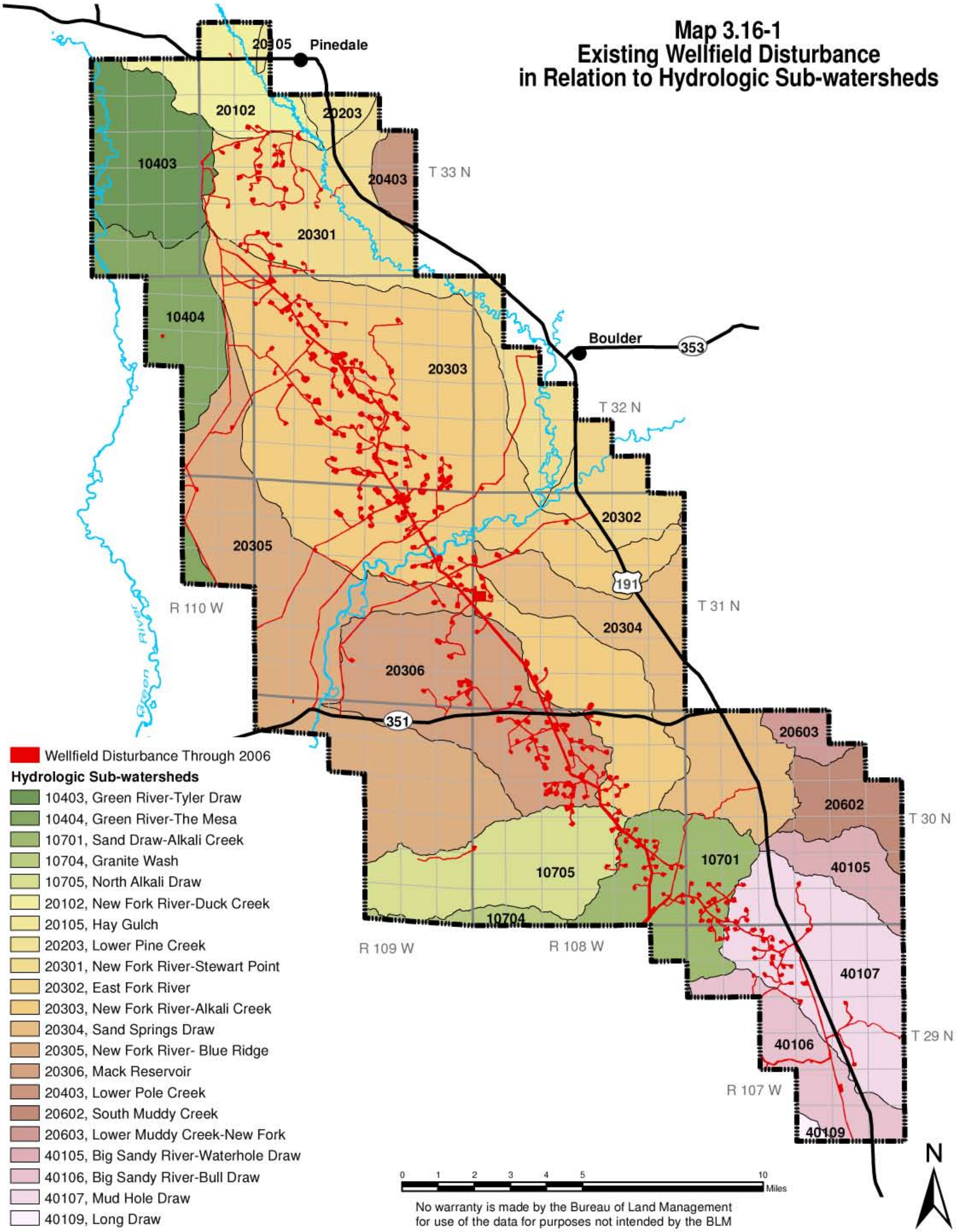
The CRBSCF identified rapidly expanding energy development in the Upper Colorado River Basin as a high-priority issue. This is because it has the potential of an adverse effect on achieving the adopted numeric salinity standards, which would violate the water-quality salinity-based standards and endanger downstream water users, and potentially affect the United States' agreement with Mexico.

3.16.1.2 Surface Water Quality

All of the Green River upstream of the confluence with the New Fork River is designated Class 1 water under WDEQ-WQD Surface Water Standards (WDEQ, 2001). This means that these are "outstanding" waters that may not be degraded. The waters of the New Fork River and tributaries are Class 2AB, which means that they support game fish populations at least seasonally, and the supply and water quality is suitable for supporting drinking water use. Class 2AB waters are also protected for nongame fisheries, fish consumption, aquatic life other than fish, primary contact recreation, wildlife, industry, agriculture and scenic value uses. Neither the Green River or New Fork River nor any of their tributaries in the PAPA are included in Wyoming's Section 303(d) 2006 list of impaired waters (WDEQ, 2006).

The SCCD monitors water in the streams of the New Fork basin quarterly. Details of the monitoring program are found in the Sampling and Analysis Plan (SCCD and PAWG, 2005). The samples are collected in March (estimated spring runoff peak), July (peak flow), and the first week in September and November. Biological samples are taken in the latter two periods.

Map 3.16-1
Existing Wellfield Disturbance in Relation to Hydrologic Sub-watersheds



Annual reports that include monitoring analysis data, compilation of spill reports from the PAPA, and incremental surface water sampling are prepared and provided by the SCCD to the PAWG Water Resources Task Group and the BLM by December 1 of the same year. They are reviewed with the public during the annual AM review, as required by the PAPA ROD (BLM, 2000b).

A report by EcoAnalysts, Inc. (2005) concluded that there had been no discernible change in water chemistry, salt load, sediment load, or invertebrate biology indices between 2000 and 2005. Suspended sediment load (field measurement of turbidity and lab measurement of total suspended solids) is not statistically higher just above the confluence with the Green River than it is at upstream stations. EcoAnalysts, Inc. inspected the bed for indications of increase in fine bed load which would impair aquatic life.

There are three stream monitoring points relating directly to the PAPA. They are on the New Fork River above the PAPA (NF4) and one each upstream (NF30) and downstream (NF19) of the point where the New Fork River crosses the PAPA. Data show that salinity (as TDS) decreases down the northwest flank of the PAPA (from NF4 to NF30), then increases again across the PAPA to NF19. The decrease is due to dilution by tributaries coming off the Wind River Range (such as Pole and Boulder creeks). The increase is due to Alkali Creek and other drainages entering the PAPA. TDS in the New Fork River above Pinedale (NF4) seasonally exceeds 500 mg/L. It is lowest in high water, when more water comes directly from snowmelt, and highest in low flow periods when groundwater seepage in upper catchments sustains baseflow. New Fork River water has predominantly calcium and bicarbonate ions, and is approximately pH neutral (headwater streams average pH 8).

Total suspended solids (TSS), measured at the same monitoring points, is often used as an index of increase or decrease of total sediment (no simple method exists for measuring total sediment load, which has suspended and bed load components). TSS is generally less than 10 mg/L in all waters of the New Fork catchment, but variable in the spring, when rain showers can cause it to rise. Many reports are given over 20 mg/L in spring. Highest TSS values in the monitoring record are from the New Fork River near the Green River confluence, below Alkali Creek. SCCD does not monitor water quality in the Green River, but Lowham (1985) indicated suspended solids averaged 23 mg/L in the upper Green River above the PAPA.

The presence of aquatic insects, such as mayflies, stoneflies, and caddisflies, is an indicator of stream health, because these species are considered to be highly sensitive to disturbance. Conversely, an abundance of nematodes, spiders, and mites can indicate that a stream is stressed. EcoAnalysts, Inc. surveyed invertebrate life in the New Fork catchment annually between 2000 and 2005 to assess the condition of the river. Samples taken at five SCCD monitoring points suggest that stream health in the New Fork catchment ranges from fair to very good (EcoAnalysts, 2005). More extensive sampling is required in order to confirm this evaluation. Water quality data have been sampled at each of the USGS gauge locations as shown below in Figure 3.16-1. Water quality data since 2000 are available only from the Green River, below Fontenelle Reservoir. Water temperature varies during each year ranging from around 65^{o}F in August to 36^{o}F in January (Figure 3.16-1). Water temperatures in the New Fork River follow annual patterns similar to temperatures in the Green River.

Water quality data collected at all four gauge locations noted in Table 3.16-1 include the concentration of dissolved oxygen (DO). DO solubility is limited by water temperature; more oxygen can be dissolved in cold water than in warm water, as seen in the monitoring trend in Figure 3.16-2.

Measurements of DO in the Green River below Fontenelle Reservoir show an apparent declining trend from 2000 through 2006 (Figure 3.16-3), particularly in summers (Figure 3.16-4). This does not correlate with water temperature trends, and may be related more to biochemistry in the reservoir rather than in the Green River. It could be related to late summer growths of algae and other aquatic plants. Elevated concentrations of phosphorous, known to stimulate algal blooms, have been documented in some tributaries to the Green River (Wyoming Water Development Commission, 2001). In September 2007, the U.S. Bureau of Reclamation announced testing of water quality in Fontenelle Reservoir to determine if toxins were present in the water due to growths of blue-green "algae" (cyanobacteria) during a late season bloom (U.S. Bureau of Reclamation, 2007). Results of the tests are not yet available. River flows have been lower through this period, and this and other factors may contribute to reservoir DO trends.

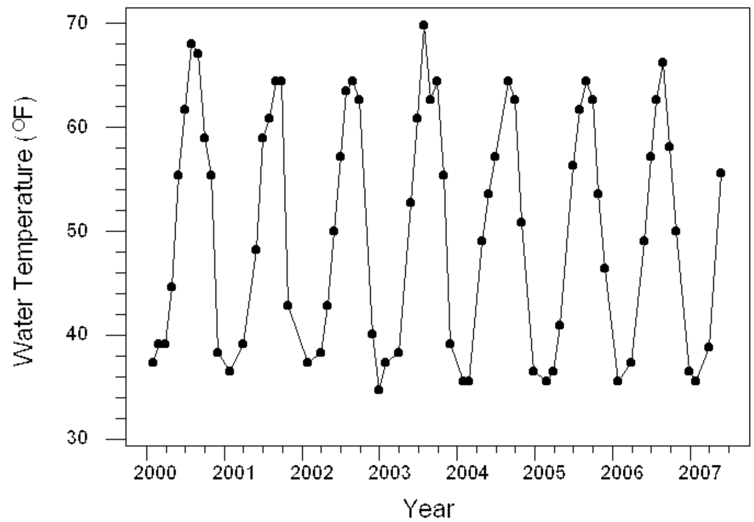


Figure 3.16-1
Variation of Water Temperatures (°F) in the Green River below Fontenelle Reservoir from 2000 to 2007

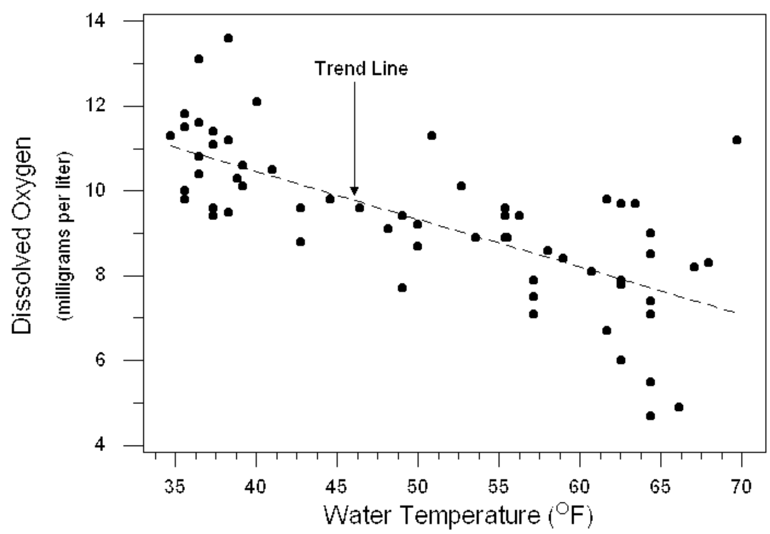


Figure 3.16-2
Relationship of Dissolved Oxygen Concentration to Water Temperature Observed in the Green River below Fontenelle Reservoir

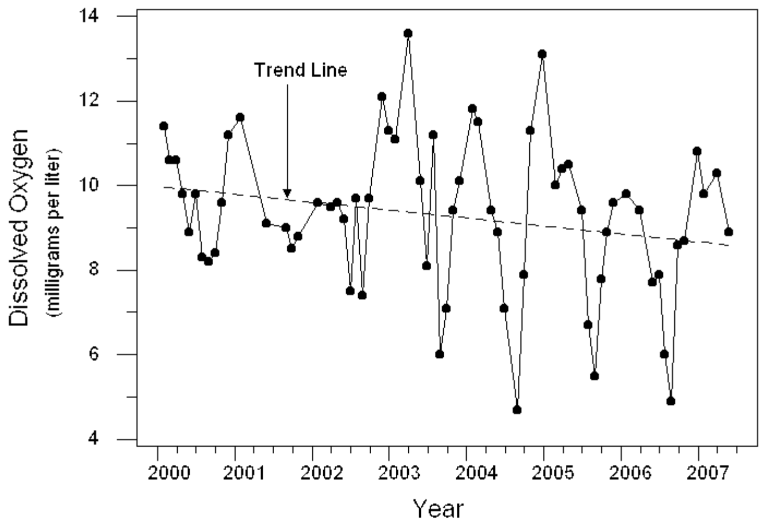


Figure 3.16-3
Declining Trends in Dissolved Oxygen Concentrations over Annual Cycles from 2000 to 2007 in the Green River below Fontenelle Reservoir.

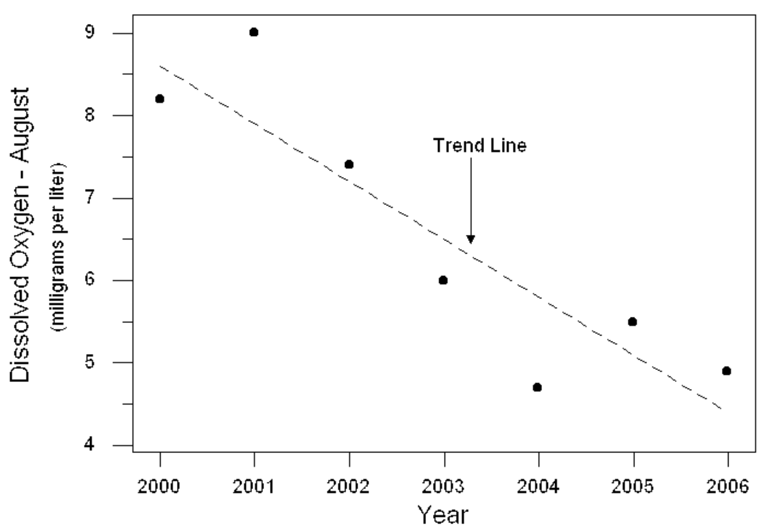


Figure 3.16-4
Declining Trends in Dissolved Oxygen Concentrations during each August from 2000 to 2007 in the Green River below Fontenelle Reservoir

3.16.1.3 Surface Water Quantity

The USGS maintains river gauging stations on the Green River near Daniel, which is upstream from the PAPA and downstream of the Fontenelle Reservoir near LaBarge. USGS gauging stations on the New Fork River are near the confluence with the Green River. The annual average flow rates (in cubic feet per second, or cfs) at these stations over the period of record are summarized in Table 3.16-1. The main tributaries to the Green River between the gauge near Daniel and below Fontenelle Reservoir are the New Fork River and Cottonwood, Big Piney, LaBarge, and Fontenelle creeks.

Table 3.16-1
Average Annual Flow Rates from Gauging Stations Near the PAPA

Gauge location	USGS Gauge Number	Period of Record	Minimum Annual Average Flow (cfs)	Mean Annual Average Flow (cfs)	Maximum Annual Average Flow (cfs)
Green River, Warren Bridge, near Daniel	09188500	1932 - 2006	280	499	768
New Fork River near confluence with Green River	09205000	1954 – 2006	313	721	1,288
Green River, near LaBarge	09209400	1963 – 2006	668	1,580	2,908
Green River, below Fontenelle Reservoir	09211200	1964 - 2005	609	1,595	3,060

With the exception of annual flows in 2005, annual average flows on the New Fork River near its confluence with the Green River have been below the long-term average of 721 cfs since 2000, most likely due to below average precipitation (Table 3.3-1). Average flows measured on the New Fork River are directly related to total precipitation estimated on the PAPA for each Water Year (October through September) from 2000-2001 though 2006-2007 (Figure 3.16-5).

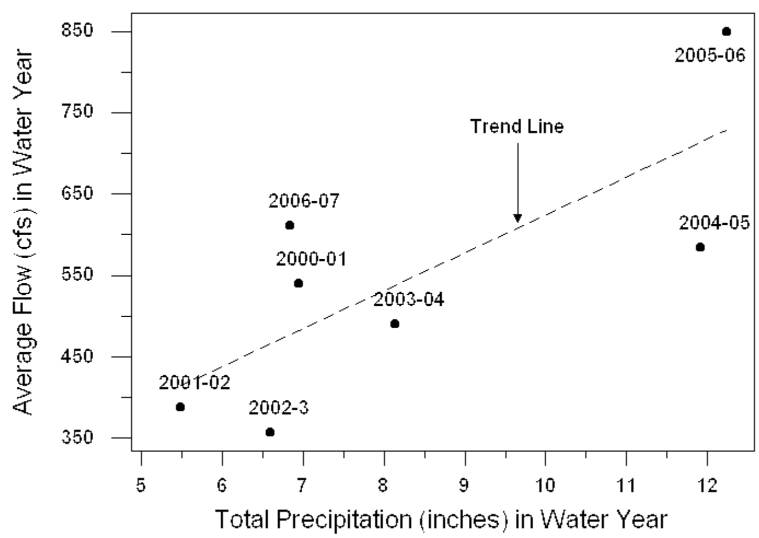


Figure 3.16-5
Relationship of Average Flows to Total Precipitation on the New Fork River During each Water Year from 2000-2001 through 2006-2007

There are approximately 377 adjudicated water rights on the New Fork River between Pinedale and Boulder, and another 270 between Boulder and the Green River (SEO, 2006). There are 54 adjudicated water rights on the Green River at the north end of the PAPA (T. 33 N., R. 110 W.). These points of diversion are predominantly for irrigation. The appropriated flows total 13,000 acre-feet/year, which is equivalent to 18 cfs.

3.16.1.4 Wellfield Development Effects

The sub-watersheds recognized by the USGS (Map 3.16-1) and the total surface area of the basins in the PAPA are listed in Table 3.16-2. The table also shows surface disturbance

Table 3.16-2
Existing Surface Disturbance in Relation to Hydrologic Sub-watersheds

Sub-Watershed (HUC 6)	Sub-Basin	Hydrologic Unit Code	Total Area in Basin (acres)	Total Area of Basin in the PAPA (acres)	Percent of Basin in the PAPA	Existing Wellfield Disturbance through 2006 (acres)			Percentage Disturbance in Basin	Percentage of the Basin Disturbed in the PAPA
						Federal Lands	Non-Federal Lands	All Lands		
Big Sandy River-Bull Draw	Big Sandy River	140401040106	19,768	5,761	29.1	72.3	1.0	73.3	0.4	1.3
Big Sandy River - Long Draw	Big Sandy River	140401040109	18,529	316	1.7	0.0	0.0	0.0	0.0	0.0
Big Sandy River-Waterhole Draw	Big Sandy River	140401040105	23,876	3,349	14.0	0.0	0.0	0.0	0.0	0.0
Mud Hole Draw	Big Sandy River	140401040107	19,619	12,923	65.9	346.0	2.1	348.1	1.8	2.7
East Fork River	New Fork River	140401020302	25,005	4,885	19.5	4.2	0.0	4.2	<0.1	0.1
Hay Gulch	New Fork River	140401020105	14,668	245	1.7	0.0	0.0	0.0	0.0	0.0
Lower Muddy Creek-New Fork	New Fork River	140401020603	34,520	1,492	4.3	0.0	0.0	0.0	0.0	0.0
Lower Pine Creek	New Fork River	140401020203	25,749	1,276	5.0	0.0	0.0	0.0	0.0	0.0
Lower Pole Creek	New Fork River	140401020403	20,119	1,757	8.7	0.0	0.0	0.0	0.0	0.0
Mack Reservoir	New Fork River	140401020306	15,353	15,353	100.0	640.6	175.4	816.0	5.3	5.3
New Fork River-Alkali Creek	New Fork River	140401020303	49,532	49,522	100.0	1,970.1	320.8	2,290.9	4.6	4.6
New Fork River- Blue Ridge	New Fork River	140401020305	39,853	24,909	62.5	196.0	13.1	209.1	0.5	0.8
New Fork River-Duck Creek	New Fork River	140401020102	37,229	5,521	14.8	21.2	15.1	36.3	0.1	0.7
New Fork River-Stewart Point	New Fork River	140401020301	32,670	17,218	52.7	286.4	84.4	370.8	1.1	2.2
Sand Springs Draw	New Fork River	140401020304	19,073	13,208	69.2	48.1	0.2	48.3	0.3	0.4
South Muddy Creek	New Fork River	140401020602	33,923	4,121	12.1	0.0	0.0	0.0	0.0	0.0
Granite Wash	Upper Green River	140401010704	12,218	1,091	8.9	0.0	0.0	0.0	0.0	0.0
Green River-The Mesa	Upper Green River	140401010404	41,713	7,293	17.5	4.2	0.0	4.2	<0.1	0.1
Green River-Tyler Draw	Upper Green River	140401010403	34,761	8,834	25.4	18.3	0.0	18.3	0.1	0.2
North Alkali Draw	Upper Green River	140401010705	15,918	9,959	62.6	113.5	21.0	134.5	0.8	1.4
Sand Draw-Alkali Creek	Upper Green River	140401010701	22,941	9,004	39.2	420.1	60.5	480.6	2.1	5.3
				198,037		**4,141.0**	**693.6**	**4,834.6**		

resulting from wellfield activities through November 2006. Most surface disturbance has occurred within the Anticline Crest.

The Mack Reservoir sub-watershed has the most disturbance in the PAPA relative to its total area within the PAPA. Over 5 percent (816 acres) of this basin in the PAPA was disturbed through November 2006. Other basins with relatively high surface disturbance as a result of wellfield activities include the New Fork River-Alkali Creek basin (4.6 percent); Sand Draw-Alkali Creek (2.1 percent), and Mud Hole Draw (1.8 percent).

3.16.1.5 Watershed Modeling

In August 2006, HydroGeo, Inc. (2006) modeled erosion and sediment loading of current conditions. Salt concentrations in stream water were not explicitly modeled, but increases in concentration are proportional to the area of soil disturbance. Two USDA models, SWAT and KINEROS2, were used to model impacts in 15 sub-watersheds. The models assumed no use of sediment control measures, no reclamation, and was not calibrated by field measurements.

The HydroGeo report concludes that there is negligible sediment transport off low slopes in the PAPA, and up to 0.04 metric tons annually per hectare (35 lb/acre/yr) off the steepest slopes. According to the report, an average of 800 metric tons of sediment is mobilized each year in the PAPA under 2006 conditions (again, assuming no sediment control). Much of the modeled sediment mobilization occurred at low storm frequencies (high precipitation), but sediment largely remained within the lower basins until larger storms move it out. Some of the Operators are conducting first flush monitoring on some of the streams draining from the PAPA. For first flush monitoring, storm water samples are collected the first time a new well pad generates runoff.

Modeling indicates that current disturbances do not contribute significantly to more sediment transport than would pristine condition with no anthropogenic disturbance, except in the Mack Reservoir, Mud Hole Draw, New Fork-Alkali Creek, New Fork-Stewart Point, and North Alkali Draw sub-watersheds. Similarly, salt yield off the PAPA, through leaching of dissolved solids in soils, has probably not significantly increased due to natural gas development, except in these same sub-watersheds. The model assumed a single storm event and did not consider incremental movement over time.

WDEQ-WQD has promulgated new stormwater and sediment control protocols (WDEQ, 2007) which are more detailed than the Gold Book (USDI-BLM and USDA USFS, 2007) best management practices. As these are voluntarily adopted by Operators, the actual storm sediment yields may decrease despite increased surface disturbance.

3.16.1.6 Produced Water

Due to elevated TDS, sulfate, and hydrocarbons, produced water from the Lance Formation is suitable only for industrial use without treatment. Operators use produced water to drill out the gas production intervals after casing production wells through overlying aquifers. Some production water is treated and used for drilling and dust control on roads. Some production water and treatment plant waste is directed to waste injection wells.

One water treatment facility currently handles PAPA produced water, the Anticline Disposal Facility. Produced water is either piped or trucked to the Anticline Disposal Facility, depending on the Operator. The facility’s capacity has expanded. In 2005, 40 to 60 percent of water used in well completions (fracturing) was produced water with minimal or no treatment. The balance of the water used for completions is either more extensively treated water or Wasatch Formation groundwater. Up to 25,000 barrels of water are used in a single well completion. About half of this water flows back immediately and is recaptured. In summer, Operators use evaporative sprinklers in the reserve pits to reduce the amount of water to be disposed.

Waste injection wells in and near the PAPA are used to dispose of water surplus to drilling needs and treatment capacity. Injection wells used for PAPA disposal are summarized in Table 3.16-3.

Table 3.16-3
Class II Water Disposal Wells in Vicinity of PAPA[1]

Well Name[2,3]	Field	Location	Formation	Owner
1 WDW	Jonah	S. 19, T. 29 N. R. 107 W.	Upper Fort Union	BP America Production Co
36-1 Lovatt Draw	Pinedale	S. 36, T. 32 N., R. 109 W.	Fort Union – Lance	Petrogulf Corp
6-16 Riverside WDW	Pinedale	S. 16, T. 31 N., R. 109 W.	Fort Union	Ultra Resources
8 WDW S Mesa 11-24	Pinedale	S. 24, T. 30 N., R. 109 W.	Fort Union	Shell Rocky Mountain
11 Highway Federal	Pinedale	S. 3, T. 29 N., R. 107 W.	Fort Union	Yates Petroleum Corp

[1] Source: WOGCC, 2007.
[2] All wells are in Sublette County.
[3] All wells were permitted and in existence in 2006.

Anticline Disposal has a discharge permit (WY 0054224, May 2006) for up to 630,000 gallons per day of treated water (approximately 1 cfs), meeting standards for pH, chloride, radium, and TDS (500 mg/L is necessary to qualify as a clean water discharge under the Colorado River Salinity Forum). Anticline Disposal had plans to begin discharge of treated produced water in 2008. Discharged water must pass toxicity testing. An addendum to the permit requires toxicity testing on trout fingerlings, as well as the typical water flea and minnow tests. The discharge point is on the New Fork River, in Section 11, T. 31 N., R. 109 W.

3.16.1.7 Treated Sewage Water

Stallion Services treats sewage from several facilities in the PAPA through biotreatment and filtration. The Hydro-Action Portable Sewage Facility has a discharge permit from the WDEQ-WQD (05-070, March 2005) to discharge treated “gray water” by sprinkler, up to 4 inches per week. The discharge permit is valid for all counties in Wyoming. The limitation is intended to prevent water from infiltrating to groundwater. Discharge is purported to meet drinking water standards.

3.16.1.8 Surface Water Withdrawals

Operators may use river water to hydrostatically test new pipeline segments. Withdrawals are made under a S.W. 1 Temporary Permit to Appropriate Surface Water, issued by the Wyoming SEO. There must be provisions to protect fish at the pump intake. Hydrostatic test water is discharged to the surface following testing, assuring that water does not directly enter a flowing stream. Discharge is via a dissipating nozzle and dikes, and is supervised to prevent channeling or sheet-wash erosion. Discharge requires a Temporary Discharge Permit issued by the Wyoming WDEQ-WQD under the Federal Water Pollution Control Act (1972, amended in 1977 and since known as the Clean Water Act) and the Wyoming Environmental Quality Act, 1973, amended 1977.

3.16.2 Pipeline Corridors and Gas Sales Pipelines

The proposed corridor/pipeline alignments would cross three perennial streams: the New Fork River, the Green River, and the Blacks Fork River. The BCC, the RVII Pipeline, and the PBC Pipeline would cross the New Fork River, which is designated as Class 2AB by WDEQ-WQD (WDEQ, 2001). Class 2AB waters support game fish populations at least seasonally, and the supply and water quality is suitable for supporting drinking water use. Class 2AB waters are also protected for nongame fisheries, fish consumption, aquatic life other than fish, primary contact recreation, wildlife, industry, agriculture and scenic value uses.

The BFGC and the RVII Pipeline (Segment 2) would cross the Green River below Fontenelle Reservoir. The OPC and the Opal Loop III Pipeline would cross the Green River farther west.

The Green River is designated as Class 2AB at these locations. The OPC and the Opal Loop III Pipeline would cross the Blacks Fork River, which is designated as Class 2AB by WDEQ-WQD.

None of the river segments crossed by the proposed corridor/pipeline alignments are included in Wyoming's Section 303(d) 2006 list of impaired waters, except for the Blacks Fork River (WDEQ, 2006). The proposed BFGC and RVII Pipeline (Segment 2) cross the Blacks Fork River in Section 28, T. 19 N., R. 111 W. The listed stream segment of the Blacks Fork River is approximately 2.5 miles downstream of the corridor/pipeline crossing at the confluence with the Hams Fork River in Section 32, T. 19 N., R. 111 W. This downstream segment of the Blacks Fork River is listed as impaired due to high levels of fecal coliform bacteria.

Other surface water resources near the proposed corridor/pipeline alignments include intermittent, ephemeral, and perennial streams, livestock ponds, any seeps and springs, and flood plains of the New Fork, Green, and Blacks Fork rivers (BLM, 1999b). Stream channel stability varies from fair to poor.

3.17 SOIL RESOURCES

3.17.1 Natural Gas Development in the PAPA

In the PAPA DEIS (BLM, 1999a), soils coinciding with the PAPA were classified into four broad groups, based primarily on differences in geologic origin (i.e., parent material and topographic or geomorphic position). The groups include: 1) terrace soils; 2) soils on pediment, alluvial fans and low terraces; 3) upland soils; and 4) alluvial soils on flood plains. No prime farmlands exist within the PAPA. Of particular concern in the PAPA DEIS were soils with characteristics that are considered sensitive to surface disturbance. The characteristics are included below:

- Group 1 - Terrace Soils. This soil group has few limiting or sensitive characteristics. The reclamation potential of this soil group is high because sufficient quality topsoil is typically present. The engineering properties of this soil group for road and well pad development are high because of the high content of coarse fragments in the subsoils. The coarse fragments increase the soil's strength and reduce or eliminate the need to haul in suitable base materials for construction purposes.

- Group 2 - Pediment, Alluvial Fans, and Low Terrace Soils. Most of these soils are characterized as non-sensitive with moderate to high reclamation potentials. The sensitive soils within group 2 include steep soils on escarpments which are either exposed bedrock (Wasatch Formation) or with shallow depth to bedrock. Such soils have a high runoff rate and erosion potential. The high runoff rate limits the effective moisture these soils receive and their shallow depth limits their water holding capacity. This causes these steep sensitive soils to be droughty which further reduces their reclamation potential.

- Group 3 - Flood Plain and Wetland Soils. Sensitive soil characteristics within this soil group include areas that are subject to flooding and soils with high water tables. This soil group has a high reclamation potential. Soils along the flood plains of the intermittent drainages in the southern end of the PAPA (e.g., Alkali Creek, North Alkali Draw, and Sand Springs Draw) are typically saline and can be sodic. Sodic soils are sensitive because of their potential to cause water quality impacts if disturbed. Eroded sediments from these soils could be transported to perennial waters. Additionally, the salinity and sodicity of these soils reduces their reclamation potential.

- Group 4 - Upland Soils. Upland soils have the greatest surface area in the PAPA. Sensitive soils within this group include steep, shallow soils or areas of exposed bedrock (Wasatch Formation) along Blue Rim. These soils have a high runoff rate and erosion potential. The high runoff rate limits the effective moisture these soils receive and their shallow depth limits their water holding capacity. This causes them to be droughty, which severely limits their reclamation potential. Badland soils are included in this sensitive soil group. Badland soils are unique landform features composed of raw exposed slopes of shale and soft sandstone, siltstone, and marlstone.

Sensitive soils (including those with a slope of 15 percent or greater) in the PAPA comprise the Sensitive Soils SRMZ, which also encompasses the Blue Rim Area of the southern PAPA (Map 3-17-1). The NRCS is currently conducting a third order soil survey in the southeastern portion of the PAPA and in adjacent lands in the Jonah Field Project Area. Available data from the NRCS survey were used by HydroGeo Inc. for watershed modeling.

As of November 2006, 57.6 acres of soils with slopes over 15 percent and 565.0 acres of the Blue Rim soils were disturbed as a result of wellfield activities (Table 3.17-1). Most surface disturbance to sensitive soils has been in the Blue Rim Area, primarily because the Anticline Crest passes through the eastern end of Blue Rim where the most intense natural gas development has occurred (Map 3-17-1). Within the combined area of the Sensitive Soils SRMZ, 595.2 acres had been disturbed through November 2006 as a result of wellfield development.

Table 3.17-1
Existing Wellfield Disturbance in Relation to Sensitive Soils and the Sensitive Soils SRMZ

Sensitive Soils Category	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Blue Rim Area Sensitive Soils	12,925	436.7	128.3	565.0
Sensitive Soils on slopes $\geq$ 15%	11,044	38.1	19.5	57.6
Sensitive Soils SRMZ[1]	21,645	458.5	136.7	595.2

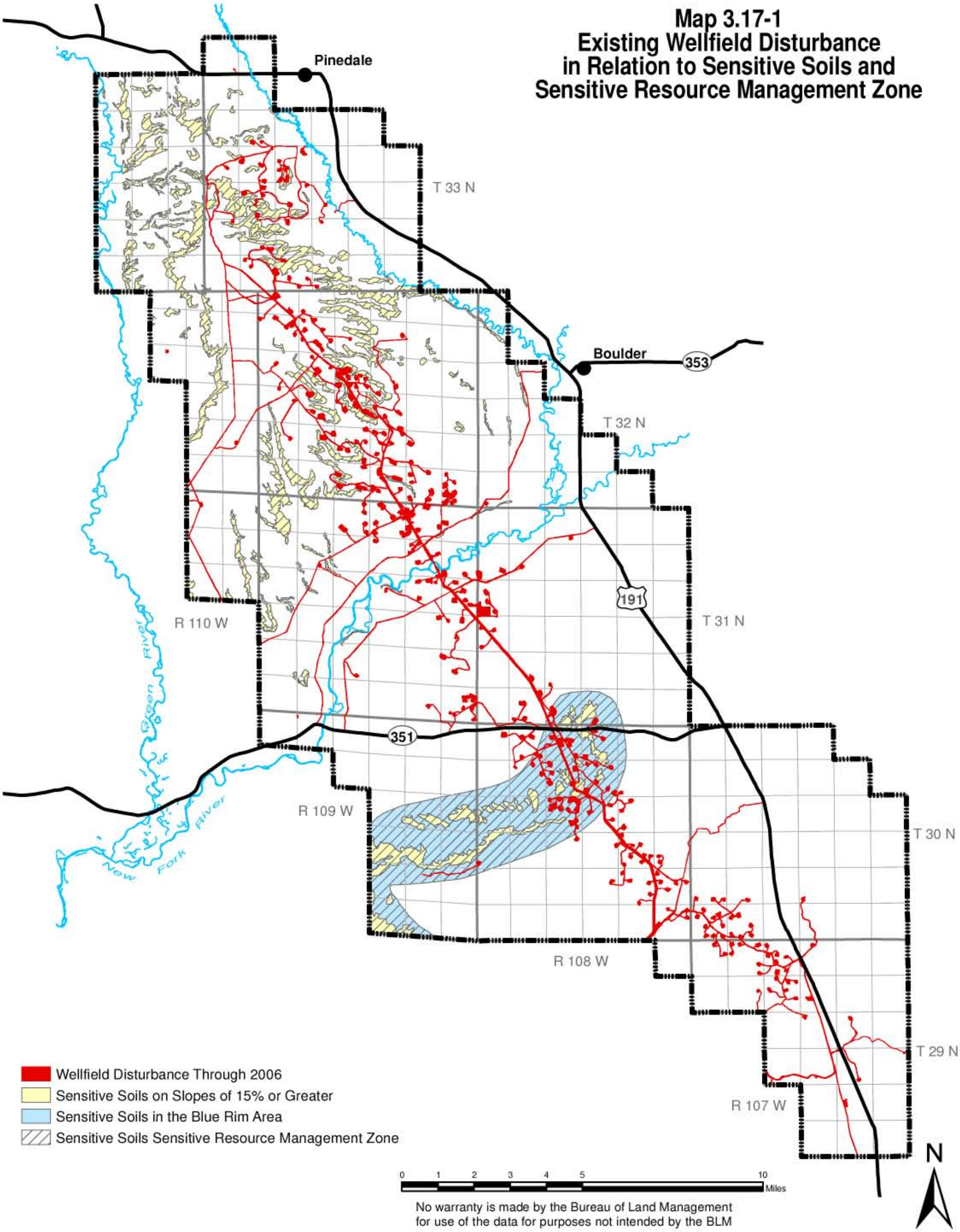
[1] Areas within Sensitive Soils SRMZ are not the combined total of the Blue Rim Area soils and soils on slopes greater than 15 percent because some soils are in both categories – see Map 3.17-1.

3.17.2 Pipeline Corridors and Gas Sales Pipelines

From north to south along the proposed corridor/pipeline alignments, the Wasatch Formation, the Laney member of the Green River Formation, and the Bridger Formation dominate the surface rock. These formations provide the principal parent materials for soils. Slopes range from nearly level to steeply sloping.

Soil development in upland areas with high clay-content parent materials resulted in a complex of aridic soils, or Aridisols. The majority of the upland soils crossed by the proposed corridor/pipeline alignments range from very shallow to mostly moderately deep, to deep, forming on rolling upland plains dissected by rock ravines, short escarpments, and draws (BLM, 1997 and 1999b).

The proposed corridor/pipeline alignments would cross sensitive upland soils including soils of the Blue Rim Area, which are shallow soils occupying steeper slopes and areas of rock outcrop. These soils typically have high water runoff rates and are subject to accelerated rates of soil erosion, especially when disturbed. The high runoff rates limit the effective moisture received by these soils. Their mostly shallow depth limits their water holding capacity, causing them to be droughty which limits reclamation potential.


Map 3.17-1
Existing Wellfield Disturbance
in Relation to Sensitive Soils and
Sensitive Resource Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
Sensitive Soils on Slopes of 15% or Greater
Sensitive Soils in the Blue Rim Area
Sensitive Soils Sensitive Resource Management Zone
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

Less sensitive upland soils include shallow to moderately deep to deep soils that occupy less steep topography. These less sensitive soils are more dominant in extent along the proposed corridor/pipeline alignments, but the shallow soil depths may still limit successful reclamation should recent drought conditions continue in the Green River Basin of Wyoming.

Bottomlands associated with drainages crossed by the proposed corridor/pipeline alignments are flood plains, terraces, and tributary alluvial fans of the perennial New Fork, Green, and Blacks Fork rivers, and several intermittent drainages. The bottomland soils of these drainages form in mostly alluvial deposits, vary in texture, are deep, and are subject to flooding. These soils typically have a high reclamation potential if they are not saline or sodic. These soils can be susceptible to gully erosion when disturbed.

Soils along the flood plains of the intermittent drainages are likely to be saline and can be sodic, containing high concentrations of sodium in proportion to concentrations of calcium and magnesium in the soil (BLM, 1999b). These soils are sensitive because of their potential to cause water quality impacts, if disturbed, and potential sedimentation of downstream perennial streams. The elevated salinity and possible sodicity of these soils reduces their reclamation potential (BLM, 1999b).

3.18 VEGETATION RESOURCES

3.18.1 Natural Gas Development in the PAPA

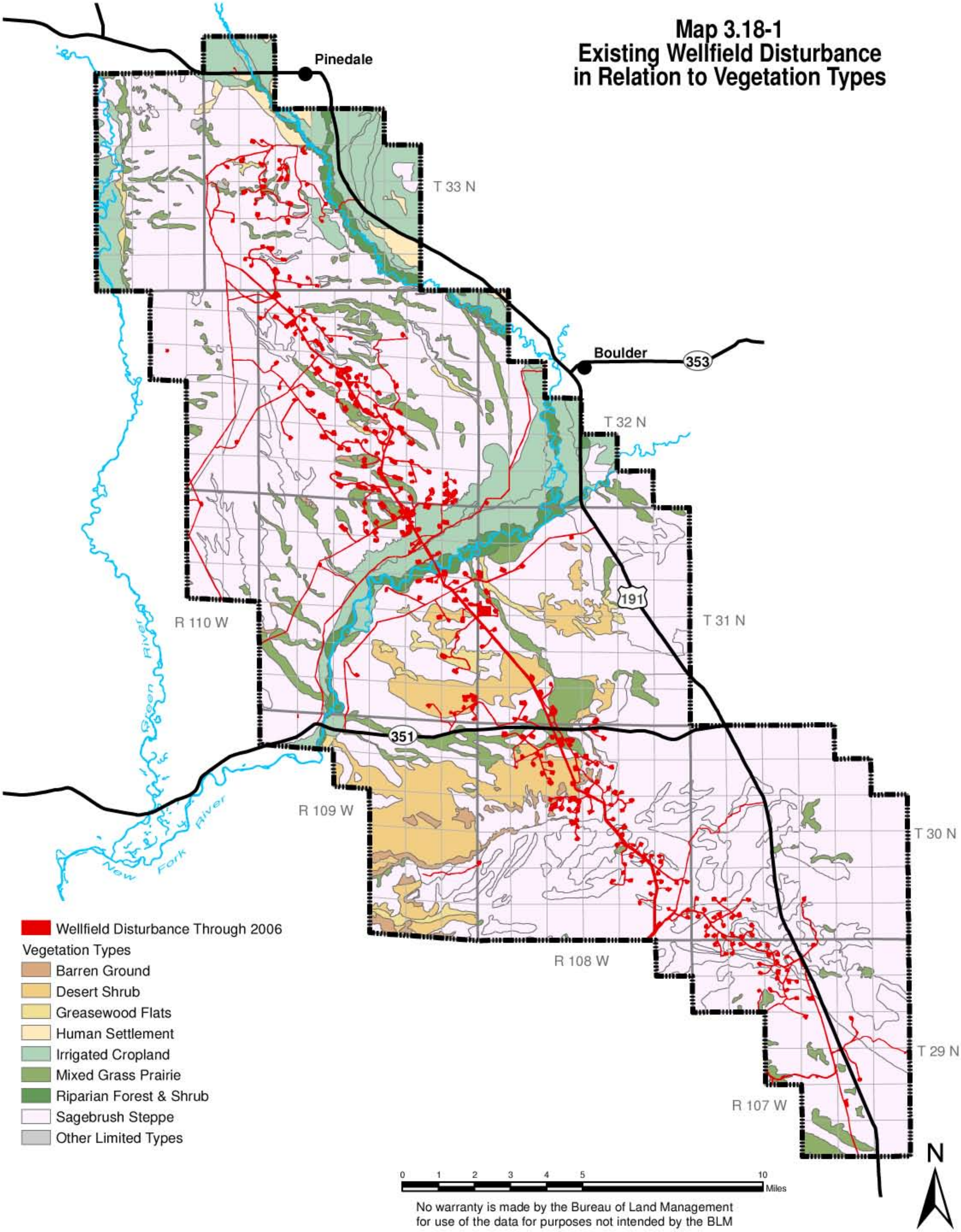
In the PAPA DEIS (BLM, 1999a), BLM described nine vegetation types (excluding human settlements) in the PAPA. Some types were composites of two sub-types, for example high density and low density Wyoming big sagebrush were combined as sagebrush steppe vegetation. Shrub-dominated and forest-dominated riparian vegetation were combined as riparian forest and shrub. Vegetation in the PAPA was mapped during preparation of the PAPA DEIS and the vegetation map is available through the Wyoming Geographic Information Science Center at the University of Wyoming (Map 3.18-1).

Most wellfield disturbance has been within the two sub-types of Wyoming big sagebrush (sagebrush steppe), which cover 147,165 acres of the PAPA. As of November 2006, wellfield activities have resulted in more than 3,900 acres of disturbance to sagebrush, approximately 2.7 percent of all sagebrush-dominated vegetation in the PAPA. A large portion of mixed grass prairie (340.8 acres or 2.8 percent) has also been disturbed (Table 3.18-1).

Table 3.18-1
Existing Wellfield Disturbance in Relation to Vegetation Types

Vegetation Category	Total Area) in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Sagebrush steppe	147,166	3,441.8	490.7	3,932.5
Mixed grass prairie	11,816	323.2	17.6	340.8
Greasewood flats	1,936	39.0	0.0	39.0
Desert shrub	11,560	225.9	68.1	294.0
Riparian forest and shrub	4,349	1.1	9.6	10.7
Other limited types	323	1.7	0.0	1.7
Barren ground	1,702	4.8	11.7	16.5
Irrigated cropland	17,677	103.5	94.6	198.1
Human settlement	1,508	0.0	1.3	1.3
Total	**198,037**	**4,141.0**	**693.6**	**4,834.6**

Map 3.18-1 Existing Wellfield Disturbance in Relation to Vegetation Types



No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM

The WGFD evaluated sagebrush growth, or production, on the Mesa since 2004 (Scribner, 2006). Production, measured as average length of sagebrush leaders was greatest in 2004 (1.25 inches) following a winter with average snowfall and above average precipitation for the water year (Table 3.3-1 and Appendix 17, Wildlife Technical Report). Sagebrush production declined in 2005 (average leader length = 0.73 inch) following a winter with below average snowfall but above average precipitation for the entire water year. Total precipitation for water year 2005-2006 was only 6.94 inches, less than the previous three water years (Table 3.3-1). As a consequence, sagebrush production on the Mesa measured in 2006 averaged 0.12 inch; the lowest average measurement over the three year testing period (Scribner, 2006).

Annual sagebrush growth appears to be related to moisture from winter snowfall. Because total snowfall (October through April) in the PAPA has been below the 30-year average of 58 inches since 1987 (except during winter 2003-2004, Section 3.3), sagebrush production, and most likely production of other plants in the PAPA, has been limited. WGFD data indicates very few young sagebrush plants in the region with most plants classified as mature or decadent (Scribner, 2006).

Invasive, Non-native Species. Many invasive plant species are classified as noxious weeds, are aggressive, and have the ability to dominate many sites with dramatic impacts to native plant communities. Noxious weeds are defined in EO 13112 as those “species whose introduction does or is likely to cause economic or environmental harm or harm to human health.” Wildlife habitat deteriorates, erosion increases, water quality diminishes, nutrient cycling and infiltration are altered, and recreational values are degraded (BLM, 1997). Weeds are often able to establish in areas following surface disturbance and are primarily present along roads, areas of oil and gas development, and in heavily grazed areas (BLM, 2003c). According to the Wyoming Cooperative Agricultural Pest Survey (CAPS), there are 24 state-designated noxious weeds and four county-declared weeds in Sublette County (Wyoming Weed and Pest Council, 2007). The declared county weeds are black henbane, scentless chamomile, field scabious, and western water hemlock. Only black henbane was considered in the PAPA DEIS (BLM, 1999a). Table 3.18-2 lists the CAPS weeds and their estimated acreages in Sublette County.

Table 3.18-2
Wyoming Designated Noxious Weeds in Sublette County

Common Name Scientific Name	Estimated Area (acres) in County for 2005	Wyoming Designated Noxious Weed [1]	Sublette County Declared Weed [2]	Weed of Concern in PAPA DEIS	Potentially Present in PAPA[3]
Black henbane *Hyoscyamus niger*	1-100	No	Yes	Yes	Yes
Canada thistle *Cirsium arvense*	5,000-20,000	Yes	–	Yes	Yes
Common burdock *Arctium minus*	0	Yes	–	No	No
Common tansy *Tanacetum vulgare*	1-100 (2003)	Yes	–	No	No
Dalmatian toadflax *Linaria dalmatica*	1-100	Yes	–	No	Yes
Dyer’s Woad *Isatis tinctoria*	1-100	Yes	–	Yes	Yes
Field bindweed *Convolvulus arvensis*	1-100	Yes	–	No	Yes
Field scabious *Knautia arvensis*	1-100	No	Yes	No	Yes
Hoary cress (whitetop) *Cardaria draba*	100-1,000	Yes	–	Yes	Yes

Common Name Scientific Name	Estimated Area (acres) in County for 2005	Wyoming Designated Noxious Weed [1]	Sublette County Declared Weed [2]	Weed of Concern in PAPA DEIS	Potentially Present in PAPA[3]
Houndstongue *Cynoglossum officinale*	1-100	Yes	–	No	Yes
Leafy spurge *Euphorbia esula*	1-100	Yes	–	Yes	Yes
Musk thistle *Carduus nutans*	1-100	Yes	–	Yes	Yes
Ox-ey daisy *Chrysanthemum leucanthemum*	1-100	Yes	–	No	Yes
Perennial pepperweed *Lepidium latifolium*	1,000-5,000	Yes	–	Yes	Yes
Perennial sowthistle *Sonchus arvensis*	100-1,000	Yes	–	Yes	Yes
Plumeless thistle *Carduus acanthoides*	0	Yes	–	No	No
Purple loosestrife *Lythrum salicaria*	0	Yes	–	No	No
Quackgrass *Agropyron repens*	1-100 (2003)	Yes	–	No	No
Russian knapweed *Centaurea repens*	1-100	Yes	–	Yes	Yes
Saltcedar *Tamarix spp.*	1-100	Yes	–	No	Yes
Scentless chamomile *Matricaria perforate*	1-100	No	Yes	No	No
Scotch thistle *Onopordum acanthium*	0	Yes	–	No	No
Skeletonleaf bursage *Franseria discolor*	0	Yes	–	No	No
Spotted knapweed *Centaurea maculosa*	1-100	Yes	–	Yes	Yes
St. Johnswort *Hypericum perforatum*	0	Yes	–	No	No
Western water hemlock *Cicuta douglasii*	n/a	No	Yes	No	Yes
Yellow toadflax *Linaria vulgaris*	1-100	Yes	–	No	Yes

[1] A Designated Noxious Weed listing provides the State of Wyoming legal authority to regulate and manage noxious weeds per the Wyoming Weed and Pest Control Act of 1973 (Wyoming Weed and Pest Council, 2007).
[2] A County Declared Weed listing provides the county with legal authority to regulate and manage noxious weeds. Source: Wyoming Weed and Pest Council, 2007.
[3] Potentially present in PAPA if present within the Pinedale Field Office Planning Area (BLM, 2007c) and Wyoming Cooperative Agricultural Pest Survey (2007).

3.18.2 Pipeline Corridors and Gas Sales Pipelines

Vegetation along the proposed corridor/pipeline alignments consists primarily of sagebrush steppe with a limited grassland component. Wetlands and riparian communities are present at locations where the alignments cross the New Fork, Green, and Blacks Fork rivers. Species composition and habitat types vary depending on soil type, salinity, exposure, and moisture levels. Precipitation is a limiting factor for vegetation in the Green River Basin and the vegetative communities are dominated by species that require little water and can exist on aridic soils.

The sagebrush steppe vegetative community is widely distributed within and along the proposed corridor/pipeline alignments and is most often associated with valley bottoms and plateaus. Sagebrush density and distribution vary from sparse low-structure sagebrush interspersed with grasses and forbs in the understory to areas more densely vegetated by sagebrush. The species that commonly occur in this community include basin big sagebrush, Wyoming big sagebrush, sand sagebrush, rubber rabbitbrush, black greasewood, prickly pear cactus, spiny hopsage, Indian ricegrass, needle-and-thread grass, and western wheatgrass.

Grassland communities along the proposed corridor/pipeline alignments are generally limited in size. They are principally found on existing pipeline rights-of-way. Small patches occur along the proposed alignments. Species vary by soil type and ground use history and include western wheatgrass, thickspike wheatgrass, Indian ricegrass, Sandberg bluegrass, and needle-and-thread grass. Wyoming big sagebrush, rabbitbrush, broom snakeweed, winterfat, and greasewood are common shrubs of this grass community.

Recently disturbed corridors from existing pipeline rights-of-way are susceptible to infestations of invasive/noxious weeds such as Canada thistle, musk thistle, black henbane, and halogeton (*Halogeton glomeratus*). Field surveys in 2006 found that halogeton is present in many areas along the existing pipeline rights-of-way (Grasslands Consulting, Inc., 2006). Table 3.18-3 lists the declared weed species in Sublette, Sweetwater, Lincoln, and Uinta counties that are known or suspected to occur (Wyoming Weed and Pest Council, 2007).

Table 3.18-3
County Declared Species Known to Occur
in Sublette, Sweetwater, Lincoln, and Uinta Counties that may
Occur Along the Proposed Corridor/Pipeline Alignments

Common Name Scientific Name	Sublette County	Sweetwater County	Uinta County	Lincoln County
Black henbane *Hyoscyamus niger*	Present	Present	Present	
Scentless chamomile *Anthemis arvensis*	Present			
Field scabious *Knautia arvensis*	Present			
Western water hemlock *Cicuta douglasii*	Present			
Foxtail barley *Hordeum jubatum*	Present	Present		
Lady's bedstraw *Galium verum*		Present		
Mountain thermopsis *Thermopsis Montana*		Present		
Yellow starthistle *Centaurea solstitialis*			Present	
Viper's bugloss *Echium vulgare*			Present	
Wild oats *Avena fatua*				Present
Bull Thistle *Cirsium vulgare*	Present			Present

3.19 GRAZING RESOURCES

3.19.1 Natural Gas Development in the PAPA

There are 50 permittees on the 16 livestock grazing allotments that coincide with the PAPA (Map 3.19-1) and that were listed in the PAPA DEIS (BLM, 1999a). The BLM management categories for area allotments have not changed since the PAPA ROD was issued (BLM, 2003a); nor have there been changes to the grazing capacity (animal unit months or AUMs) since the PAPA DEIS (Schultz, 2006). Approximately 37,000 (maximum restriction) livestock are stocked within various allotments and various times during the annual cycle. Most livestock are cattle, although some permittees graze limited numbers of horses. There are approximately 165,738 allotted acres in the PAPA.

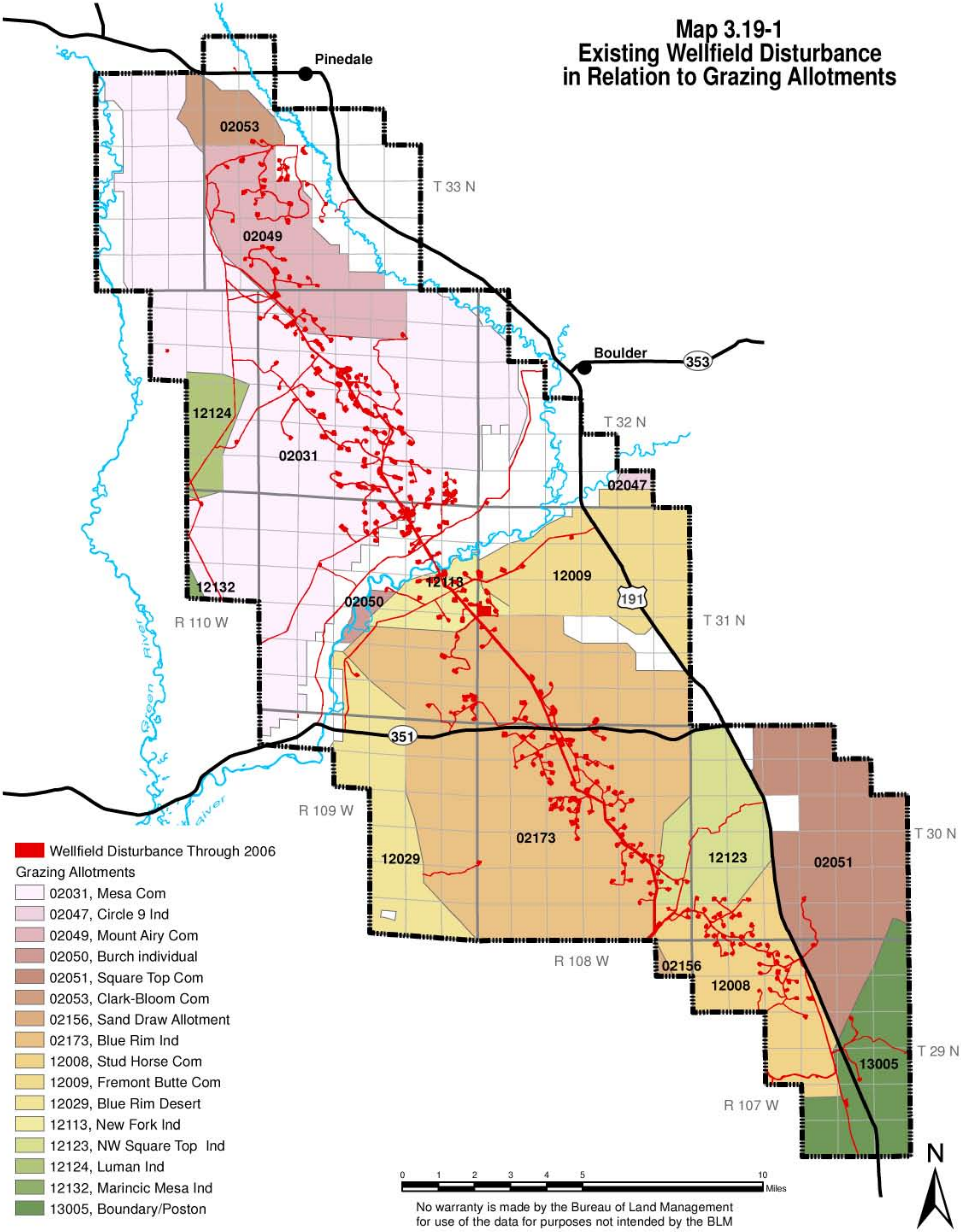
No revised or new allotment management plans have been initiated in the PAPA, although several range improvement projects have been implemented since 2000, including erosion control and water development. The BLM, permittees, and some Operators have coordinated several projects to provide better water sources for livestock. There have been multiple water development projects (wells, stock tanks, livestock reservoirs) in the various allotments in the PAPA. Many of those allotment improvements are shown on Map 3.20-1 and indicated as point locations included within the Wetland SRMZ.

The BLM has reported inadequate fencing around pits and tanks. Increased vehicular traffic has caused several livestock deaths and livestock have been accessing pits in the PAPA since the PAPA ROD (BLM, 2000b) was issued. Permittees have begun to use their own people to monitor and maintain oil and gas related activities/structures to protect their livestock and associated facilities.

The Mesa Common Allotment and Trapper’s Point just to the north of the allotment, is a crucial area for “The Green River Stock Drift,” a century-old seasonal stock driveway considered part of a potential Sublette County Rural Ranching Traditional Cultural Property and a potential Rural Historic Landscape. Increases in wellfield activities have led to increased incidences as they relate to grazing management, including loss/movement of stock watering locations, fence/gate/cattleguard issues, and disruption of over movement of The Green River Stock Drift. Increases in wellfield development have contributed to high levels of dust on some areas of forage plants (Schultz, 2006).

In 2003 and 2004, the BLM proposed a 25 percent reduction in PAPA allotment use because of drought (Section 3.3 and Table 3.3-1, Section 3.18.1, and Appendix 17, Wildlife Technical Report). The number of livestock grazing on BLM allotments was moderately reduced during that time (Schultz, 2006). In 2005, moisture levels and range conditions improved, and the 2005 grazing season returned to normal levels and permitted numbers.

The PAPA DEIS (BLM, 1999a) indicated that different allotments within the PAPA were capable of supporting varying levels of livestock according to estimates of the average area (acres) required to support one AUM, or acres per AUM. The most land to support one AUM was within the Marincic Mesa Individual Allotment (No. 12132), which averaged 16.92 acres per AUM. The least land to support one AUM was in the Luman Individual Allotment (No. 12124), which averaged 4.92 acres per AUM. With data for all allotments combined, the average area required to support one AUM for the entire PAPA is estimated to be 10.52 acres or an average of 0.095 AUM per acre.


Map 3.19-1
Existing Wellfield Disturbance
in Relation to Grazing Allotments
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
02053
02049
02031
12124
12132
02050
12113
12009
02047
02173
12029
12123
02051
02156
12008
13005
Wellfield Disturbance Through 2006
Grazing Allotments
02031, Mesa Com
02047, Circle 9 Ind
02049, Mount Airy Com
02050, Burch individual
02051, Square Top Com
02053, Clark-Bloom Com
02156, Sand Draw Allotment
02173, Blue Rim Ind
12008, Stud Horse Com
12009, Fremont Butte Com
12029, Blue Rim Desert
12113, New Fork Ind
12123, NW Square Top Ind
12124, Luman Ind
12132, Marincic Mesa Ind
13005, Boundary/Poston
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

Grazing allotments in the PAPA have been affected to varying degrees by wellfield disturbance (Table 3.19-1 and Map 3.19-1). Before the PAPA ROD (BLM, 2000b) was issued, there had been relatively few surface disturbances within any single allotment. The allotments most affected since the PAPA ROD was issued are on the Anticline Crest.

As of November 2006, the amount of wellfield disturbance in all allotments was 4,356.5 acres (Table 3.19-1). Assuming an average of 0.095 AUMs per acre, this disturbed land would support 414 AUMs. Most surface disturbance in the PAPA that is not yet revegetated would be reclaimed, and so estimated loss of AUMs is a current condition that is expected to be temporary. The New Fork Individual Allotment has the most surface disturbance relative to its area within the PAPA; 11.5 percent of the surface area has been disturbed by wellfield activities since 2006 with most having occurred on federal lands (Table 3.19-1).

Table 3.19-1
Existing Wellfield Disturbance in Relation to Grazing Allotments

Allotment and Number	Surface Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Mesa Common (02031)	48,634	1,242.7	131.6	1,374.3
Circle 9 Individual (02047)	332	0.0	0.0	0.0
Mount Airy Common (02049)	10,004	428.7	0.3	429.0
Burch Individual (02050)	587	0.7	0.1	0.8
Square Top Common (02051)	14,293	31.1	0.0	31.1
Clark-Bloom Common (02053)	2,513	15.5	0.0	15.5
Sand Draw (02156)	160	0.0	0.0	0.0
Blue Rim Individual (02173)	40,028	1,172.2	198.2	1,370.4
Stud Horse Common (12008)	10,022	458.0	60.1	518.1
Fremont Butte Common (12009)	10,833	76.8	0.0	76.8
Blue Rim Desert (12029)	7,756	28.7	0.0	28.7
New Fork Individual (12113)	2,953	322.5	17.1	339.6
NW Square Top Individual (12123)	7,031	100.5	0.2	100.7
Luman Individual (12124)	2,710	7.9	0.0	7.9
Marincic Mesa Individual (12132)	164	0.0	0.0	0.0
Boundary/Poston (13005)	7,266	62.5	1.1	63.6
Total	**165,712**	**3,947.8**	**408.7**	**4,356.5**

3.19.2 Pipeline Corridors and Gas Sales Pipelines

The proposed corridor/pipeline alignments would cross portions of 13 grazing allotments within the PFO, RSFO, and KFO (Table 3.19-2). Most of these allotments are designated for use by sheep and cattle or by cattle only. Seasonal use varies among allotments. The proposed corridor/pipeline alignments may also cross some range improvements within these allotments, including fences and stock water facilities/pipelines.

Table 3.19-2
Grazing Allotments Potentially Crossed by the Proposed Corridor/Pipeline Alignments from North to South[1]

Allotment	Allotment Area (acres)	Allotment AUMs	Livestock Type	Season of Use
Mesa Common (2031)[2]	55,789	4,701	Cattle/horses	5/5-11/5 5/1-10/31
New Fork Individual (2113)[2]	1,850	302	Cattle	5/10-6/20
Blue Rim Individual (2173)[2]	36,585	3,258	Cattle	5/10-6/23
Sand Draw (2156)[2]	31,740	2,324	Cattle	5/1-6/26
Blue Rim Desert (2029)[2]	39,609	2,826	Cattle	5/1-6/21
South Desert (2040)[2]	34,564	2,621	Cattle	5/1-8/23
Figure Four (13023)[3]	114,425	6,644	Sheep/cattle	5/10-1/10
Eighteen-Mile (13017)[3]	228,840	18,994	Sheep/cattle	5/1-1/31
Lombard (13022)[2]	94,802	6,643	Sheep/cattle	5/1-1/31
Seedskadee (11112)[4]	12,555	298	Horse Sheep/cattle	All year 5/1-12/31
Slate Creek (11113)[4]	267,048	20,780	Sheep/cattle	4/15-11/30
Granger Lease (11302)[4]	467,059	20,430	Sheep/cattle	Dec-Apr/May-Oct

[1] Source: Schulz, 2006; D'Ewart, 2006, and Burgin, 2006.
[2] PFO.
[3] RSFO.
[4] KFO.

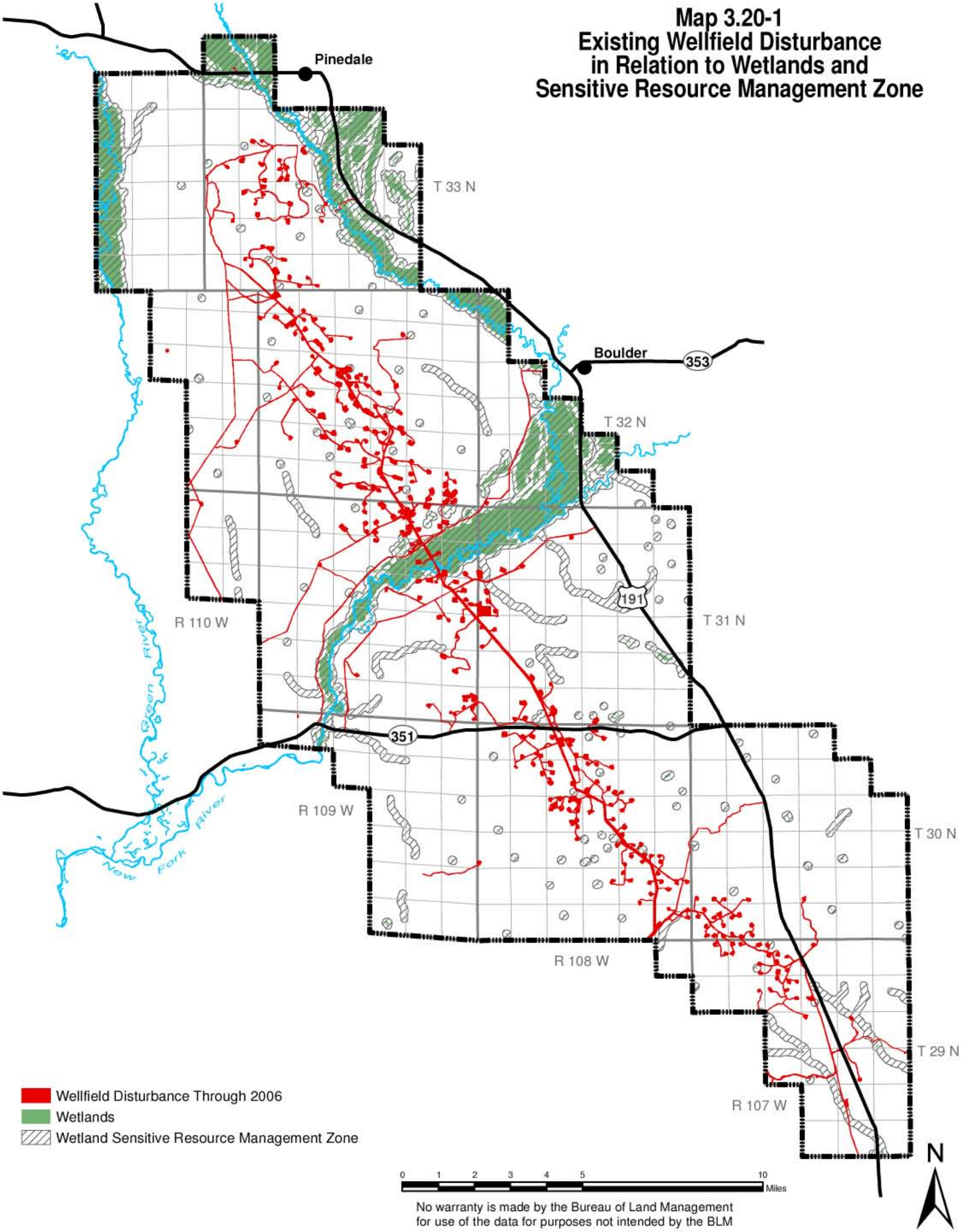
3.20 WETLANDS, RIPARIAN RESOURCES AND FLOOD PLAINS

3.20.1 Natural Gas Development in the PAPA

Wetlands are subject to protection under federal law and EO 11990, regardless of land ownership. The EPA and COE use the following definition of wetland to administer the Clean Water Act's Section 404 permit program for dredge and fill activities: *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* (40 CFR § 230.3 and 33 CFR § 328.3).

Wetlands have three essential characteristics: 1) hydrophytic vegetation; 2) hydric soils; and 3) wetland hydrology (BLM, 1999a). Riparian areas adjacent to perennial streams, such as the Green and New Fork rivers, usually contain willow and cottonwood communities, wet meadows, and irrigated fields that are all likely to exhibit wetland characteristics. Riparian areas adjacent to intermittent and ephemeral streams (Lovatt Draw, North Alkali Draw, Sand Draw, and Sand Springs Draw) may also contain wetlands where seasonal flows and high water tables are present. For reasons discussed in the PAPA DEIS (BLM, 1999a), all wetlands in the PAPA were identified as the Wetland SRMZ. Consistent with the BLM's policy to protect a 500-foot buffer from wetland boundaries, the Wetland SRMZ includes 500 feet from wetlands, including non-jurisdictional wetlands not subject to protection under 40 CFR § 230.3, 33 CFR § 328.3, and EO 11990 (Map 3.20-1).

Wetlands include wet meadows and all irrigated hay fields and pastures above the New Fork River's flood plain that may not be jurisdictional wetlands. Most of the wetlands in the PAPA occur along the flood plains of the Green and New Fork rivers and most (96 percent) are on private and state lands. Because of agriculture and residential developments on private lands, the total area affected by various human-related disturbances to wetlands and the Wetland SRMZ before approval of the PAPA ROD (BLM, 2000b) was extensive. Since issuance of the



Map 3.20-1
Existing Wellfield Disturbance in Relation to Wetlands and Sensitive Resource Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
Wetlands
Wetland Sensitive Resource Management Zone
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM

PAPA ROD (BLM, 2000b), the BLM is not aware of any well pad construction within wetlands (Gamper, 2007). Most disturbance has been due to pipeline and road construction. Because these are linear components, disturbance cannot be avoided.

In addition to the Wetland SRMZ, the 100-year flood plain, as identified by the Federal Emergency Management Agency, was determined to be the Flood Plain SRMZ (Map 3.20-2) in the PAPA DEIS (BLM, 1999a). The Sublette County Zoning and Development Regulations specifically address development in flood areas (Chapter III, Section 13). The County regulations define a floodway as *"that area of the county, including the channel of any water course, stream or river, required to effectively carry and discharge flood waters, that is inundated by the ten year recurrence interval flood."* The County's development standards prohibit the placement of any structures in any floodway. In flood areas, where groundwater level is within 4 feet of the surface, all structures and site improvements must be designed to minimize groundwater pollution or contamination. There are approximately 11,022 acres of land within the 100-Year Flood Plan and Flood Plain SRMZ. Of this, approximately 55.8 acres (10.1 acres on federal lands and minerals) have been disturbed as a result of wellfield activities. Most of this disturbance is due to construction of roads and pipelines.

3.20.2 Pipeline Corridors and Gas Sales Pipelines

Along the proposed corridor/pipeline alignments, wetlands are limited in extent and are only present along the river banks of the Blacks Fork and Green rivers and in the flood plain of the New Fork River at the proposed crossing locations. The wetlands are primarily expressed as emergent herbaceous vegetation consisting of sedges and rushes. The flood plain also supports forest-dominated riparian habitats with mostly willows and cottonwoods.

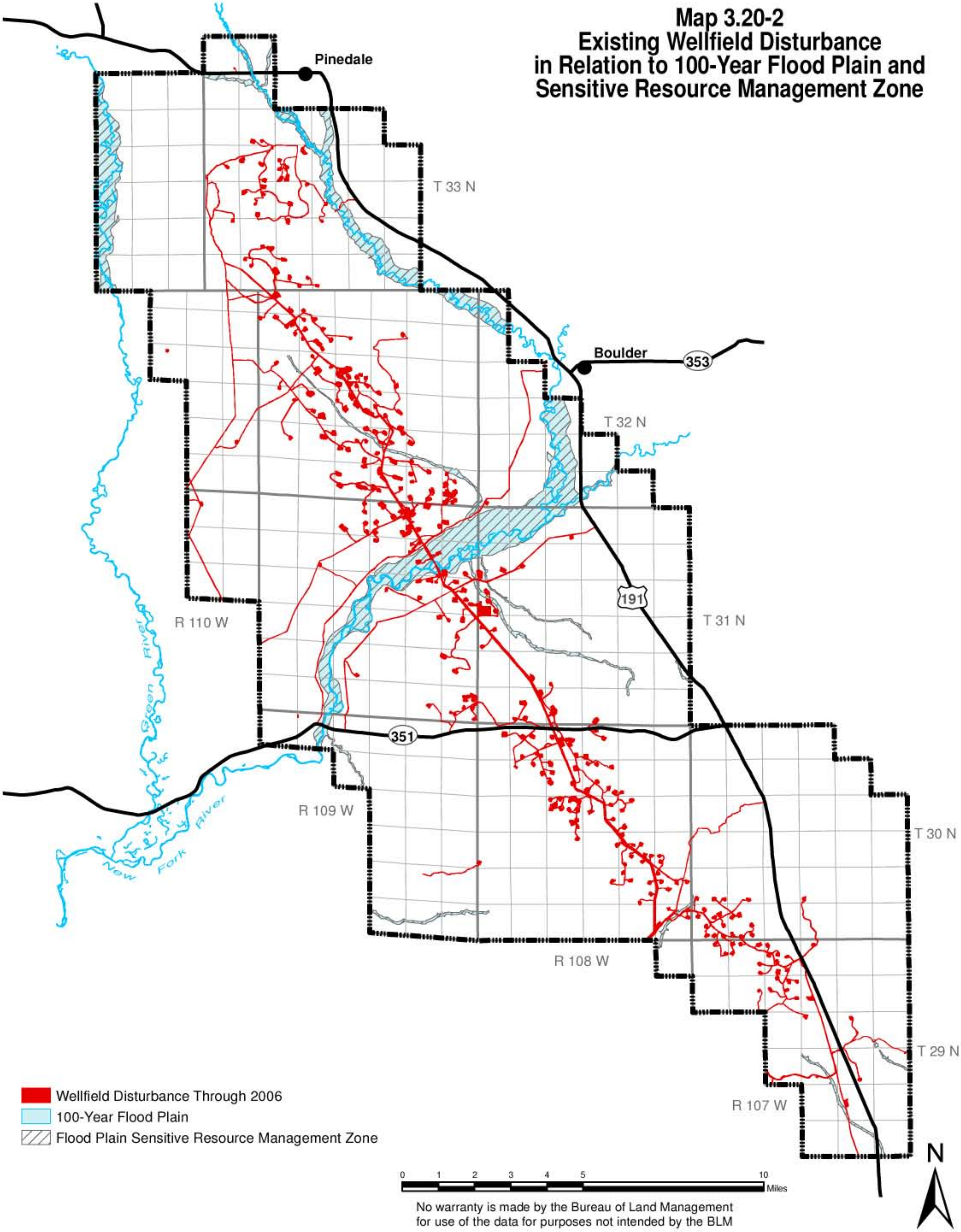
3.21 THREATENED AND ENDANGERED SPECIES AND SPECIAL STATUS SPECIES

3.21.1 Natural Gas Development in the PAPA

3.21.1.1 Federally Listed, Proposed, and Candidate Species

At the time the PAPA DEIS (BLM, 1999a) was prepared, Ute ladies'-tresses orchid, black-footed ferrets, bald eagles, whooping cranes, and four species of Colorado River fish were species listed under the Endangered Species Act (ESA) that were considered potentially vulnerable to development in the PAPA. Although they were addressed in the PAPA DEIS (BLM, 1999a), whooping cranes (endangered) are not included because the last surviving crane in the population died in 2002 (Whooping Crane Conservation Association, 2004). Canada lynx and mountain plover were species proposed for listing, and the swift fox was a candidate species for listing under the ESA. Since 2000, Canada lynx have been listed as threatened (USFWS, 2000) while the proposal to list mountain plovers as threatened was withdrawn (USFWS, 2003b). Swift fox is no longer considered to occur in the region.

In a written communication to the BLM, the USFWS (2005a and 2005b) identified the following species that could be affected by natural gas developments in the PAPA: black-footed ferret (endangered), Kendall Warm Springs dace (endangered), Colorado River fish (endangered), bald eagle (threatened), grizzly bear (threatened), Canada lynx (threatened), Ute ladies'-tresses orchid (threatened), and gray wolf (experimental population). As discussed below, bald eagles are no longer listed as threatened under the ESA. USFWS provided an updated list of species to BLM that could occur within the Pinedale Field Office area in 2007 (USFWS, 2007d). As discussed below, bald eagles and grizzly bears had been removed (delisted) from the list of threatened and endangered species.



Map 3.20-2
Existing Wellfield Disturbance in Relation to 100-Year Flood Plain and Sensitive Resource Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
100-Year Flood Plain
Flood Plain Sensitive Resource Management Zone
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM
N

Four species of Colorado River fish (bonytail, Colorado pikeminnow, humpback chub, and razorback sucker), each listed as endangered and with designated critical habitat within the Yampa, Green, and Colorado River systems downstream from the Project Area, continue to be included for evaluation of effects within the PAPA as they were in 1999. Since summer 2007, the Distinct Population Segment (DPS) of gray wolves within the Northern Rocky Mountain population (including wolves in Wyoming) was removed from the list of threatened and endangered species (USFWS, 2008). The status of wolves within the PAPA vicinity is discussed, below. USFWS (2007d) also noted that the yellow-billed cuckoo, a candidate species for listing under ESA, could occur within riparian areas west of the Continental Divide.

Black-footed Ferret. Historical evidence suggests that black-footed ferrets occurred in the Green River Basin. Ferrets are closely associated with prairie dog colonies, like those in sagebrush-grasslands (Cerovski et al., 2004). The USFWS (2004a) evaluated the potential for prairie dog colonies in Wyoming to support black-footed ferrets. The USFWS determined that many areas in the state are not likely to be inhabited by the species, based on habitat quality and the likelihood that ferrets, if ever they were present, are now extirpated. The USFWS (2004a) determined that approximately 64 square miles of the PAPA (all or portions of T. 29-31 N. and R. 109-111 W.) are within the Big Piney Prairie Dog Complex, in which surveys for black-footed ferrets are recommended. The remainder of the PAPA has been cleared for further need to conduct surveys for the species (FWS, 2004a). An old black-footed ferret skull was located in 2007 during surveys conducted for burrowing owls within T. 31 N., R. 109 W. Identification of the skull was verified by the USFWS.

Kendall Warm Springs Dace. This species is restricted to Kendall Warm Springs, an aggregation of thermal seeps and springs that eventually flow into the Green River. The population is limited to approximately 980 feet of pools and stream segment, all within the Bridger-Teton National Forest (USFWS, 1982), approximately 30 miles north of Pinedale.

Colorado River Fish. The USFWS (2005b and 2007d) has indicated that the bonytail, Colorado pikeminnow, humpback chub, and razorback sucker may inhabit the Colorado River System downstream from the PAPA in the Green River. Prior to construction of Flaming Gorge Reservoir, populations of pikeminnows and bonytails may have been viable in the Green River, although they are now extirpated (Baxter and Stone, 1995).

Canada Lynx. A reproducing population of Canada lynx has been documented near Merna where they prey on snowshoe hares (Laurion and Oakleaf, 1998). Lynx are generally associated with dense coniferous forests (Englemann spruce-subalpine fir) at high elevations (Cerovski et al., 2004). Suitable habitats for lynx are not present in the PAPA.

Ute Ladies'-tresses Orchid. Except for its possible occurrence along the Green River, this species was not addressed in the PAPA DEIS (BLM, 1999a). Examination of the location revealed unsuitable habitat. Ute ladies'-tresses orchid was listed as threatened in 1992 (USFWS, 1992). In Wyoming, Ute ladies'-tresses orchid have been located on old oxbows or flood plain terraces associated with small streams on sites that remain moist (meadow plant communities) throughout the summer, either due to seasonal flooding or sub-irrigation (Fertig, 2000). All four of the known populations in Wyoming occur in the eastern half of the state. Searches were conducted in western Wyoming (Jackson Hole, National Elk Refuge, and Green River Basin) during the 1990s (Fertig, 2000). Given the elevation ranges and precipitation regimes associated with site occurrence, the species' presence within the PAPA is unlikely. The USFWS (2004c) is undertaking a 5-year status review of Ute ladies'-tresses orchid to determine if delisting the species is warranted.

Yellow-billed Cuckoo. This species was petitioned for listing in 1998. Following a status review, the USFWS (2001) found that listing the western DPS of yellow-billed cuckoos (including those in Wyoming) as threatened was warranted but precluded and the species is currently a candidate for listing (USFWS, 2005a). The species is found in eastern Wyoming where it is associated with deciduous woods and thickets along riparian zones (Dorn and Dorn, 1990 and Cerovski et al., 2004).

No yellow-billed cuckoos have been documented in the upper Green River Basin, although breeding may have occurred southeast of the basin (Cerovski et al., 2004). There are nine National Biological Survey Breeding Bird Survey (BBS) routes in the upper Green River area. Although some of these routes have been surveyed since 1980, none have continuous records. Yellow-billed cuckoos have not been reported in any of the surveys in the PAPA vicinity. Further, BBS routes in 2002 on BLM-administered public lands that included the PAPA did not detect the species (McGee et al., 2002). Current presence in the vicinity of the PAPA is unknown and none have been observed in southwestern Wyoming since 1981 (Bennett, 2002).

Surveys have been conducted for yellow-billed cuckoos within the BLM Pinedale Field Office area on an as needed basis. Currently, the BLM does have a 500 ft buffer to protect riparian habitats. This buffer would be used in addition to any site specific information that may be collected if yellow-billed cuckoos are observed.

3.21.1.2 Delisted Species

Bald Eagle. The USFWS proposed to remove the bald eagle from the list of endangered and threatened wildlife in 1999 because the bald eagle’s population growth had exceeded most goals established in various recovery plans (USFWS, 1999). The USFWS reopened the public comment period on February 16, 2006 (USFWS, 2006a), and on August 8, 2007, the bald eagle was delisted (USFWS, 2007d). Although no longer listed as threatened under the ESA, bald eagles remain protected under the Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668-668d) and the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712). The BGEPA prohibits “take” of bald and golden eagles, which includes pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, or molest, or disturb (50 CFR § 22.3). The USFWS defines “disturb” as “to agitate or bother a bald or golden eagle to the degree that it interferes with or interrupts normal breeding, feeding, or sheltering habits, causing injury, death, or nest abandonment" (USFWS, 2006b). The BLM in Wyoming will follow State guidance (IM WY-2007-037 – BLM, 2007d) during the interim period, until the USFWS develops a process to allow for “take” of bald eagles under the BGEPA. The guidance states, “Wyoming BLM will continue to apply protective measures (terms and conditions) found in the Statewide Bald Eagle Programmatic Biological Opinion (BO – USFWS, 2004b) or other valid BOs to safeguard bald eagles and their nesting and roosting habitats when authorizing various actions. Pinedale BLM will follow the *New Fork and Green Rivers within the Pinedale Anticline Oil and Gas Exploration and Development Project Area Biological Opinion* (New Fork and Green Rivers BO - USFWS, 2007c). Bald eagles nesting in northwest Wyoming have been increasing steadily since 1978 (Patla et al., 2003). Bald eagles nest in trees, including cottonwoods, and in riparian zones associated with large lakes and streams (Cerovski et al., 2004).

Wintering bald eagles regularly occur in western Wyoming, generally from November 1 through April 15 (USFWS, 2005a), and may occur during any time of year along the Green River corridor. Observations of bald eagles and other wintering birds are reported by the Audubon Society’s Christmas Bird Counts. These counts were made near the PAPA during December 1984 and 1987, and only one bald eagle was reported in each year. Migratory bald eagles have been observed during April and November generally throughout the Green River Basin (Patla, 2004), which is also potential bald eagle nesting and roosting habitat. Bald eagles arrive on the Green River the second week of October, coinciding with kokanee salmon and brown trout spawning, which are probably a primary source of autumn food (BLM, 1995).

During February 2005, the BLM conducted a winter ground survey of bald eagles in the PFO Administrative Area. A total of 54 eagles were counted, most of them along the Green River and its tributaries, although 10 eagles were documented along the New Fork River between Boulder and its confluence with the Green River. Most bald eagle observations during surveys were associated with forest-dominated riparian cover. During the February 2006 survey, eight bald eagles were documented along the New Fork River. In winter 2007, 16 bald eagles were observed in the vicinity of the PAPA along the New Fork River and Green River.

In 2004 and 2005, there were two active bald eagle nests in the PAPA, each producing two young (Patla, 2005). Both nests were active again in 2006 with adults incubating during early April (Patla, 2006). One of the nests was discussed in the PAPA DEIS (BLM, 1999a) and was active in 1999. Early in the 2007 nesting season, there were five bald eagle nests occupied by adults within the PAPA or within 1 mile of the PAPA boundary. A total of five young eagles fledged from only two of the nests; two nests produced no young; and one of the occupied nests was apparently abandoned by the adult(s) prior to initiating nesting activity (Patla, 2007).

In Wyoming, bald eagle eggs hatch around May 1, and young fledge about July 10 (Johnsgard, 1986). However, nest building may be initiated during February (Call, 1978 and USFWS, 2005a). Fledged juvenile bald eagles may remain in the nest vicinity for a month, often through August (Isaacs et al., 1983 and USFWS, 2005a).

Since the issuance of the PAPA ROD (BLM, 2000b), one well pad was constructed within 1 mile of one of the bald eagle nests in 2004. In addition, 17 miles of road and 12.5 miles of pipeline were constructed within 1 mile of the two nests. Prior to July 2000, however, there had been considerable surface disturbance within 1 mile of both nest sites, primarily due to agricultural facilities, residences, and roads (Table 3.21-1). U.S. Highway 191 is within 1 mile of one nest and the Boulder South Road is within 1 mile of the other. Before July 2000, eleven well pads had been constructed within 1 mile of bald eagle wintering habitat along the New Fork River riparian zone. Since then, 29 additional well pads have been constructed within that 1 mile zone. There has been a total of 172 acres of wellfield disturbance within 1 mile of the bald eagle nests that were occupied in 2007. The majority of this disturbance has been on federal lands (Table 3.21-1). By November 2006, a total of 716.1 acres had been disturbed by wellfield activities within 1 mile of the New Fork River riparian zone and 10.7 acres had been disturbed in forest-dominated riparian vegetation (Table 3.21-1).

Table 3.21-1
Existing Wellfield Disturbance in Relation to 1-Mile Buffer of Bald Eagle Habitats

Habitat Component	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
1 mile of Occupied Bald Eagle Nests	4,000	114.8	57.6	172.4
1 mile of New Fork River Riparian Zone	38,160	509.8	206.3	716.1
Forest-Dominated Riparian Vegetation	4,036	1.1	9.6	10.7

Grizzly Bear. The entire PAPA is outside the outer boundary for grizzly bear occupancy established in the Wyoming Grizzly Bear Management Plan (Moody et al., 2002). In the plan, the WGFD's policy is to limit bear occurrence outside of the boundary, with the intent to exclude them from becoming reestablished in other areas of the state. In November 2005, the USFWS proposed to designate grizzly bears in the Greater Yellowstone Ecosystem as a DPS that could be removed from the list of endangered and threatened wildlife once recovery of the DPS had been achieved. The USFWS published the Final Rule (USFWS, 2007e) for removal of the DPS in March 2007. The area defined by the USFWS as the Greater Yellowstone Ecosystem DPS includes the PAPA action area. Grizzly bears in other portions of their range not included in the Greater Yellowstone Ecosystem DPS remain protected as threatened under the ESA (USFWS, 2007e).

The grizzly bear has a wide range of habitat tolerance. The preferred habitat for grizzly bears is typically contiguous, relatively undisturbed mountainous habitat with a high topographic gradient and vegetative diversity. Among other food sources, grizzlies feed on winter-killed big game carrion, often encountered on big game winter ranges, including those in the PAPA. Otherwise, suitable habitat for the species is not present in the PAPA.

Gray Wolf. Since the reintroduction of 31 animals in Yellowstone National Park (YNP) during 1995 and 1996, the gray wolf population in the Greater Yellowstone Recovery Area during 2003 included approximately 89 animals in Wyoming inhabiting areas outside of YNP (USFWS et al., 2004). By 2005, there were 134 wolves in Wyoming outside of YNP and 252 wolves in the state's portion of the Greater Yellowstone Recovery Area (USFWS et al., 2006). The animals are classified as a nonessential experimental population (USFWS, 2005a). Gray wolves inhabit coniferous forests as well as shrub and grasslands in mountains and foothills, where they feed on big game and smaller prey species (Cerovski et al., 2004).

Packs have become established outside of YNP including two packs near the PAPA: the Green River Pack east of the PAPA in the upper Green River Basin in 2002, and the Daniel Pack northwest of the PAPA in 2003 (USFWS et al., 2004). Since their establishment, both wolf packs have preyed on cattle and sheep and pack members in both packs have been killed in control actions. Wolves in the Daniel pack continued to kill livestock through 2005 and the USFWS authorized that all wolves in the pack be killed. Six wolves from the pack were shot in December 2005 but two others escaped; the pack became reestablished in 2006 (USFWS et al., 2007). Other wolves dispersed to the Pinedale/Cora area and were subsequently killed after repeated livestock depredations (USFWS et al., 2005). There were five wolves reported in the Pinedale/Cora area in 2006 (USFWS et al., 2007). In 2006, a total of 22 wolves had been killed by federal officials in Sublette County, including the last adult member of the Green River Pack and members of a pack that had become established near Prospect Mountain, east of Farson. The USFWS authorized removal of the pack. Five wolves were killed in 2006 after 22 depredations on cattle but several pack members without radio collars could not be located (USFWS et al., 2007).

During winter 2002-2003, wolves killed two elk (both in the Pinedale Elk Herd Unit) on two of the three elk wintering feedgrounds: Fall Creek and Scab Creek (Clause, 2004a). Wolves killed 16 elk on the Black Butte and Soda Lake feedgrounds within the Green River Elk Herd Unit during 2003 (Clause, 2004b). Although portions of both elk herd units coincide with the PAPA, only the northern portion coincides with the winter range utilized by elk in the Green River Herd Unit. While unlikely, wolves could potentially be present near the PAPA.

Most recently, the USFWS (2008) published a Final Rule to delist the northern Rocky Mountain DPS of the gray wolf. The Final Rule, published on February 27, 2008, became effective on March 28, 2008. The gray wolf is now managed by WGFD under Wyoming State statute as a trophy game animal in the northwestern part of the state (outside of lands administered by the National Park Service) and managed as a predatory animal in the remaining parts of Wyoming, including the PAPA action area (WGFD, 2007c).

3.21.1.3 Sensitive Species in the PAPA

Greater Sage-Grouse. The eastern subspecies of greater sage-grouse was petitioned for listing as endangered in 2002. Wyoming is included in the subspecies' range. However, the USFWS determined that evidence was lacking to distinguish the eastern subspecies as a valid subspecies, and therefore it is not a DPS applicable under the ESA (USFWS, 2004d). A similar evaluation was rendered on a petition to list the western subspecies in 2003.

The USFWS completed a status review of the greater sage-grouse and determined that it does not warrant protection under the ESA throughout its range, including Wyoming (USFWS, 2005c); however, in a recent ruling, a U.S. District Judge in Boise, Idaho stated that the USFWS must reconsider whether greater sage-grouse should be listed as an endangered species. Greater sage-grouse are managed as an upland game bird in Wyoming and the species is discussed in Section 3.22.1.2. Greater sage-grouse leks, wintering grounds, and nests have been documented within the PAPA.

Pygmy Rabbit. Pygmy rabbits in Washington's Columbia Basin were listed as endangered in 2003 (USFWS, 2003c) but that listing does not apply to the species in Wyoming. Pygmy rabbits have been designated as a sensitive species by the BLM (BLM, 2002) as well as by the USFWS (2005a). The pygmy rabbit was petitioned for listing under the Endangered Species Act on April 21, 2003. On May 20, 2005, USFWS published a finding that the petition did not present substantial information indicating that listing the species was warranted. But on March 28, 2006, a complaint was filed alleging violations within the USFWS' 2005 finding. On September 26, 2007, a court ruled that USFWS improperly imposed a higher than necessary standard on the 2005 petition. To comply with the September 26, 2007 ruling, the USFWS published a new finding on January 8, 2008 in which they acknowledged substantial scientific information was presented in the petition and listing for the pygmy rabbit may be warranted. USFWS is now conducting a status review to determine if listing may be warranted. The status review is expected to be concluded in 12 months from initiation.

Pygmy rabbits use subspecies of sagebrush and other shrub species (bitterbrush, rabbitbrush, greasewood, snowberry, and juniper) that may be present (Ulmschneider et al., 2004). Burrows are usually hidden under sagebrush. Characteristic pygmy rabbit habitat includes drainages with dense, tall sagebrush. Pygmy rabbits burrow in loamy soils, deeper than 20 inches. Soil composition needs to be able to support a burrow system with numerous entrances and it needs to be soft enough for digging.

Wyoming's pygmy rabbit habitat includes uncharacteristic areas (Wyoming Wildlife Consultants LLC., 2006 and Ulmschneider et al., 2004). In the PAPA, pygmy rabbits have been observed in characteristic (McGee et al., 2002) and uncharacteristic habitats, such as flat areas with short sagebrush (Wyoming Wildlife Consultants LLC, 2006). Often, they are associated with soil mounds near sagebrush. Such mounds can become entire burrowing systems. Pygmy rabbits occur throughout the PAPA (especially on the Mesa) and in the Jonah Field Project Area. The extent of their presence outside these areas is unknown (Wyoming Wildlife Consultants LLC, 2006 and Purcell, 2005). Over 30 pygmy rabbit sightings and over 200 burrows were documented in the PAPA in 2005. The BLM is currently conducting surveys, is developing a research project to identify the impacts of development on pygmy rabbits, and is planning on developing conservation measures to mitigate these impacts.

Other Special Status Species. In addition to species listed under the ESA, the BLM has identified sensitive species (BLM, 2002) in the Pinedale and Rock Springs resource areas, some of which are known to occur or potentially occur in the PAPA. The BLM developed a formal sensitive species list after the PAPA ROD (BLM, 2000b) was issued. BLM-sensitive species known to occur in or near the PAPA include: ferruginous hawk, long-billed curlew, burrowing owl, sage thrasher, loggerhead shrike, Brewer's sparrow, sage sparrow, and white-tailed prairie dog (McGee et al., 2002). River otters were documented in the New Fork River during the 1980's (Rudd et al., 1986). Other species' occurrences, listed in Table 3.21-2, are judged as possible, unlikely, or highly unlikely based on their habitat requirements and known distributions (Baxter and Stone, 1980; Baxter and Stone, 1995; McGee et al., 2002; and Cerovski et al., 2004).

Table 3.21-2
BLM-Sensitive Fish and Wildlife Species and WGFD Species of Special Concern Not Listed Under ESA that could Occur in the PAPA, Habitats, and Other Status Designations[1]

Common Name Scientific Name	Habitat (BLM, 2002)	Potential Occurrence	State Rank[1]	WGFD Status[2]
Fish				
Roundtail chub *Gila robusta*	Colorado River drainage in large rivers, streams and lakes	possible	S3	NSS1
Leatherside chub *Gila coperi*	Green River drainage in clear, cool streams and pools	highly unlikely	S1	NSS1
Bluehead sucker *Catostomus discobolus*	Green River drainage, all water types	possible	S3	NSS1
Flannelmouth sucker *Catostomus latipinnis*	Colorado River drainage in large rivers, streams and lakes	present	S3	NSS1
Colorado River cutthroat trout *Oncorhynchus clarki pleuriticus*	Colorado River drainage, clear mountain streams	unlikely	S1	NSS2
Amphibians				
Northern leopard frog *Rana pipiens*	Beaver ponds, permanent water in plains and foothills	possible	S3	none
Columbia spotted frog *Rana pretiosa*	Ponds, sloughs, small streams	unlikely	S3	none
Western boreal toad *Bufo boreas boreas*	Pond margins, wet meadows, riparian areas	possible	S1	none
Birds				
Snowy egret *Egretta thula*	Marshes, lakes, rivers	possible	S3B	NSS3
White-faced ibis *Plegadis chihi*	Marshes, wet meadows	possible	S1B	NSS3
Forster's Tern *Sterna forsteri*	Marshes, estuaries, lakes, reservoirs	highly unlikely	S1	NSS3
Black Tern *Chliodonias niger*	Marshes	unlikely	S1	NSS3
Trumpeter swan *Cygnus buccinator*	Lakes, ponds, rivers	possible	S2	NSS2
Northern goshawk *Accipiter gentiles*	Conifer and deciduous forests	highly unlikely	S3	NSS4
Merlin *Falco columbarius*	Coniferous or deciduous trees	present	S4	NSS3
American peregrine falcon *Falco pereginus anatum*	Cliffs in most habitats near lakes and rivers	possible	S3	NSS3
Ferruginous hawk *Buteo regalis*	Basin-prairie shrub, grasslands, rock outcrops	present	S5N	NSS3
Greater sage-grouse Centrocercus urophasianus	Basin-prairie shrub, mountain-foothills shrub	present	S4	game bird
Mountain plover *Charadrius montanus*	Grasslands	present	S2	NSS4
Long-billed curlew *Numenius americanus*	Grasslands, plains, foothills, wet meadows	possible	S3B	NSS3

Common Name Scientific Name	Habitat (BLM, 2002)	Potential Occurrence	State Rank[1]	WGFD Status[2]
Yellow billed cuckoo *Coccyzus americanus*	Open woodlands, streamside willow and alder groves	highly unlikely	S1	NSS2
Burrowing owl *Athene cunicularia*	Grasslands, basin-prairie shrub	present	S3	NSS4
Great gray owl *Strix nebulosa*	Coniferous forests, aspen, mountain-foothills grassland	unlikely	S2	NSS4
Lewis's Woodpecker *Melanerpes lewis*	Open riparian woodland, cottonwood, mixed conifer	possible	S2	NSS3
Loggerhead shrike *Lanius ludovicianus*	Basin-prairie shrub, mountain-foothills shrub	possible	S3	none
Sage thrasher *Oreoscoptes montanus*	Basin-prairie shrub, mountain-foothills shrub	present	S5	NSS4
Grasshopper sparrow *Ammodramus savannarum*	Basin-prairie shrub, wet meadow, grasslands	possible	S4	NSS4
Brewers sparrow *Spizella breweri*	Basin-prairie shrub	present	S5	NSS4
Sage sparrow *Amphispiza belli*	Basin-prairie shrub, mountain-foothills shrub	present	S3	NSS4
Mammals				
Dwarf shrew *Sorex nanus*	Mountain-foothills shrub	unlikely	S4	NSS3
Fringed myotis *Myotis thysanodes*	Coniferous forest, woodland, prairie-basin shrub	possible	S2	NSS2
Long-eared myotis *Myotis evotis*	Conifer and deciduous forests, caves and mines	possible	S4	NSS2
Spotted bat *Euderma maculatum*	Desert sagebrush-grasslands	possible	S3	NSS2
Townsend's Big-eared Bat *Corynorhinus townsendii*	Basin-prairie and mountain-foothills shrub, desert grasslands	unlikely	S2	NSS2
Pygmy rabbit *Brachylagus idahoensis*	Prairie-basin shrub and riparian shrub	present	S1	NSS3
White-tailed prairie dog *Cynomis leucurus*	Grasslands, basin-prairie shrub	present	S3	NSS3
Idaho pocket gopher *Thomomys idahoensis*	Shallow stony soils	highly unlikely	S2	NSS3
River Otter *Lutra Canadensis*	Riparian areas, burrows, caves	present	S3	NSS4

[1] Source: BLM, 2002; Keineth et al., 2003 and Cerovski et al., 2004.

[2] State Rank: Assigned by WYNDD and reflects status of species within political borders of Wyoming: S1 = Extremely rare, S2 = Very rare, S3 = Rare, S4 = Apparently secure, but may be rare in portions of its range, S5 = Secure under present conditions. "B" following state rank indicates breeding status; "N" indicates non-breeding status.

[3] WGFD Status = Wyoming Game and Fish Department Status:
NSS1 = Species with ongoing significant habitat loss, populations greatly restricted or declining, and extirpation appears possible.
NSS2 = Species 1) whose habitat is limited or vulnerable, but no recent or significant loss has occurred and populations are greatly restricted or declining; or 2) with ongoing significant loss of habitat and populations are declining or restricted in numbers and distribution, but extirpation is not imminent.
NSS3 = Species in which 1) habitat is not limited, but populations are greatly restricted or declining and extirpation appears possible; 2) habitat is limited or vulnerable, although no significant recent loss has occurred and populations are declining or restricted in numbers or distribution, but extirpation is not imminent; or 3) significant habitat loss is ongoing, but the species is widely distributed and population trends are thought to be stable.
NSS4 = Populations greatly restricted or declining, extirpation possible; habitat stable and not restricted -OR- Populations declining or restricted in numbers or distribution, extirpation not imminent; Species widely distributed, population status or trends unknown but suspected to be stable; habitat restricted or vulnerable but no recent or on-going significant loss; species likely sensitive to human disturbance -OR- Populations stable or increasing and not restricted in numbers or distribution; on-going significant loss of habitat.

Species of Special Concern, that are managed by the WGFD and may inhabit the PAPA, are listed in Table 3.21-2. Two of the species that are not BLM-sensitive, but which are present in the PAPA, are mountain plover and merlin. Observations of mountain plovers and merlins, as well as burrowing owls, have been made on or in the immediate vicinity of the PAPA since 2001, and their status in relation to wellfield development is under investigation (Ecosystem Research Group, 2006).

The BLM (2007c) has indicated that the following special status plant species may occur within the Pinedale Resource Area and, based on their habitat associations, are likely to occur in the PAPA: large-fruited bladderpod, Beaver Rim phlox, and tufted twinpod (Table 3.21-3). Meadow pussytoes, Trelease's racemose milkvetch, Cedar Rim thistle, and Big Piney milkvetch could occur if suitable habitats are present.

Table 3.21-3
BLM-Sensitive Plant Species Not Listed Under ESA
that could Occur in the PAPA, Habitats, and Other Status Designations[1]

Common Name Scientific Name	Habitat (BLM, 2002)	Potential Occurrence	State Rank[1]
Meadow pussytoes Antennaria arcuata	Moist, hummocky meadows, seeps or springs surrounded by sage/grasslands 4,950-7,900 feet elevation	possible	S2
Trelease's racemose milkvetch *Astragalus racemosus* var. *treleasei*	Sparsely vegetated sagebrush on shale or limestone outcrops, barren clay slopes, 6,500-8,200 feet elevation	possible	S2
Cedar Rim thistle *Cirsium aridum*	Barren, chalky hills, gravelly slopes, fine textured sandy-shaley draws, 6,700-7,200 feet elevation	possible	S2
Large-fruited bladderpod *Lesquerella macrocarpa*	Gypsum-clay hills, benches, clay flats, barren hills, 7,200-7,700 feet elevation	likely	S2
Payson’s bladderpod *Lesquerella paysonii*	Rocky slopes, ridges, flood plains, and disturbed roadsides; 5,500 to 10,600 feet elevation	unlikely	S3
Beaver Rim phlox *Phlox pungens*	Sparsely vegetated slopes on sandstone, siltstone, limestone substrates, 6,000-7,400 feet elevation	likely	S2
Tufted twinpod *Physaria condensate*	Sparsely vegetated shale slopes, ridges, 6,500-7,000 feet elevation	likely	S2
Swallen Mountain ricegrass *Achnatherum (Oryzopsis) swallenii*	Rocky slopes and rims, sandy to gravely limey-clay soils, grael covered; 6,500 to 7,900 feet elevation	unlikely	S2
Big Piney milkvetch *Astragalus drabelliformis*	Sandstone, stony clay, badlands, barren clay slopes and ridges; 6,900 to 7,200 feet elevation	possible	S2

[1] Sources: BLM, 2002 and Keinath et al., 2003.
[2] State Rank: assigned by WYNDD and reflects status of species within political borders of Wyoming:
S1 = Extremely Rare
S2 = Very Rare
S3 = Rare
S4 = Apparently secure, but may be rare in portions of its range
S5 = Secure under present conditions.

3.21.2 Pipeline Corridors and Gas Sales Pipelines

Special status species potentially occurring along the proposed corridor/pipeline alignments include the same federally-listed species as those identified as having the potential to occur in the PAPA. No suitable habitats are present within the proposed corridor/pipeline alignments corridors for Kendall Warm Springs dace and Canada lynx (listed species), or for grizzly bears and gray wolves (delisted species). Occurrences of black-footed ferrets and Ute ladies’-tresses orchid (listed species) are possible, but unlikely. Bald eagles (delisted species) are likely to occur within riparian zones associated with the Green River and New Fork River. Endangered Colorado River fish have been extirpated from the Green River, although they occur downstream in the Colorado River drainage. Greater sage-grouse and pygmy rabbits are likely to occur along portions of the proposed corridor/pipeline alignments.

All BLM-sensitive fish, wildlife, and plant species identified in Table 3.21-2 and Table 3.21-3 that could occur in the PAPA may also occur along the proposed corridor/pipeline alignments. Several additional BLM-sensitive species, identified by the BLM RSFO and KFO that could occur along the proposed corridor/pipeline alignments are listed in Table 3.21-4.

Table 3.21-4
BLM-Sensitive Fish, Wildlife, and Plant Species that could Occur in the Vicinity of the Proposed Corridor/Pipeline Alignments (in addition to those in Table 3.21-2 and Table 3.21-3)

Common Name Scientific Name	Habitat (BLM, 2002)	Potential Occurrence	State Rank[1]	WGFD Status[2]
Wildlife				
Great Basin spadefoot *Spea intermontana*	Springs, seeps, temporary and permanent waters	unlikely	S3	none
Midget faded rattlesnake *Crotalus viridis concolor*	Mountain foothills shrub and rock outcrops in southwestern Wyoming and adjacent Colorado and Utah	highly unlikely	S1	none
Swift Fox *Vulpes velox*	Open prairies and arid grasslands, including areas intermixed with winter wheat fields	highly unlikely	S2	NSS4
Plants				
Mystery wormwood *Artemisia biennis var. diffusa*	Only known site is in Sweetwater County along clay flats and playas at 6,500 feet	highly unlikely	S1	none
Precocious milkvetch *Astragalus proimanthus*	Cushion plant communities on rocky, clay soils mixed with shale on summits and slopes of white shale hills from 6,800-7,200 feet	highly unlikely	S1	none
Nelson's milkvetch *Astragalus nelsonianus*	Alkaline clay flats, shale bluffs and gullies, pebbly slopes, and volcanic cinders in sparsely vegetated sagebrush, juniper, and cushion plant communities from 5,200 to 7,600 feet	unlikely	S2	none
Small rock cress *Boechera (Arabis) pusilla*	Cracks and crevices in sparsely vegetated granite/pegmatite outcrops in sagebrush-grasslands around 8,000 feet	highly unlikely	S1	none
Ownbey's thistle *Cirsium ownbeyi*	Sparsely vegetated shaley slopes in sage and juniper communities between 6,440-8,400 feet	highly unlikely	S2	none
Wyoming tansymustard *Descurainia torulosa*	Sparsely vegetated sandy slopes at base of cliffs of volcanic breccia or sandstone from 8,300-10,000 feet	highly unlikely	S1	none
Entire-leaved peppergrass *Lepidium integrifolium* var *integrifolium*	Sparsely vegetated and seasonally wet clay flats, greasewood communities on clay hummocks, and moist alkaline meadows at 6,200-6,770 feet	highly unlikely	S1	none
Prostrate bladderpod *Lesquerella prostrate*	Plains, hills, and slopes in sagebrush, grass, and juniper communities in Lincoln and Uinta counties in the Muddy and Upper Bear River Mountains	highly unlikely	S1	none
Stemless beardtongue *Penstemon acaulis* var *acaulis*	Cushion plant or black sage grassland communities on semi-barren rocky ridges, knolls, and slopes at 5,900-8,200 feet	highly unlikely	S1	none
Dorn's twinpod *Physaria dornii*	Lincoln and Uinta counties in the Blacks Fork and Muddy drainages on dry, sparsely vegetated, calcareous-shaley slopes and ridges dominated by mountain mahogany and rabbitbrush	highly unlikely	S1	none

Common Name Scientific Name	Habitat (BLM, 2002)	Potential Occurrence	State Rank[1]	WGFD Status[2]
Persistent sepal yellowcress *Rorippa calycina*	Sandy, muddy streambanks, stockponds, reservoirs 3,660-6,800 feet elevation	unlikely	S2S3	none
Green River greenthread *Thelesperma caespitosum*	Occurs along white shale slopes and ridges of the Green River Formation at 6,300 feet	highly unlikely	S1	none-
Uinta greenthread *Thelesperma pubescens*	Sweetwater and Uinta counties in the Upper Green-Flaming Gorge Reservoir and Blacks Fork rivers on very windy rims of extremely coarse-cobbly soils of the Bishop Conglomerate	highly unlikely	S1	none
Cedar Mountain Easter-daisy *Townsendia microcephala*	Sweetwater and Uinta counties in the Blacks Fork drainage on rocky slopes and cobbly ridges of the Bishop Conglomerate	highly unlikely	S1	none

[1] State Rank is the same as defined in Table 3.21-2 (vertebrates) and Table 3.21-3 (plants).
[2] WGFD status is the same as defined in Table 3.21-2.

3.22 WILDLIFE AND AQUATIC RESOURCES

3.22.1 Natural Gas Development in the PAPA

Wildlife habitats and their functions in the PAPA, including wintering, breeding, and nesting habitats, were described in detail in the PAPA DEIS (BLM, 1999a) and supporting documents. Since 2000, there have been several wildlife studies that have provided information that was unavailable when the PAPA ROD (BLM, 2000b) was issued. Some of the new information is presented in the sections below. Further, WGFD (2004a) has developed guidance relevant to current and future natural gas development in the PAPA: *Recommendations for Development of Oil and Gas Resources within Crucial and Important Wildlife Habitats.* WGFD updated the document in 2007 although the latest edition has not been approved for release by the Wyoming Game and Fish Commission.

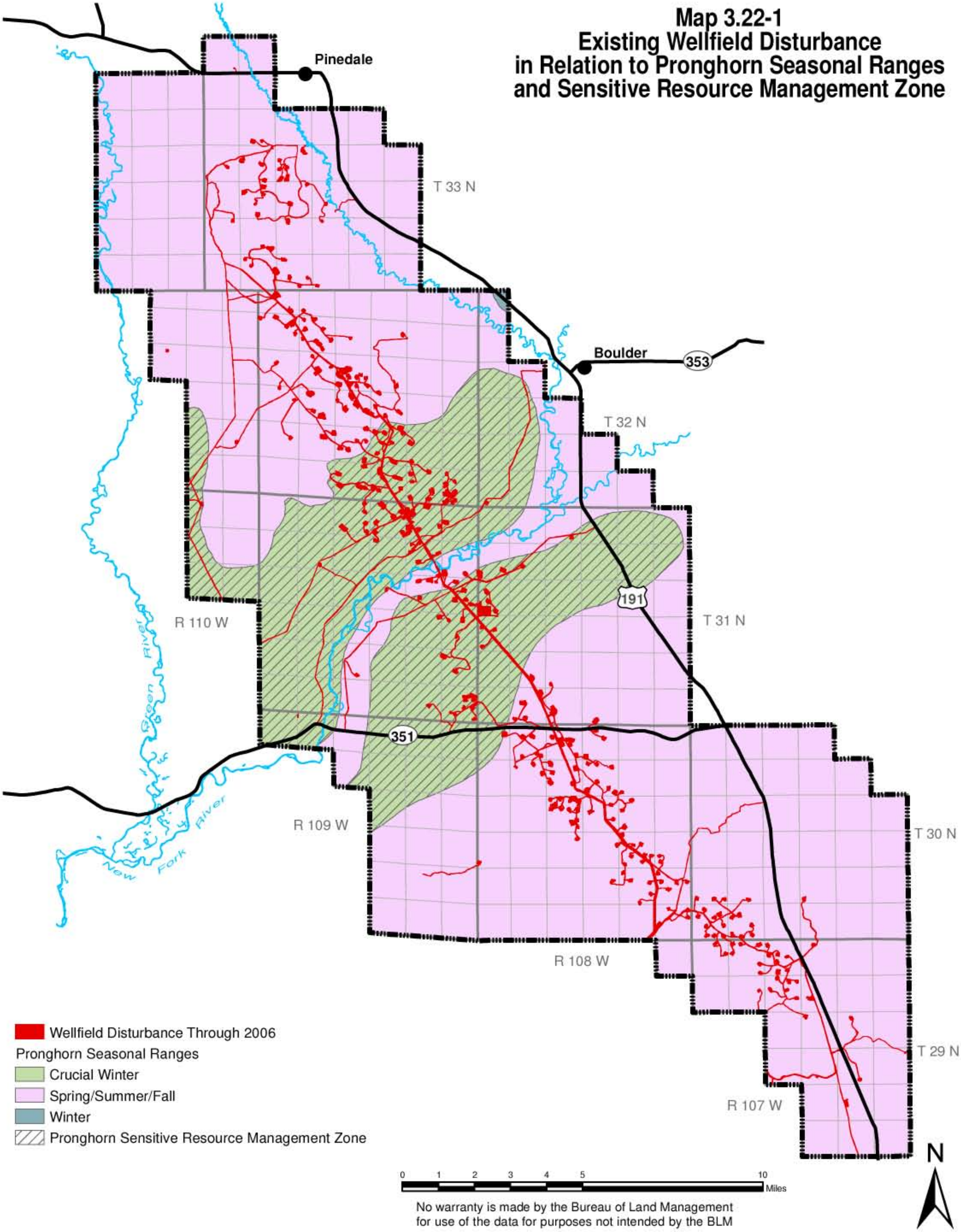
There are several research and monitoring projects that have been commissioned and funded by the Operators. Data are submitted to the BLM, WGFD, and Operators each year by the respective contractors. The following studies have been ongoing for several years:

- Annual Wildlife Monitoring. Monitoring began after the PAPA ROD was issued in 2000 and has been ongoing since then, focusing on parameters specified in the PAPA ROD. The monitoring is fully funded by the majority of the Pinedale Anticline Operators.
- Mule Deer Study. This research and modeling, which began in 1999 by Ultra has been continued since 2001 by Questar.
- Pronghorn Research. This research project was commissioned by Shell/Ultra in 2005 and is in its third year.
- Sage Grouse Study. This study was implemented by Ultra/Shell/Questar in 2005 and is in its third year.

3.22.1.1 Big Game

Pronghorn. The PAPA covers several seasonal ranges utilized by pronghorn in the Sublette Herd Unit (Map 3.22-1). Winter ranges in the PAPA are occupied by pronghorn that migrate from distant summer ranges in Grand Teton National Park (GTNP) and Bridger-Teton National Forest (BTNF). Animals captured and equipped with radio telemetry collars may begin migrating to the PAPA as early as October in some years, or as late as December in others, taking approximately 1 month to complete the trip (Sawyer and Lindzey, 2000).

Map 3.22-1
Existing Wellfield Disturbance in Relation to Pronghorn Seasonal Ranges and Sensitive Resource Management Zone



No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM

To reach the PAPA, pronghorn summering in GTNP and BTNF must travel 50 to 80 miles while crossing numerous obstacles, including 47 fences, several highways (including U.S. Highway 191), rivers (Upper Green River and Gros Ventre River), and must pass through proliferating housing subdivisions with associated fences and roads (Sawyer and Lindzey, 2000). One migratory passage of particular concern is a bottleneck in the vicinity of Trappers Point (not shown on Map 3.22-1). The bottleneck is north of the PAPA and is constricted to a 0.5-mile wide zone by the convergence of U.S. Highway 191, State Highway 352, riparian zones of the Green River and New Fork River, and private lands that have been subdivided, developed, and fenced (Sawyer and Lindzey, 2000). In 2003, over 21 miles of highway right-of-way fencing was modified to provide better passage for migratory big game (WGFD, 2004b). In 2005, WDOT installed roadside sensors along a 2-mile portion of U.S. Highway 191 that coincides with big game migrations through the Trappers Point Bottleneck. When the sensors detect animal presence, they activate flashing warning signs to alert motorists that large animals are likely to be on the highway. The system, when functional, has successfully detected big game on the highway though it is currently being upgraded (Maxam, 2006).

In the vicinity of this migration corridor constriction, the Trappers Point Bottleneck (Sawyer and Lindzey, 2000), the average daily traffic volume on U.S. Highway 191 at about milepost 100 increased from 3,000 vehicles (230 trucks)/24 hours in 2000 to 5,300 vehicles (340 trucks)/24 hours in 2005 (Table 3.6-2). Pronghorns have been killed by vehicles along U.S. Highway 191 and State Highway 351 although data collected by WDOT (Carpenter, 2006) has not shown a trend of mortality related to traffic volume. In 2006, at least 12 pronghorns were killed on U.S. Highway 191 between Daniel Junction and the border with Sweetwater County while at least 13 were killed on the entire length of State Highway 351 (Carpenter, 2007). Carcass counts on both highways were higher in 2006 than during the previous two years.

Pronghorn returning to GTNP may begin moving in April or earlier, depending on snow conditions (Sawyer and Lindzey, 2000). Pronghorn movements from crucial winter ranges on the southern slopes of the Mesa begin by shifting their distribution to the top of the Mesa, subsequently continuing north on the top and western edge of the Mesa (Sawyer and Lindzey, 2000).

Long-term fawn production data (1978 to 2003) indicate an overall significant decline in the numbers of fawns per doe counted before harvest (BLM, 2004a). However, fawn production increased from 0.60 fawns per doe in 2003 to 0.74 fawns per doe in 2004 then declined in 2005 and 2006 (Table 3.22-1). The population decreased to 42,460 animals in 2004, partially due to low fawn production the year before (Frost, 2006). Conversely, the population increased in 2005 due to higher fawn production in 2004 (Table 3.22-1), probably as a result of increased precipitation and shrub growth that year (see Vegetation, Section 3.18.1). Based on revised population modeling, the total population in 2006 was 60,080 animals (Frost, 2007). The most recent revised population model also reevaluated populations in past years. Thus, the estimated post-season population in 2005 was revised to 58,131, in 2004 to 51,357, and in 2003 to 48,532 pronghorn. The current population model (Frost, 2007) projects an increasing population for the entire Sublette Herd Unit although observed fawn production declined in 2005 and 2006.

From 1999-2003, harvest had been variable, but generally increased since 2001, especially the doe harvest, which had increased 1.5 times between 2001 and 2003. Doe harvest in 2006 was 1,824 animals, the highest since 2001 (Table 3.22-1). Doe harvest since 1999 has been much less than during the 1980s and early 1990s, when harvest exceeded 5,000 does in 1992 (BLM, 2004a).

Table 3.22-1
Pronghorn Sublette Herd Unit Population, Productivity, and Harvest

Year	Postseason Population Estimate[1]	Preseason Fawns per Doe [1]	Harvest [2]			
			Bucks	Does	Fawns	Total
1999	44,191	0.763	2,909	2,113	374	5,396
2000	42,097	0.570	3,447	2,492	343	6,282
2001	43,348	0.619	2,245	1,053	373	3,671
2002	43,630	0.615	2,467	1,477	212	4,156
2003	44,239	0.597	2,435	1,585	161	4,181
2004	42,460	0.740	2,444	1,544	239	4,227
2005	47,930	0.688	2,248	1,583	143	3,974
2006	60,080	0.658	2,364	1,824	205	4,393

[1] Estimates of modeled population for the given year as reported in WGFD, 2000-2007, Annual Big Game Herd Unit Reports.
[2] WGFD, 2000-2007. Annual Reports of Big and Trophy Game Harvest.

WGFD began modeling the northern portion of the Sublette Herd Unit population in 1997; that portion includes animals inhabiting the PAPA. Data are provided for the northern Sublette Herd Unit in Table 3.22-2. Fawn production in the northern portion had been lower than in the entire herd unit from 1999 through 2005. In 2006, the observed fawn production of 0.691 fawns per doe exceeded that in the entire herd unit (0.658 fawns per doe). Although a likely consequence of decreased precipitation and concomitant decreased shrub production, the reason(s) for the observed variability of fawn production in the northern portion of the herd unit has not been documented.

Table 3.22-2
Pronghorn Northern Sublette Herd Unit Population, Productivity, and Harvest

Year	Postseason Population Estimate [1]	Preseason Fawns per Doe [1]	Harvest [2]			
			Bucks	Does	Fawns	Total
1999	20,006	0.711	1,123	560	80	1,763
2000	18,927	0.525	1,279	685	119	2,083
2001	18,581	0.545	920	377	39	1,336
2002	23,249	0.578	1,056	498	38	1,592
2003	22,290	0.550	1,024	531	50	1,605
2004	21,964	0.680	1,095	543	70	1,708
2005	27,537	0.652	982	614	75	1,671
2006	28,869	0.691	1,092	935	114	2,141

[1] Estimates of modeled population for the given year as reported in Wyoming Game and Fish Department, Annual Big Game Herd Unit Reports, Green River Region, 2000-2007.
[2] Wyoming Game and Fish Department, Annual Reports of Big and Trophy Game Harvest, 2000-2007.

Annual adult doe survival rates, estimated from animals radio-collared in GTNP and BTNF, have been high, ranging from 97 percent survival in 1998-1999 to 84 percent survival in 1999-2000 (Sawyer and Lindzey, 2000). A study is currently underway to document pronghorn movements, habitat use, and responses to habitat alterations and disturbance, including natural gas developments in the PAPA (Berger et al., 2006). In the first progress report from the study, Berger et al. (2006) compared several variables between two experimental groups: pronghorn exposed to natural gas development (treatment group) in the PAPA and pronghorn not exposed to the development (control group). In 2006, no significant differences were detected among animals in the two study groups for the following: body mass, stress hormones (fecal corticosteroids), disease antibodies, and vitamins and minerals in blood sera (including polychlorinated biphenyls (PCBs) and organochlorides). While survival rates were lower in the treatment group (69.3 percent) than the control group (95 percent), the difference was not statistically significant (Berger et al., 2006).

Snow depths influenced the distribution of pronghorns; they rarely used areas where snow was 7.5 inches deep (± 1.5 inches) but were most likely to be where snow was 5.5 inches deep or less (Berger et al., 2007). During 2005, pronghorn kept a distance of 330 feet from well pads, although some individuals spent extensive time near pads (Berger et al., 2006). Preliminary study results in 2005 suggested that continual fragmentation of previously undisturbed land led to reduced use by pronghorn. Pronghorn appeared to abandon habitat in parcels with patch sizes at or about 600 acres (Berger et al., 2006). Similar observations during 2006 were not reported (Berger et al., 2007). During winter 2006, some radio-collared pronghorns utilized portions of the Jonah Field, apparently indicating some habituation to disturbances, while other study animals completely avoided wellfield disturbances. In the PAPA, pronghorns wintered extensively on crucial winter ranges previously defined by WGFD, though study animals did not avoid wellfield disturbances within the PAPA as some did within the Jonah Field (Berger et al., 2007).

The study has corroborated the importance and use of the Trapper's Point Bottleneck by pronghorns migrating to and from crucial winter ranges in the PAPA (Berger et al., 2007). In addition, the principal north and south migratory movements of animals within the PAPA appear to be west of the Anticline Crest and the wellfield development along the North Anticline Road. All, or nearly all, study animals cross the New Fork River on a parcel of State Trust land (Berger et al., 2007) approximately 1.7 to 2.9 miles southwest from the junction of the Paradise Road and North Anticline Road. Once across the New Fork River, all migratory pronghorns continue moving west of the Anticline Crest as they cross Highway 351 but some shift farther west, to the vicinity of the Burma Road, while others' movements are offset but parallel to the Jonah North Road as they move south toward the Jonah Field.

Most of the PAPA (150,324 acres) coincides with habitats used by pronghorn primarily during spring, summer, and fall (Table 3.22-3). Nearly 25 percent of the PAPA (47,590 acres) is pronghorn crucial winter range. The PAPA DEIS (BLM, 1999a) identified all crucial winter range as the Pronghorn SRMZ (Map 3.22-1). Surface disturbance associated with wellfield development has been proportionately more extensive within crucial winter range than in other seasonal ranges in the PAPA. As of November 2006, there were 4,834.6 acres of wellfield disturbance in the PAPA (all of which is in pronghorn seasonal ranges).

Table 3.22-3
Existing Wellfield Disturbance in
Relation to Pronghorn Seasonal Ranges

Pronghorn Seasonal Ranges	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Crucial Winter Range and Pronghorn SRMZ	47,590	1,327.7	249.6	1,577.3
Spring/Summer/Fall Range	150,324	2,813.3	444.0	3,257.3
Winter Range	120	0.0	0.0	0.0
Total	**198,034**	**4,141.0**	**693.6**	**4,834.6**

Mule Deer. Much of the PAPA coincides with crucial winter range utilized by mule deer in the Sublette Herd Unit (Map 3-22-2). Mule deer summer in mountainous terrain surrounding the PAPA to the west (Salt River Range and Wyoming Range), north (Snake River Range and Gros Ventre Range), and east (Wind River Range). They migrate to winter ranges in the PAPA and Pinedale Front Complex, traveling up to 60 to 100 miles although a few mule deer appear to be yearlong residents of the Pinedale Mesa (Sawyer and Lindzey, 2001).

Depending on snow conditions, mule deer may begin arriving on winter ranges on the Pinedale Mesa during late October (Sawyer and Lindzey, 2001), later during mild winters. If winter conditions are mild, deer may move northwest, to the vicinity of Cora Butte (Sawyer et al., 2003). Most migratory mule deer wintering on the Pinedale Mesa begin movements back to their summer range in late March or early April, depending on weather conditions (Sawyer and Lindzey, 2001).

From 1995 to 2001, the population increased from approximately 27,000 to more than 37,000 then declined to 33,000 animals in 2002, further decreased to 27,000 in 2004 (Clause, 2005) though increased slightly in 2005 (Table 3.22-4). After winter 1992-1993, the population was at an all-time low and the WGFD eliminated or greatly reduced doe and fawn harvest (harvest of any deer) to accelerate population growth (Smith, 2003). Harvest of all sex and age groups was further reduced from 2003 through 2005 (Clause, 2006a). The estimate of fawns per doe adjusted for harvest (Table 3.22-4) is used to compare fawn production in years with few or no does harvested to production in years with more does harvested (Ayers et al., 2000). Fawn productivity since winter 1992-93 increased through 1997, but has been erratic since then. Fawn productivity declined from 2003 to 2005 but increased in 2006 (Table 3.22-4).

Table 3.22-4
Mule Deer Sublette Herd Unit Population, Productivity, and Harvest

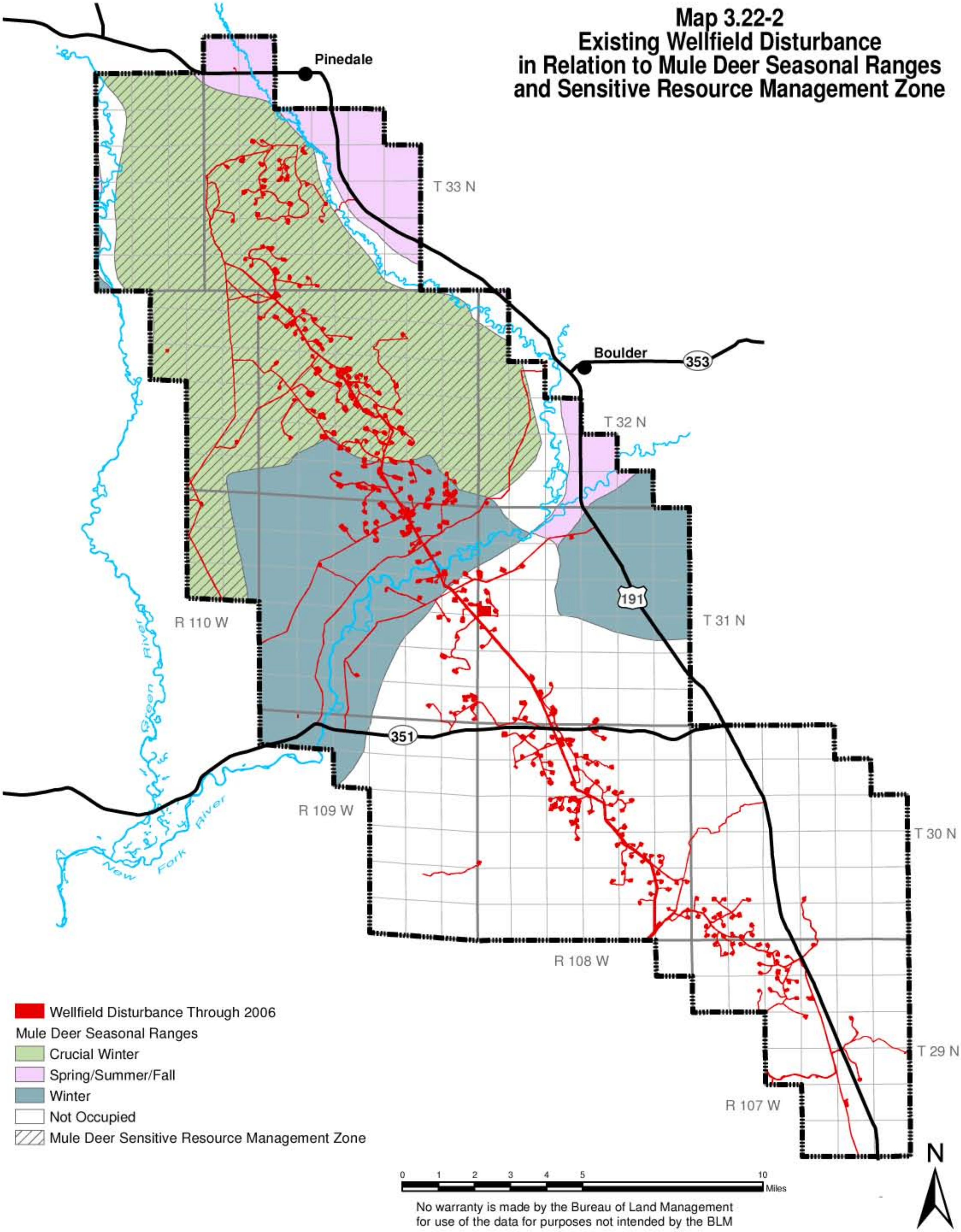
Year	Postseason Population Estimate [1]	Unadjusted Fawns per Doe Postseason [1]	Fawns per Doe Adjusted for Doe Harvest	Harvest [2]			
				Bucks	Does	Fawns	Total
1999	32,594	0.795	0.794	2,478	23	10	2,511
2000	36,564	0.819	0.810	2,991	226	22	3,239
2001	37,358	0.704	0.694	2,787	372	64	3,223
2002	32,949	0.644	0.618	2,742	817	71	3,630
2003	34,022	0.782	0.769	1,946	305	35	2,286
2004	26,633	0.684	0.672	1,689	302	38	2,029
2005	28,044	0.653	0.649	1,597	172	51	1,820
2006	26,474	0.770	0.752	1,546	353	33	1,932

[1] Estimates of modeled population for the given year as reported in Wyoming Game and Fish Department, Annual Big Game Herd Unit Reports, Jackson/Pinedale Region, 2000-2007.
[2] Wyoming Game and Fish Department, Annual Reports of Big and Trophy Game Harvest, 2000-2007.

Depressed fawn production observed from 2000-2003 has been attributed to drought conditions (Smith, 2003). For all other big game species discussed in this section, production of young increased in 2004, possibly as a response to improved forage following increased precipitation beginning in winter 2003-2004 (Table 3.3-1). Mule deer fawn production did not follow the trend but rather declined further in 2004 and continued to decline through 2005 (Table 3.22-4).

The annual precipitation by water year has been approximated for crucial winter ranges in the herd unit (Section 3.3 and Wildlife Technical Report, Appendix 17). Annual precipitation from 2000 through 2003 was well below the average precipitation of the previous 30 years. By the time herd composition surveys were conducted in 2001, there had been two consecutive years of below-average precipitation (including winter snowfall), three consecutive years in 2002, and four years of drought in 2003. The trend of low precipitation continued at least through water

Map 3.22-2 Existing Wellfield Disturbance in Relation to Mule Deer Seasonal Ranges and Sensitive Resource Management Zone



year 2003. Precipitation in 2004 and 2005 was above the 30-year average but was well below average during water year 2006. Snowfall in winter 2006-2007 was below average (Table 3.3-1).

Over-winter mortality of fawn and adult mule deer in the Sublette Herd Unit has been estimated since 1993 (Wildlife Technical Report, Appendix 17). Throughout the period of data collection, adult over-winter mortality rates have been low, ranging from 26 percent mortality (74 percent survival) in winter 2002-2003 to 3 percent mortality (97 percent survival) in winter 1998-1999. Fawn over-winter mortality rates have been higher than adult deer mortality rates in any given year and significantly higher than adult mortality since winter 2001-2002.

Adult doe mule deer survival in the Sublette Herd Unit has also been monitored by radio telemetry (Sawyer et al., 2003). In general, over-winter survival rates of telemetered adult does have deviated (though not significantly) from survival rates estimated by age ratios (Wildlife Technical Report, Appendix 17). Female adult mule deer over-winter survival has been consistently above 80 percent survival since the study began in 1999 (Sawyer et al., 2003).

In the PAPA and other winter ranges in the Sublette Herd Unit, over-winter fawn mortality is directly related to total snowfall November through March. Additionally, drought or wet conditions on the winter range during the previous two years' growing seasons strongly influence fawn over-winter mortality by ameliorating or exacerbating the influence of winter snowfall (Wildlife Technical Report, Appendix 17). For example, a 65 percent fawn mortality rate during winter 2003-2004 was associated with approximately 50 inches of snowfall, totaled from November through March, and only 15 inches of total precipitation (total inches of water including the water equivalent of snowfall) during the previous two growing seasons. Approximately 41 inches of snow fell during winter 2004-2005 but there was 21 inches of total precipitation during the 2 years prior. Fawn mortality in winter 2004-2005 was only 31 percent. During winter 2005-2006, the mortality rate of fawns on winter ranges along the Pinedale Front Complex was significantly greater than mortality of fawns on winter ranges in the Mesa Complex, the only year since 1992 with such a significant difference. Although climatological data do not indicate that winter conditions were more severe on the Pinedale Front Complex than on the Mesa Complex, anecdotal observations made a case for increased winter severity. There are no NWS stations within or proximate to the Pinedale Front Complex to confirm the observations (Wildlife Technical Report, Appendix 17). Fawn mortality rates on the two winter range complexes were not significantly different during winter 2006-2007.

The Trappers Point Bottleneck, described above for pronghorn, limits migration of mule deer to and from the PAPA (Sawyer and Lindzey, 2001). The bottleneck may contribute to mule deer-vehicle mortality in the 7-mile length of U.S. Highway 191 between Pinedale and Daniel Junction. Available data indicate that many more deer than pronghorns have been killed by vehicles in the 7-mile length of highway (WGFD, 2004c and Carpenter, 2006). Generally, the proportion of mule deer fawns killed by vehicles is greater than the proportion of fawns in the Sublette Herd Unit, indicative of their susceptibility. Numbers of mule deer killed by vehicles along U.S. Highway 191 and State Highway 351, reported by WDOT from 1999 through 2005 (Carpenter, 2006), do not appear to be related to traffic volume on either highway. There were 121 mule deer killed by vehicles on U.S. Highway 191 in 2006 between milepost 110 (Daniel Junction) and milepost 58 (7 miles north of the Sweetwater County line). Within that same portion of U.S. Highway 191, 40 mule deer were killed in 2005 but 159 deer (includes two white-tailed deer) were killed in 2004 (Carpenter, 2007). Traffic volumes had increased from 2004 to 2006 (Section 3.6.1.1).

Wildlife population growth depends not only on birth and death rates, but also on immigration and emigration of animals into and out of the population. Results of the Sublette Mule Deer Study (Phase II) have shown a consistently declining wintering mule deer population on Mesa crucial winter ranges (Sawyer et al., 2005a). Deer density decreased from 77 deer per square mile in winter 2001-2002 to 41 per square mile in 2004-2005. The density in 2005-2006 was similar to that in the previous winter (Sawyer et al., 2006). No such trend was observed on crucial winter ranges used as a control in the study (Pinedale Front Complex) that were unaffected by natural gas development. Although the wintering mule deer population on the Pinedale Mesa has declined each year from 2001 to 2005, available information indicates deer are not using alternative habitats, since emigration to other winter ranges is extremely limited. Fewer deer each year may indicate increased mortality of deer that formerly utilized the Mesa, along with declining recruitment of additional deer on the winter range since 2001-2002.

Coincidental with the declining wintering population, use of habitats on the Mesa by wintering mule deer is lowest where well pads have been developed (Sawyer et al., 2004). Areas categorized as high mule deer use prior to development changed to low use as development progressed and areas of low use changed to higher use areas (Sawyer et al., 2005a). This suggests that the natural gas development on the Mesa has displaced mule deer to less suitable habitat within the Mesa Winter Range Complex. Mule deer have progressively used areas farther away from well pads and development, with the exception of winter 2003-2004, when deep snow may have reduced available habitat options. There were fewer deer on the Mesa in winter 2003-2004 than before 2001, even though winter habitat use patterns by deer were similar during the two periods. During winter 2004-2005, mule deer use of habitats on the Mesa was most similar to use patterns observed during the previous winter. In both years, mule deer shifted away from using some habitat areas that had been high use areas prior to development, but not to the same degree as during the second and third years of the study (2001-2002 and 2002-2003). Mule deer abundance in 2005 was similar to abundance the previous winter (Sawyer et al., 2006).

Twenty-five percent of the PAPA (54,242 acres) coincides with mule deer crucial winter range (Table 3.22-5). In the PAPA DEIS (BLM, 1999a), all mule deer crucial winter range defined by WGFD and winter/yearlong range defined by BLM were included in the Mule Deer SRMZ. Since the PAPA DEIS, WGFD reclassified seasonal ranges in the PAPA and the current distribution of crucial winter range is now the Mule Deer SRMZ shown in Map 3.22-2. There were more than 2,400 acres disturbed by wellfield activities within mule deer seasonal habitats by November 2006. Most of the surface disturbance is within crucial winter range.

Table 3.22-5
Existing Wellfield Disturbance in Relation to Mule Deer Seasonal Ranges

Mule Deer Seasonal Ranges	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Crucial Winter Range and Mule Deer SRMZ	54,242	1,217.5	241.6	1,459.1
Spring/Summer/Fall Range	10,396	5.0	2.7	7.7
Winter Range	35,248	801.9	196.9	998.8
Winter/Yearlong Range	7,320	4.8	9.8	14.6
Total	**107,206**	**2,029.2**	**451.0**	**2,480.2**

Elk. The PAPA coincides with two elk herd units, the Green River Herd Unit and the Pinedale Elk Herd Unit. The Green River Herd Unit occupies the northernmost portion of the PAPA as non-crucial winter range (1,324 acres) and winter/yearlong range (997 acres). No seasonal ranges in the PAPA are occupied by elk in the Pinedale Herd Unit. No wellfield development has occurred in any seasonal habitats used by elk through 2006. An elk SRMZ was not identified in the PAPA. Each year, WDOT has recorded a few vehicle related mortalities of elk along U.S. Highway 191, primarily north of Daniel Junction and not in the vicinity of the PAPA (Carpenter, 2006).

Since 2000, calf production in the Green River Herd Unit declined through 2002. Calf production increased in 2004, similar to pronghorn and moose (below). Calf productivity in the Green River Herd Unit appears lower than in the Pinedale Herd Unit (BLM, 2004a). Harvest of all sex and age groups decreased since 2000, except for bulls, which increased in 2004 (Table 3.22-6).

Long-term trends for elk in the Green River Herd Unit indicate calf production has been significantly declining since the late 1970s. Data for the Pinedale Herd Unit do not reveal such a significant declining trend (BLM, 2000-2007, Annual Big Game Herd Unit Reports) and are not included in Table 3.22-6 because occupied portions of the herd unit do not coincide with the PAPA.

Table 3.22-6
Elk Green River Herd Unit Populations, Productivity, and Harvest

Year	Postseason Population Estimate [1]	Unadjusted Calf per Cow Postseason [1]	Calf per Cow Adjusted for Harvest	Harvest [2]				
				Bull	Spike	Cow	Calf	Total
1999	3,855	0.248	0.248	138	24	212	54	428
2000	3,461	0.317	0.315	190	54	345	104	693
2001	3,122	0.302	0.284	157	37	280	45	519
2002	2,544	0.203	0.222	178	17	342	109	646
2003	2,049	0.227	0.225	179	27	260	55	521
2004	2,258	0.281	0.269	217	24	226	44	511
2005	2,506	0.239	0.251	144	31	203	72	450
2006	2,567	0.281	0.269	129	22	168	30	349

[1] Estimates of modeled population for the given year as reported in WGFD, 2000-2007, Annual Big Game Herd Unit Reports.
[2] WGFD, 2000-2007, Annual Reports of Big and Trophy Game Harvest.

Wintering elk in both herd units are sustained on feedgrounds that, in part, are maintained to avoid elk conflicts with livestock and private property, especially for elk in the Pinedale Herd Unit (Clause, 2007b). The Scab Creek, Muddy Creek, and Fall Creek feedgrounds in the Pinedale Herd Unit have been established since 1976, and combined, supported approximately 1,747 elk during winter 2005-2006 (Clause, 2006b). Three feedgrounds in the Green River Herd Unit (Black Butte, Green River Lakes, and Soda Lake) supported approximately 2,015 elk during winter 2005-2006 (Clause, 2006c). Elk on all six feedgrounds are vaccinated against brucellosis.

Moose. In the PAPA DEIS (BLM, 1999a), the Moose SRMZ coincided with crucial winter/yearlong moose habitat for the Sublette Herd Unit, found primarily within the riparian zone associated with the New Fork River (Map 3.22-3). Slightly more than 18,000 acres of moose crucial winter/yearlong have been defined within the PAPA. As of November 2006, 146.9 acres were disturbed within this habitat by wellfield activities.

The Sublette Herd Unit moose population has declined recently, and the production of calves per cow (adjusted for harvest) has significantly declined from 1994 through 2005 (Table 3.22-7). Similar to pronghorn and elk populations near the PAPA, moose calf production in the herd unit increased in 2004 and 2005 although harvest of bulls, cows, and calves were reduced in both years from harvest levels in 2003. Moose have been killed by vehicles on U.S. Highway 191, near the PAPA, but only occasionally since 1999 (Carpenter, 2006). In 2006, two yearling moose were killed on U.S. Highway 191 between milepost 92 and milepost 98, south of Pinedale (Carpenter, 2007).

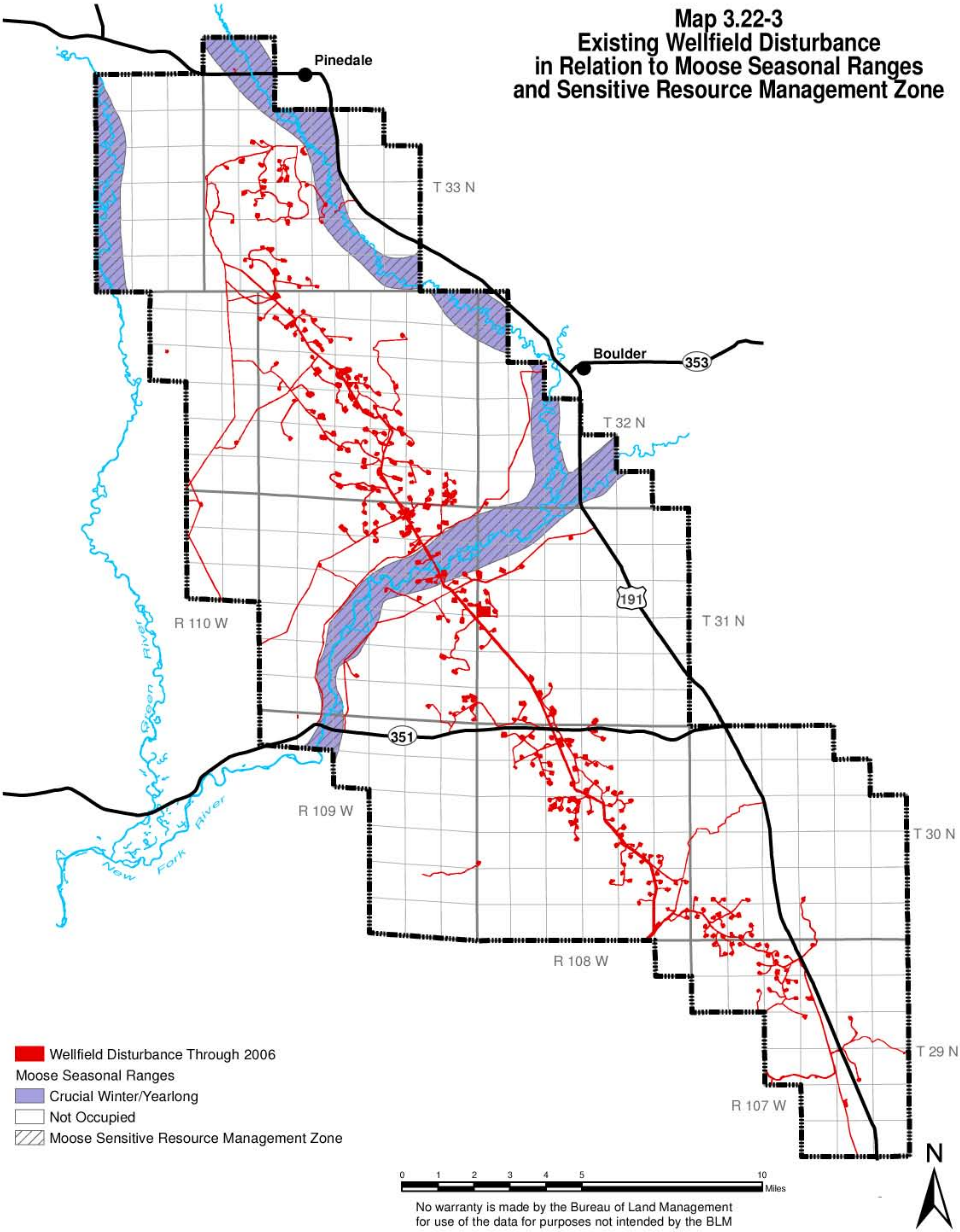

Map 3.22-3
Existing Wellfield Disturbance
in Relation to Moose Seasonal Ranges
and Sensitive Resource Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
Moose Seasonal Ranges
Crucial Winter/Yearlong
Not Occupied
Moose Sensitive Resource Management Zone
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
N

Table 3.22-7
Moose Sublette Herd Unit Populations, Productivity, and Harvest

Year	Postseason Population Estimate [1]	Unadjusted Calf per Cow Postseason [1]	Calf per Cow Adjusted for Harvest	Harvest [2]			
				Bull	Cow	Calf	Total
1999	5,817	0.427	0.405	306	171	21	498
2000	5,967	0.458	0.435	332	172	28	532
2001	5,665	0.344	0.337	352	160	39	551
2002	3,726	0.417	0.406	362	144	35	541
2003	4,028	0.350	0.334	339	161	18	518
2004	4,107	0.412	0.401	258	84	10	352
2005	3,926	0.409	0.400	227	57	5	289
2006	4,066	0.448	0.441	219	53	7	279

[1] Estimates of modeled population for the given year as reported in WGFD, 2000-2007, Annual Big Game Herd Unit Reports.
[2] WGFD, 2000-2007, Annual Reports of Big and Trophy Game Harvest.

3.22.1.2 Upland Game Birds

Greater sage-grouse is the predominant upland game bird in southwest Wyoming. Greater sage-grouse have been casually observed on BBS routes conducted throughout the Upper Green River Basin region by cooperators with the USGS Patuxent Wildlife Research Center (Sauer et al., 2007). Observations of number of greater sage-grouse counted per BBS route indicate that their relative abundance since 1994 peaked in 2000 but has been declining (Figure 3.22-1).

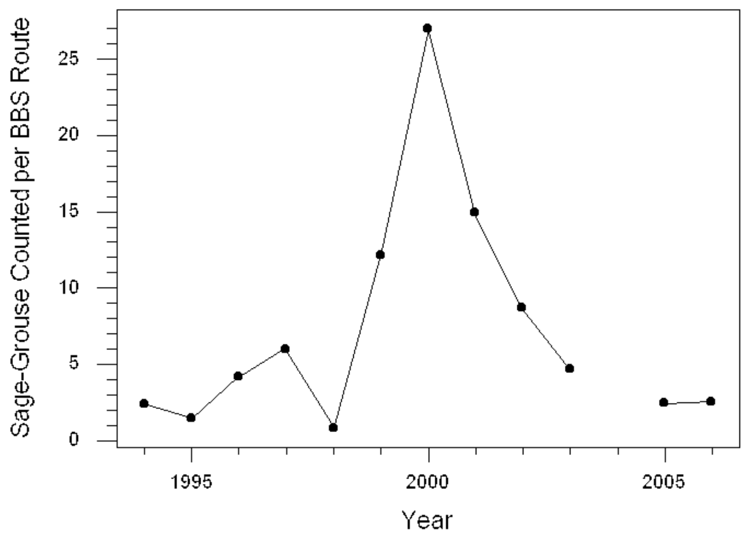


Figure 3.22-1
Greater Sage-Grouse Counted per Breeding Bird Survey Route within the Upper Green River Basin, 1994 through 2006
(Source: Sauer et al., 2007)

Adult male greater sage-grouse arrive first on leks, usually by mid-March, thereafter joined by sub-adult males and females (Lyon, 2000). Females move to nest site vicinities several days after copulation (Lyon, 2000). Although reports indicate that most females nest within 2 miles of leks where they breed (Braun et al., 1977), some greater sage-grouse hens in the PAPA have nested farther than that. The greatest distance from lek to nest was over 28 miles, observed for one female (Lyon, 2000). Greater sage-grouse hens tend to nest in the same vicinity in consecutive years (Lyon, 2000). In the PAPA DEIS (BLM, 1999a), greater sage-grouse nesting habitat was assumed to include areas within a 2-mile radius around each active and inactive lek, even though distances from leks to nests in the region can be quite variable (Heath et al., 1997 and Lyon, 2000). The current distribution of leks in the PAPA, including those within 2 miles of the PAPA boundary, is shown in Map 3.22-4.

The PAPA is within Small and Upland Game Management Area (SUGMA) 3 (Bridger) north of the New Fork River, and in SUGMA 7 (Eden) south of the river. The WGFD documented harvest data, including total hunters, total recreation-days, and total greater sage-grouse harvested in both SUGMAs since 1982. With data from both areas combined, there have been significant declining trends in numbers of hunters, total hunting recreation-days, and total greater sage-grouse harvested during the past two decades. Of particular importance is the total number of greater sage-grouse harvested per recreation-day, which has significantly declined since 1982, suggesting declining greater sage-grouse abundance (Figure 3.22-2).

The decline has occurred even though WGFD has shortened harvest seasons, delayed opening season dates to increase survival of reproductive hens, and decreased bag limits to enhance population growth (Clause, 2006d). Harvest per recreation-day did increase from 2002 through 2005, possibly reflecting increased survival following above-average precipitation in 2004 and 2005 (Table 3.3-1) as well as the effects of more conservative harvest management. However, harvest per recreation day declined in 2006 (Figure 3.22-2).

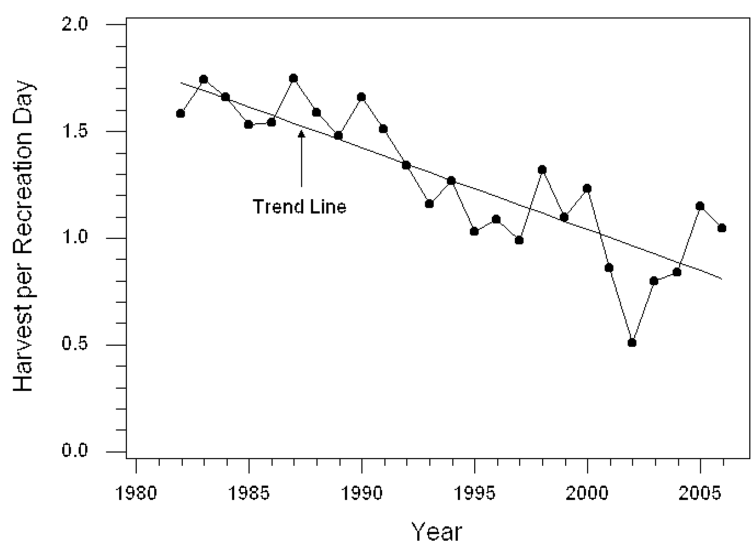
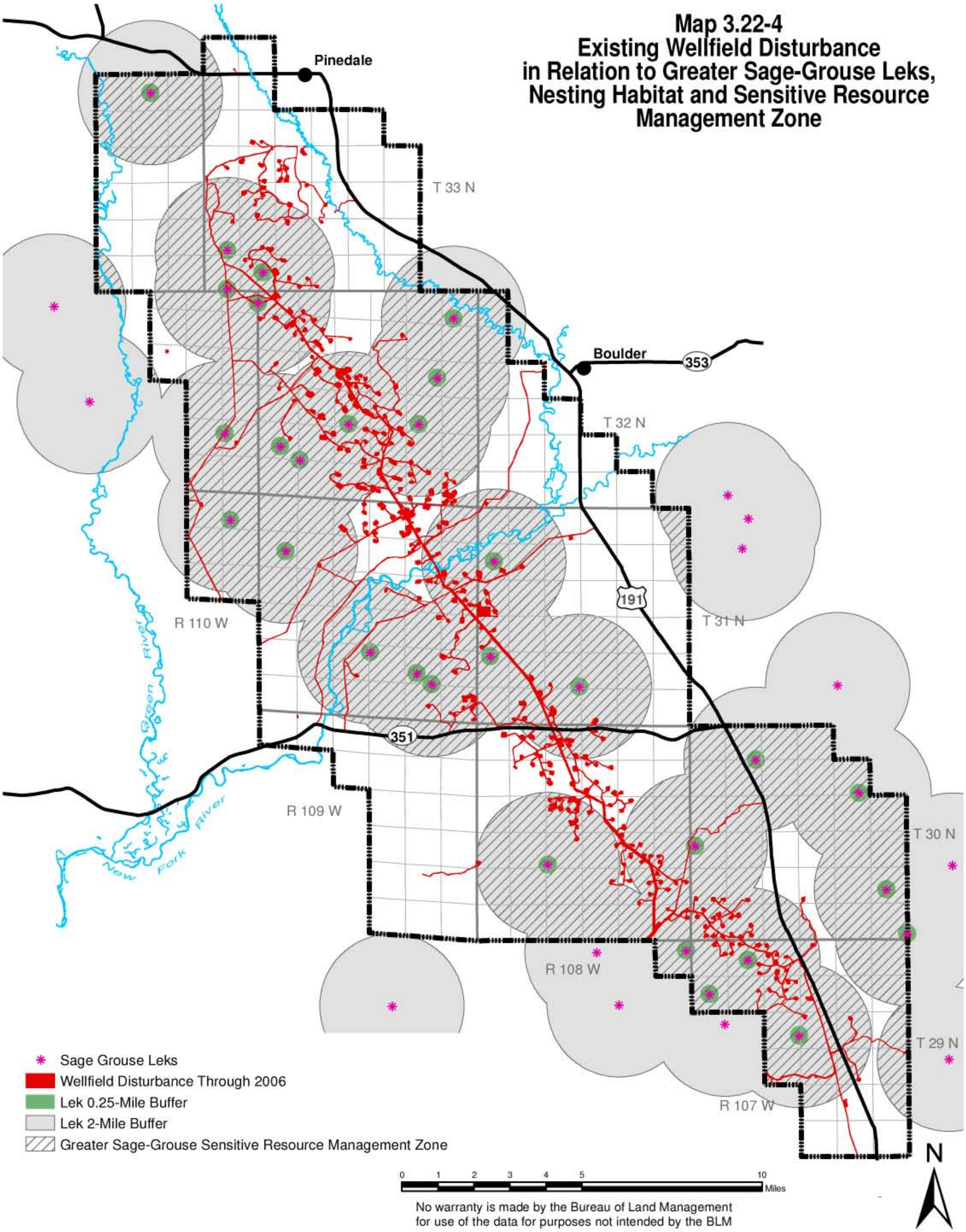


Figure 3.22-2
Greater Sage-Grouse Harvested per
Recreation-Day in SUGMA 3 and 7 Combined, 1982 to 2006
(Source: WGFD, 1983-2007, Annual Reports of Upland Game and Furbearer Harvest)


Map 3.22-4
Existing Wellfield Disturbance in Relation to Greater Sage-Grouse Leks, Nesting Habitat and Sensitive Resource Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Sage Grouse Leks
Wellfield Disturbance Through 2006
Lek 0.25-Mile Buffer
Lek 2-Mile Buffer
Greater Sage-Grouse Sensitive Resource Management Zone
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM
N

Annual census of greater sage-grouse leks has been used to track changes in the breeding population (Connelly et al., 2004), particularly if leks are censused repeatedly within a given year so that the peak in male attendance can be determined (Jenni and Hartzler, 1978). Data on peak male attendance at leks within SUGMAs 3 and 7 have been compiled by WGFD (Christiansen, 2007). To evaluate potential effects of oil and gas development on greater sage-grouse lek attendance, records compiled by the WOGCC for all oil and gas wells within the state were obtained (Meyer, 2007) including those that are within SUGMAs 3 and 7. Along with other information, each record provides the most recent status and location for a well. The summaries in Table 3.22-8 are based on locations of each lek and each producing oil or gas well within SUGMAs 3 and 7, the linear trend (increasing, no trend, or decreasing trend derived from linear regression analysis) in peak male attendance at each lek during the past 10 years (1998-2007), and each lek's current status (in 2006 or 2007, whenever last surveyed). Only leks that had been censused in at least 5 of the past 10 years were included in the analysis.

Eight leks in the two SUGMAs combined, were active in 2007 but each demonstrated significant decreasing trends in peak numbers of attending male since 1998. Similarly, there were 17 leks that were inactive in 2007 and all had significant declining trends for the past 10 years. Taken

Table 3.22-8
Patterns in Peak Lek Attendance by Male Sage-Grouse in Small and Upland Game Management Areas 3 and 7 from 1998 through 2007

Current (2006 or 2007) Lek Status [1]	10-Year Trend Peak Male Attendance (1998-2007)	Number of Leks With Current Status and Trend	Mean Yearly Peak Male Attendance in 10 years (95% Confidence Interval)	Mean Number of Producing Wells[2] Within 2-mile Radius (95% Confidence Interval)
Active	Increasing	28	73.13 (± 18.26)	2.68 (± 3.59)
	No Trend	54	40.50 (± 7.61)	7.37 (± 6.15)
	Decreasing	8	24.73 (± 16.45)	25.50 (± 10.64)
Inactive	No Trend	16	5.87 (± 6.48)	17.69 (± 22.35)
	Decreasing	17	9.11 (± 4.71)	32.68 (± 16.98)
Unknown	No Trend	3	36.87 (± 30.44)	0

[1] Only includes leks that had been surveyed at least 5 out of the past 10 years and does not include abandoned leks. Source: Christiansen, 2007.
[2] Includes producing oil and gas wells, flowing wells, active injector wells, and other types requiring worker visits. Source: Meyer, 2007.

as a group, leks with decreasing peak male attendance had significantly more producing oil or gas wells within a 2-mile radius from the lek location than the 28 leks that demonstrated significant increasing trends in peak numbers of attending males since 1998 (Table 3.22-8).

Available information does not indicate that any of the producing oil or gas wells within 2 miles of any lek were drilled during periods of lek attendance. However, once drilled, completed, and productive, wells require regular visits by wellfield workers for maintenance and product transport. Vehicular traffic associated with producing wells must continue throughout the year (Section 3.6.1.1 – Transportation), regardless of the status of greater-sage grouse leks. Thus, the number of producing oil and gas wells within a 2-mile radius of greater sage-grouse leks represents a relative amount of wellfield disturbance due to a variety of activities, mostly vehicular traffic, during all seasons including greater sage-grouse breeding, nesting, and juvenile rearing periods in the species' annual cycle.

The PAPA coincides with three greater sage-grouse lek complexes, the Mesa Complex north of the New Fork River, Duke’s Triangle Complex south of the river and north of State Highway 351, and the Yellow Point Complex with leks in the southern portion of the PAPA (Map 3.22-5). The Upper Green River Basin Sage-Grouse Working Group (2006) defines a lek complex as a group of leks near each other where regular interchange of male greater sage-grouse is expected. In 2001, there were eight active leks in the Mesa Complex, three active leks in the Duke’s Triangle Complex, and six active leks in the Yellow Point Complex (Christiansen, 2007) for a total of 17 active leks. In all three complexes combined, there were five inactive leks and eleven additional leks with unknown status because they were not surveyed or were not located that year. By 2006, there were six active leks in the Mesa Complex (including one new lek - Lovatt West - formed in 2005), three active leks in the Duke’s Triangle Complex (including one new lek - Duke's Triangle New – formed in 2005), and six active leks in the Yellow Point Complex (Christiansen, 2007) for a total of 15 active leks, two less than the total in 2001.

Only two leks, in all three complexes in the PAPA combined, have been increasing in peak male attendance from 1998 through 2007 while peak attendance has been decreasing at eleven leks, five of which are in the Yellow Point Complex (Table 3.22-9). In contrast, eleven leks within three other complexes proximate to the PAPA (Ryegrass Complex to the northwest, Muddy Creek Complex to the west, and Speedway Complex to the east) increased from 1998 through 2007 though none decreased in that period. Similar to the pattern found for all leks in SUGMAs 3 and 7, there were either no or very few producing oil and gas wells within 2 miles of all leks with increasing trends of peak male attendance from 1998 through 2007 (Table 3.22-9). All leks in the PAPA with decreasing trends had at least 18 producing wells within a 2-mile radius. There were no leks in complexes off the PAPA that had decreasing trends (Table 3.22-9). The data imply that the relative amounts of wellfield disturbance due to traffic and other actions related to wellfield production during all seasons within 2 miles of greater sage-grouse leks is related to declining male attendance at leks.

Leks in and near the PAPA were intensively monitored between 1999 and 2004. The investigation indicated that male counts on leks that were heavily impacted by natural gas wells declined 51 percent from one year prior to well development through 2004 (Holloran, 2005). For example, on two leks in the PAPA, before development in 2001, average counts on each lek exceeded 15 males but only one male was observed only once on each lek in 2005, and none were seen at either lek in 2006 or in 2007. Generally, there were fewer strutting males on leks closer to drilling rigs than on leks farther away from drilling rigs.

Strutting male numbers decreased with increased traffic volumes within 1.86 miles of the leks and with increased noise intensity estimated at leks. The decline has been attributed to displacement of males from and low recruitment of yearling males on impacted leks (Holloran, 2005 and Kaiser, 2006).

Two new leks, one on the Mesa (Lovatt West) and south of the New Fork River (New Dukes Triangle), were found in 2005, both were active in 2006 but only the Lovatt West lek was active in 2007. During 2006 and 2007, there were no males observed at two leks on the Mesa (Mesa Springs and Lovatt Draw Reservoir) and as noted earlier, both leks are currently inactive.

Mature females are likely to reuse the same nest site; however, yearling females select nesting locations farther from haul roads and active drilling rigs, suggesting the long-term response of nesting females is avoidance of development areas (Holloran, 2005).

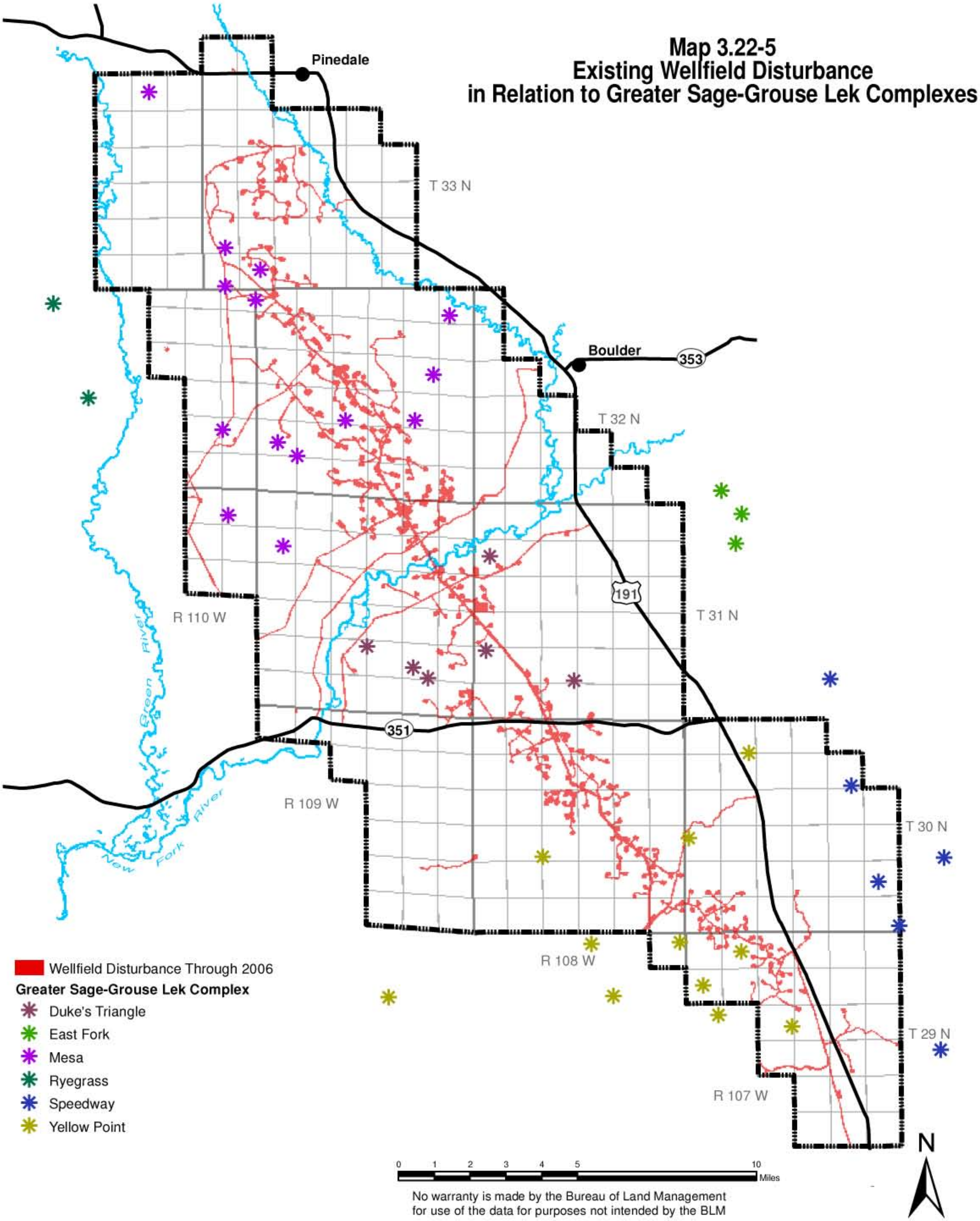

Map 3.22-5
Existing Wellfield Disturbance
in Relation to Greater Sage-Grouse Lek Complexes
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
Greater Sage-Grouse Lek Complex
Duke's Triangle
East Fork
Mesa
Ryegrass
Speedway
Yellow Point
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

Table 3.22-9
Patterns in Peak Lek Attendance by Male Greater Sage-Grouse in and off the PAPA [1]

10-Year Trend in Peak Male Attendance (1998-2007)	Number of Leks With Trend	Mean Yearly Peak Male Attendance (range in value)	Mean Number of Producing Wells Within 2-mile Radius (range in value)
Lek Complexes in PAPA			
Mesa Complex			
Increasing	1	58	0
No Trend	8	37.5 (0 – 126)	7.1 (0 – 30)
Decreasing	3	13.7 (9 – 19)	107.3 (56 – 179)
Duke's Triangle Complex			
Increasing	0	N/A	N/A
No Trend	1	0	38
Decreasing	3	23.7 (2 – 42)	28.0 (18 – 41)
Yellow Point Complex			
Increasing [2]	1	9	0
No Trend	5	28.2 (2 – 53)	27.4 (9 – 54)
Decreasing	5	12.8 (1 – 42)	66.2 (22 – 189)
Lek Complexes off PAPA			
Ryegrass Complex			
Increasing	2	20.1 (2 – 38)	0
No Trend	8	15.0 (2 -31)	0
Decreasing	0	N/A	N/A
Muddy Creek Complex			
Increasing	3	39.2 (5 – 58)	0
No Trend	3	25.8 (2 – 54)	0
Decreasing	0	N/A	N/A
Speedway Complex			
Increasing	4	113.1 (79 – 156)	0.3 (0 – 1)
No Trend	2	50.7 (4 – 97)	0.5 (0 – 1)
Decreasing	0	N/A	N/A

[1] Sources: Christiansen, 2007 and Meyer, 2007.
[2] Male greater sage-grouse in the Prairie Dog lek changed the lek location in 2007 with higher peak attendance than at the former location.

Greater sage-grouse also winter in the PAPA. Greater sage-grouse movements to winter ranges can take some time and may occur between late August and December. For example, most radio-telemetered greater sage-grouse were in the PAPA and vicinity by November 1998 but arrived later in the PAPA in 1999, possibly due to mild weather that year (Lyon, 2000). Wintering greater sage-grouse depend, in part, on sagebrush extending above the snow and Lyon (2000) documented numerous wintering greater sage-grouse on the Mesa and some within the PAPA south of the New Fork River. Likewise, distributions of greater sage-grouse winter fecal pellet groups surveyed by Wyoming Wildlife Consultants (BLM, 2004c) from 2001 through 2003 indicate wintering grouse are present in the PAPA, north and south of the New Fork River.

The PAPA ROD (BLM, 2000b) established seasonal restrictions in the form of guidelines for the protection of greater sage-grouse in seasonal habitats. The restrictions are stated in Appendix A of the PAPA ROD and are reiterated in Section 2.4.2 in Chapter 2. Subsequent to the PAPA ROD, BLM issued guidance for the protection of greater sage-grouse habitat in IM WY2004-057 (BLM, 2004b). This guidance is also provided in Section 2.4.2 in Chapter 2.

There are 113,325 acres included in the Sage Grouse SRMZ (Table 3.22-10) which are associated with the 2-mile buffers of all occupied leks. As of November 2006, there was approximately 20 acres of disturbance within the 0.25-mile buffer for greater sage-grouse leks. There was over 3,600 acres of disturbance within the 2-mile buffer and Sage Grouse SRMZ. Most disturbance is been on federal lands and minerals (Table 3.22-10).

Table 3.22-10
Existing Wellfield Disturbance in Relation to Greater Sage-Grouse Lek Buffers and SRMZ

Lek Buffer	Total Area in the PAPA (acres)	Existing Wellfield Disturbance Through 2006 (acres)		
		Federal lands	Non-federal lands	All lands
0.25-Mile Buffer	2,831	20.36	0.0	20.36
2-Mile Buffer and Sage Grouse SRMZ	113,325	3,139.3	487.5	3,626.8

Mourning doves are upland game birds potentially harvested in the PAPA, though not to the extent of greater sage-grouse. Ruffed grouse and chuckar may also be hunted in or near the PAPA (Table 3.22-11).

Table 3.22-11
Harvest Data for Other Upland Game Birds
and Derived Statistics in SUGMA 3 and 7 During 2006[1]

Game Bird	SUGMA	Hunters	Hunter Days	Harvest	Days per Hunter	Days per Harvest	Harvest per Day
Mourning Dove *Zenaida macroura*	3 - Bridger	25	79	112	3.16	0.71	1.42
	7 - Eden	74	143	361	1.93	0.40	2.52
Ruffed Grouse *Bonasa umbellus*	3 - Bridger	400	1,842	1,195	4.61	1.54	0.65
	7 - Eden	39	464	102	11.90	4.55	0.22
Chuckar *Alectoris chuckar*	7 - Eden	25	57	31	2.28	1.84	0.54

[1] Source: WGFD, 2007a.

3.22.1.3 Small Game and Furbearing Mammals

Harvest of cottontails and squirrels has been reported in SUGMAs 3 and 7, and both are potentially harvested in the PAPA. Ten species of furbearing mammals may be trapped, snared, or shot near the PAPA although harvest data are not compiled for furbearer species by

SUGMA. Furbearers include badger, bobcat, weasel, coyote, raccoon, red fox, skunk, beaver, mink, and muskrat.

Populations of rabbits in North America may be cyclic (Dunn et al., 1982 and Chapman et al., 1982). Cottontails harvested per recreation-day in SUGMAs 3 and 7 since 1982 show a 6 to 7-year cycle of peaks. Apparent peaks in 1996 and 2003 were lower than earlier peaks in 1983 and 1990 (Figure 3.22-3), suggestive of an overall population decline at least during peaks. Harvest data from 1982 through 2005 may indicate that cycle intensity may be dampened given that the trend since 1982 has been fewer hunters spending fewer recreational days pursuing cottontails.

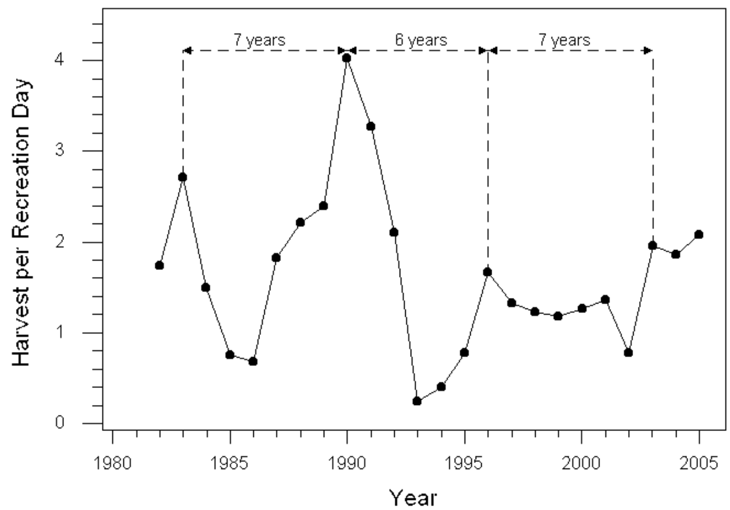


Figure 3.22-3
Cottontail Rabbits Harvested per Recreation-Day in SUGMA 3 and 7 Combined, 1982 to 2006

3.22.1.4 Migratory Birds

Data compiled for nine National Biological Survey BBS routes in the upper Green River area reveal 150 bird species have been observed on one or more routes since 1980 (Sauer et al., 2007). Of those, 107 species are listed as Nearctic-Neotropical migratory birds by the USFWS, Division of Bird Habitat Conservation, pursuant to the Neotropical Migratory Bird Conservation Act. As with all federal agencies, BLM has mandates to protect migratory birds under the Migratory Bird Treaty Act (16 U.S.C. 703-711), the Bald and Golden Eagle Protection Act ((16 U.S.C. 668-668d), EO 13186 (January 10, 2001), and BLM IM 2008-050 (BLM, 2008). Under IM 2008-050, BLM has committed to minimize unintentional take of migratory birds and optimize their conservation until a national Memorandum of Understanding with USFWS is established as required under EO 13186.

Not all species on BBS routes are migrants, though, and data for many of the migratory species are sparse, limited to only a few observations some years on a few routes. BBS data for 45 migratory species in the region allowed estimation of trends from 1994 through 2006. With nine routes in the region, there were only 45 migratory species with barely adequate data to estimate trends over the past 13 years (1994-2006), with 2004 excluded. In 2004, only two of the nine routes were surveyed, an inadequate sample to include in further analysis. There were 16 of the 45 species with either increasing or decreasing linear trends during the 13-year period (Table 3.22-12).

Table 3.22-12
Neotropical Migratory Birds in the Vicinity of the PAPA with Decreasing or Increasing Trends Estimated from National Biological Survey Breeding Bird Survey Data from 1994 to 2006

Common Name Scientific Name	Nest Substrate[1]	General Habitat[1]	Trend (level of significance)
Great Blue Heron *Ardea herodias*	Trees	Riparian, lakes, rivers	Decreasing (P<0.10)
Northern Harrier *Circus cyaneus*	Ground in dense vegetation	Grassland, shrubland, marshes	Increasing (P<0.20)
Swainson's Hawk *Buteo swainsoni*	Trees, cliffs	Open areas below 9000 feet	Decreasing P<0.20)
Killdeer *Charadrius vociferus*	Ground	Shoreline, aquatic sites in most habitats	Decreasing (P<0.01)
Spotted Sandpiper *Actitis macularia*	Ground near water	Shorelines of rivers and lakes	Decreasing (P<0.10)
Northern Flicker *Colaptes auratus*	Cavity	Most habitats with trees/poles present	Decreasing (P<0.10)
Black-billed Magpie *Pica pica*	Small trees and shrubs	All habitats below 8000 feet	Increasing (P<0.20)
Horned Lark *Eremophila alpestris*	Ground	Shrublands and grasslands	Increasing (P<0.05)
Rock Wren *Salpinctes obsoletus*	Holes and crevices	Rock outcrops and rock piles	Increasing (P<0.20)
Mountain Bluebird *Sialia currucoides*	Cavity	Most habitats with nesting cavities and open areas	Decreasing (P<0.10)
Green-tailed Towhee *Pipilo chlorurus*	Shrubs and ground	Mixed conifer forest, woodland-chaparral, juniper-sagebrush, basin prairie and mountain foothills shrubland, riparian shrub	Increasing (P<0.20)
Vesper Sparrow *Pooecetes gramineus*	Ground	Shrubland, grassland, agricultural areas	Increasing (P<0.10)
Sage Sparrow *Amphispiza belli*	In or under sagebrush	Shrubland	Decreasing (P<0.05)
Savannah Sparrow *Passerculus sandwichensis*	Ground	Willows, grasslands, marshes, irrigated meadows	Increasing (P<0.05)
Song Sparrow *Melospiza melodia*	Ground	Riparian, marshes	Increasing (P<0.20)
Yellow-headed Blackbird *Xanthocephalus xanthocephalus*	Over water in emergent vegetation	Marshes	Decreasing (P<0.05)

[1] Abbreviated from descriptions by Cerovski et al., 2004.

Trends of abundances for eight migratory species appear to be declining; of these, three species (killdeer, spotted sandpiper, and sage sparrow) nest on or close to the ground in a variety of habitats. Two species with declining abundance nest in tree cavities (northern flicker and mountain bluebird) and four inhabit wetland and/or riparian habitats (great blue heron, killdeer, spotted sandpiper, and yellow-headed blackbird). The abundance of other species that utilize riparian or other moist habitats appears to be increasing (savannah sparrow and song sparrow) and both species nest on the ground. In addition to these two species, other species that appear to be increasing include northern harrier, black-billed magpie, horned lark, rock wren, green-tailed towhee, and vesper. Increasing numbers of black-billed magpies in the region could be indicative of increasing carrion due to increased traffic on area highways. Magpies in the region may be year-long residents (Dorn and Dorn, 1990).

Many common raptor species are known to nest, migrate, and seasonally reside, in the vicinity of the PAPA. These include golden eagle, red-tailed hawk, ferruginous hawk, great horned owl, bald eagle, Swainson's hawk, northern harrier, prairie falcon, American kestrel, merlin, osprey, and short-eared owl. These raptors and all other migratory birds are protected under the Migratory Bird Treaty Act in which taking, killing, or possessing migratory birds is unlawful. Although the common raven occurs in the PAPA, is a potential predator and/or scavenger, and classified as a raptor by some, it is in the same family as jays, magpies, and crows (Corvidae) and not discussed further. Nesting records of golden eagles, ferruginous hawks, short-eared owls, and other raptors, including American kestrel, osprey, great horned owl, northern harrier, prairie falcon, red-tailed hawk, and Swainson's hawk, have been made on or in the immediate vicinity of the PAPA since 2001, and their status in relation to wellfield development has been investigated (Ecosystem Research Group, 2006).

Sharp-shinned hawk, Cooper's hawk, northern goshawk, burrowing owl, and long-eared owl, may also be present in the PAPA during the summer. Birds that may winter in the PAPA include golden eagle, red-tailed hawk, rough-legged hawk, and great horned owl, as well as other less common species (Call, 1978).

3.22.1.5 Nongame Wildlife Species

Nongame mammals, birds, and herpetofauna that were likely to have inhabited the PAPA when the PAPA DEIS was issued (BLM, 1999a) are not likely to have changed since then. Numbers of select terrestrial nongame wildlife species potentially associated with the several vegetation-based habitats in the PAPA are provided in Table 3.22-13.

Table 3.22-13
Numbers of Terrestrial Nongame Wildlife Species Expected in the Different Vegetation Categories in the PAPA[1]

Vegetation Category	Reptile Species Numbers		Bird Species Numbers		Mammal Species Numbers	
	Unique to Type	In Multiple Types	Unique to Type	In Multiple Types	Unique to Type	In Multiple Types
Sagebrush steppe	0	3	0	45	0	30
Mixed grass prairie	0	3	1	48	0	32
Greasewood flats	0	1	0	33	0	16
Desert shrub	0	1	0	48	0	24
Riparian forest and shrub	0	2	47	56	5	23
Other limited types	0	2	14	37	4	24
Barren ground	0	1	0	22	0	9
Irrigated cropland	0	1	8	47	0	14
Human settlement	0	2	6	45	0	10

[1] Based on distributions and habitat associations provided in Cerovski et al., 2004.

Most nongame reptiles, birds, and mammals likely to occur in the PAPA are expected within sagebrush steppe, the most extensive vegetation cover type in the area. However, the nongame species are also expected to utilize other available vegetation. There are some species of birds and mammals that are only likely to inhabit specific vegetation-based habits, particularly riparian forest and shrub. Amphibians potentially occurring in the PAPA have been identified above, in Table 3.21-2 and include tiger salamanders (Baxter and Stone, 1980).

3.22.1.6 Aquatic Resources

Aquatic resources in the PAPA were described in Section 3.20 of the PAPA DEIS (BLM, 1999a). The Green River and New Fork River provide habitats for several game fish species. Since 2000, WGFD surveyed in the Green River downstream and upstream from the confluence of the New Fork River and within the New Fork River, downstream of the confluence with the

East Fork River and upstream to Pine Creek. The results of the investigations have been summarized in Annual Fisheries Progress Reports (WGFD, 2002, 2003a, 2004d, 2005, 2006b, and 2007b).

Sampling to estimate populations of game fish in the various river segments has been conducted in some years (Table 3.22-14). Though sample sizes for some species have been too small to allow population estimates, the values in Table 3.22-14 probably represent relative population sizes. Brown trout consistently appear to be most abundant in each of the river segments near the PAPA. Rainbow trout have generally been the next most abundant game fish, although abundance of Snake River cutthroat trout in the Green River, downstream of the confluence with the New Fork River, appeared to exceed rainbow trout in 2002.

Table 3.22.14
Population Estimates of Game Fish Species in
River Segments of the Green River and New Fork River Proximate to the PAPA[1]

River Segment	Common Name Scientific Name	Estimate of Fish > 6 inches per mile in River Segment[2]				
		2001	2002	2003	2004	2006
Green River Downstream from New Fork Confluence	Snake River Cutthroat Trout *Oncorhynchus clarki behnkei*	18	24	ns	ns	ns
	Brown Trout *Salmo trutta*	197	616	ns	ns	ns
	Rainbow Trout *Oncorhunchus mykiss gairdneri*	22	11	ns	ns	ns
Green River Upstream from New Fork Confluence	Snake River Cutthroat Trout *Oncorhynchus clarki behnkei*	ns	ns	ss (1)	-	ns
	Brown Trout *Salmo trutta*	ns	ns	ss (150)	349	ns
	Rainbow Trout *Oncorhunchus mykiss gairdneri*	ns	ns	ss (8)	164	ns
	Mountain Whitefish *Prosopium williamsoni*	ns	ns	928	-	ns
	Brook Trout *Salvelinus fontinalis*	ns	ns	-	12	ns
New Fork River Downstream from East Fork Confluence	Snake River Cutthroat Trout *Oncorhynchus clarki behnkei*	ss (2)	ns	ns	ns	~1
	Brown Trout *Salmo trutta*	302	ns	ns	ns	305
	Rainbow Trout *Oncorhunchus mykiss gairdneri*	5	ns	ns	ns	~9
	Kokanee Salmon *Oncorhunchus nerka*	ss (≥3)	ns	ns	ns	~7
	Lake Trout *Salvelinus namaycush*	ss (1)	ns	ns	ns	0
New Fork River Upstream from East Fork Confluence	Snake River Cutthroat Trout *Oncorhynchus clarki behnkei*	ns	2	~3	ns	ns
	Brown Trout *Salmo trutta*	ns	507	973	ns	ns
	Rainbow Trout *Oncorhunchus mykiss gairdneri*	ns	16	~71	ns	ns
	Kokanee Salmon *Oncorhunchus nerka*	ns	-	~6	ns	ns

[1] Source: WGFD, 2002, 2003a, 2004d, 2005, 2006b, and 2007b.
[2] ss = sample too small for population estimate, followed by numbers of individuals observed, in parenthesis, ns = not sampled.

Rainbow trout have been declining in the Green River since stocking was discontinued prior to 2000. The abundance of mountain whitefish in the Green River, upstream of the confluence with the New Fork River, was greater than for all trout species in 2003 (Table 3.22-14). Other, less abundant, game species include kokanee salmon, brook trout, and lake trout.

In 2001, the abundance of rainbow trout and Snake River cutthroat trout in the segment of the New Fork River that flows through the PAPA had declined relative to previous years. Conversely, the abundance of brown trout had increased in 2001. While rainbow and Snake River cutthroat trout spawn in the spring, brown trout are fall spawners (Baxter and Stone, 1995). Declines of rainbow and Snake River cutthroat trout in the New Fork River may be related to the increase of brown trout. Drought conditions through 2003 may have influenced the population of some game fish. The parasitic infection, whirling disease, was first documented in the New Fork River in 1998. Brown trout have been documented to be more resistant to whirling disease than rainbow trout (Hedrick et al., 1999) which may have also influenced the increased proportion of browns to rainbows in the New Fork River. Brown trout and mountain whitefish were sampled in the New Fork River during 2003 but tested negative, and the extent of the disease among game fish has not been determined.

Rainbow trout and cutthroat trout spawn in late May to early June, and have been known to hybridize (Henderson et al., 2000). This time period coincides with the greatest discharge period of the New Fork River (Figure 3.22-4) which leaves rainbow and cutthroat redds especially susceptible to increased sedimentation loads. Increased sedimentation poses a threat to trout redds by smothering the eggs and can limit the ability of trout to reproduce naturally (Lisle, 1989).

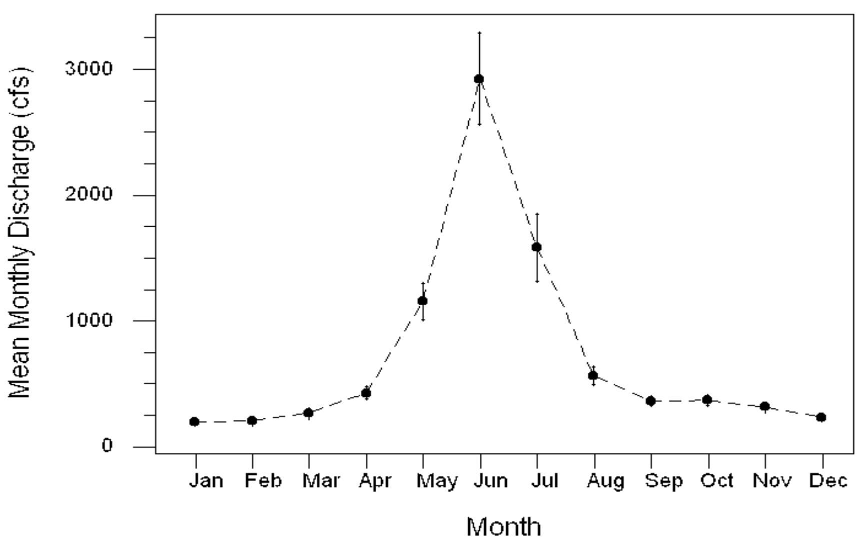


Figure 3.22-4
Mean Monthly Discharge in Cubic Feet per Second or cfs (with 95% Confidence Intervals) in the New Fork River (USGS Gauge 09205000) near Big Piney, Wyoming Averaged from 1954 to 2006

Surveys for native non-game fish in the Green River drainage began in 2003 with primary emphasis on the status and distribution of the bluehead sucker, flannelmouth sucker, and roundtail chub (WGFD, 2006b). So far, only the flannelmouth sucker has been found in the Green River but none of the three species - bluehead sucker, flannelmouth sucker, and roundtail chub - has been documented in the New Fork River or its tributaries near the PAPA. Bluehead suckers and roundtail chubs have been found downstream of the PAPA, including the Big and Little Sandy rivers and Blacks Fork drainage. Other native non-game species have been collected in the Green River, upstream and downstream of the confluence with the New Fork River (Table 3.22-15). Though native to Wyoming, white suckers are not native to the Green River drainage and have hybridized with native flannelmouth suckers. Hybridization by non-native species is one threat to native species in the Green River drainage.

Table 3.22-15
Native, Non-Game Fish Documented in
River Segments of the Green River Proximate to the PAPA[1]

Common Name Scientific Name	Segment from Confluence with New Fork River	
	Downstream	Upstream
Mountain Sucker *Catostomus platyrhynchus*	present 2002	present 2003
Flannelmouth Sucker *Catostomus latipinnis*	present 2002	present 2003
White Sucker *Catostomus commersoni*	present 2002	present 2003
Flannelmouth x White Sucker hybrid	-	present 2003
Redside Shiner *Richardsonius balteatus*	present 2002	present 2003
Speckled Dace *Rhinichthys osculus*	present 2002	present 2003
Utah Chub *Gila atraria*	present 2002	-
Fathead Minnow *Pimephales promelas*	present 2002	-
Mottled Sculpin *Cottus bairdi*	present 2002	present 2003

[1] Source: WGFD, 2003a and 2004d.

The condition of the riparian component of aquatic habitat along the New Fork River is a concern. Big game browsing appears to limit recruitment of mature riparian trees, principally willows and cottonwoods (WGFD, 2003a). Riparian trees provide shade, instream detritus, and streambank stability, all of which are important to sustain aquatic resources.

3.22.2 Pipeline Corridors and Gas Sales Pipelines

Wildlife species known to occur on lands crossed by the proposed corridor/pipeline alignments include a variety of common mammals, wild horses, aquatic species, and migratory birds common to sagebrush-steppe, grassland, and wetland riparian community types, similar to wildlife that occur in the PAPA.

Pronghorn habitat for the Sublette and Carter Lease herds is crossed by the existing pipeline corridors, as well as the proposed corridor/pipeline alignments. The proposed corridor/pipeline alignments would cross crucial winter, crucial severe winter relief, spring/summer/fall, and year-long ranges of the Sublette and Carter Lease herds north and south of the Green River and at the southern terminus near Granger, respectively (Frost, 2006 and Lockwood, 2006). The proposed corridor/pipeline alignments would cross yearlong, winter/yearlong, and winter ranges for mule deer (Fralick, 2005). Approximately 2 miles of elk severe winter relief area would be crossed on the south side of the Green River, within the BFGC and the OPC. Approximately 1 mile of moose winter/yearlong and approximately 2 miles of moose yearlong habitat would be crossed by the proposed corridor/pipeline alignments. Habitats within the proposed corridor/pipeline alignments are not known to support populations of elk and moose, although, individuals are infrequently observed in the vicinity of the proposed corridor/pipeline alignments (Fralick, 2005).

Greater sage-grouse leks, within and near the existing pipeline rights-of-way and proposed corridor/pipeline alignments have been identified by the BLM. Five greater sage-grouse leks have been identified within 2 miles of the proposed corridor/pipeline alignments in Sublette County.

Sagebrush steppe habitats along the proposed corridor/pipeline alignments are known to support several migratory and non-migratory bird species. These species include ferruginous hawk, Swainson's hawk, golden eagle, mountain plover, greater sage-grouse, mountain plover, Brewer's sparrow, sage sparrow, McCown's longspur, loggerhead shrike, and the lark bunting.

Grasslands and short-grass prairie habitat types are very limited along the proposed corridor/pipeline alignments and are primarily restricted to road-side ditches and areas of grazing or past disturbance where encroachment by shrubs has not occurred. This habitat type supports several migratory bird species, such as long-billed curlew, Brewer's sparrow, lark bunting, McCown's longspur, short-eared owl, burrowing owl, upland sandpiper, mountain plover, golden eagle, ferruginous hawk, and Swainson's hawk. Due to the limited expression of this habitat type, migratory bird species that are grassland obligates are not likely to be present along the proposed corridor/pipeline alignments.

Wetland and riparian habitats are very limited within the proposed corridor/pipeline alignments. Emergent wetland vegetation is present along the river banks of the Blacks Fork and Green rivers. Riparian habitats are not present at the proposed crossing locations of these rivers. The proposed crossing location of the New Fork River supports emergent wetlands within the flood plain as well as forested riparian habitat adjacent to the proposed corridor/pipeline alignments. This habitat type may support a number of avian species near the proposed corridor/pipeline alignments, such as red-tailed hawk, osprey, and bald eagle.

The Little Colorado Desert Wild Horse Herd Management area overlaps with approximately 23 miles of the proposed corridor/pipeline alignments. These horses are managed as an important part of the natural system under the multiple-use concept since 1971, when the Wild Free-Roaming Horses and Burro Act of 1971 was passed (Dunder, 2006).

The Green River, Blacks Fork River, and New Fork River are all known to support fisheries. The Green River below the Fontenelle Dam supports brown, rainbow, and cutthroat trout. Kokanee salmon spawn in October downstream of the Fontenelle Dam. The Green River is classified as a Class 2 trout fishery, which is a fishery of statewide importance. The Blacks Fork is classified as a Class 4 trout fishery. It is a fishery of local importance, but normally incapable of supporting pressure from substantial fishing (WGFD, 1991). The New Fork River supports both rainbow and brown trout.

3.23 HAZARDOUS MATERIALS

Hazardous materials that would be present in the PAPA include those used and produced in association with natural gas drilling, completion, and production. These substances and their current management protocol are discussed in detail in the Hazardous Materials Management Summary (Appendix 12).

Chapter 4
Environmental Consequences

4.1 INTRODUCTION

This chapter discloses the impacts of the Alternatives on the human environment. BLM's Practices and Restrictions for the Pinedale Anticline Project Area would apply to all Alternatives (Appendix 4). Measures intended to further reduce impacts have been included in the Alternatives to varying degrees. These measures are part of the Alternative itself and include differences in how and when development and production would occur. There are unique supporting documents for each Alternative (Table 2.4-1 in Chapter 2) which include:

- Alternative A Transportation Plan (Appendix 5A) and Reclamation Plan (Appendix 8A);
- Alternative B Appendix 5B (Transportation Plan), Reclamation Plan (Appendix 8B), and Wildlife and Habitat Mitigation Plan (Appendix 9A);
- Alternative C Transportation Plan (Appendix 5C), Reclamation Plan (Appendix 8C), and Wildlife and Habitat Mitigation Plan (Appendix 9B);
- Alternative D Transportation Plan (Appendix 5D), Reclamation Plan (Appendix 8D), Wildlife and Habitat Mitigation Plan (Appendix 9C), Wildlife Monitoring and Mitigation Matrix (Appendix 10), and Alternative D Mitigation (Appendix 11); and
- Alternative E Transportation (Appendix 5E) and Reclamation Plan (Appendix 8D).

The variation in Alternatives, described in detail in Chapter 2, provides a range of Alternatives and allows for the comparison of the effectiveness of mitigation measures. Additional mitigation opportunities are located at the end of each section in this chapter. These additional mitigation opportunities could be applied to any Alternative.

The existing environment in 1999, as described in the PAPA DEIS (BLM, 1999a), was very different from the one present in 2006 and described in Chapter 3 of this Final SEIS. In 1999, much was unknown about the future of natural gas development in the PAPA. Consequently, impacts described in the PAPA DEIS are generic while recognizing that level and significance of actual impact to each resource would depend on the level of development, as it would ultimately progress in the future.

Of necessity, environmental impacts disclosed in the PAPA DEIS (BLM, 1999a) are based on assumptions associated with the anticipated levels of development. Effects to various resources by natural gas development in the PAPA are now known, at least for the level of development that has occurred since the PAPA ROD (BLM, 2000b) was issued in July 2000. Documentation of the effects is incorporated into the appropriate sections of Chapter 3, and, when applicable, known effects are addressed in this chapter.

The Alternatives for future development in the PAPA considered in this Final SEIS are quantitatively and qualitatively different from the Alternatives analyzed in the PAPA DEIS (BLM, 1999a). In 1999, three exploration and development scenarios were incorporated in each of three Alternatives, which were titled "Mitigation Alternatives." The three exploration and development scenarios were developed to address the uncertainty of the future spatial (geographic) distribution and intensity of natural gas development. The exploration and development scenarios in the PAPA DEIS are as follows:

1. The *Project Wide Exploration/Development Scenario* assumed that development would occur throughout the entire PAPA. Two potential levels of development were analyzed; 500 and 700 producing well pads. The scenario assumed that to reach the 700 well pad development level, 900 well pads would be constructed and that 200 of the well pads would be reclaimed because the wells would be non-productive dry holes. Similarly, it was assumed that 650 well pads would be constructed to achieve the 500 producing well pad development level (150 well pads would be reclaimed).
2. The *Anticline Crest Exploration/Development Scenario* assumed that approximately 70 percent of the well pads would be located within 1 mile of the Anticline Crest and 30 percent of the well pads would be located in three hot spots away from the Anticline Crest. An equal number of well pads would be developed in each hot spot. Two potential levels of development (500 and 700 producing well pads) were evaluated under this scenario for each of the Alternatives described below.
3. The *No Action Exploration/Development Scenario,* required by CEQ guidelines, was included to describe the impacts of no further development in the PAPA while recognizing that the BLM could not impose the scenario because federal minerals were leased and the BLM made the commitment to allow development of natural gas. The No Action scenario provided a benchmark against which to compare the impacts of the other anticipated levels of development.

The three exploration/development scenarios were analyzed in the framework of three "Mitigation Alternatives," which incorporated different levels of mitigation requirements during future implementation of each scenario. The three Alternatives analyzed in the PAPA DEIS (BLM, 1999a) are:

- The *Standard Stipulations Alternative* assumed that either 500 or 700 producing well pads would be developed entirely under BLM's Standard Mitigation Guidelines (Appendix A of the DEIS) and lease stipulations. Impact analysis was based on an average of up to eight drilling rigs operating in the PAPA year-round. Unless required by lease stipulations, the *Standard Stipulations Alternative* generally did not limit the density of development (the number of potential well pad locations per section) in any of the SRMZs. In most cases, the Alternative addressed impacts from locating up to 16 well pads per section in each of the SRMZs.
- The *Resource Protection (RP) Alternative on Federal Lands and Minerals* analyzed the impacts of implementing the RP Alternative on only federal lands and minerals. This Alternative assumed that either 500 or 700 producing well pads would be developed using BLM's Standard Mitigation Guidelines and lease stipulations. It disclosed the types of impacts that would remain even if the BLM implemented additional controls to reduce impacts. It evaluated the benefits of slower paced development by limiting the number of drilling rigs operating annually in the PAPA to five. The RP Alternative considered pad drilling as an option to reduce surface disturbance and human presence in the PAPA. Pad drilling refers to the practice of directionally drilling multiple wells, each with different bottom-hole locations, from a single well pad. The RP Alternative included the use of centralized production facilities to reduce storage of condensate and produced water on each well pad, collecting them at central locations for removal, thereby reducing truck traffic needed for liquids removal.
- The *Resource Protection (RP) Alternative on All Lands and Minerals* analyzed the impacts of implementing the RP Alternative throughout the PAPA (on all lands and minerals). This Alternative assumed that either 500 or 700 producing well pads would be developed using BLM's Standard Mitigation Guidelines and lease stipulations. This Alternative evaluated

implementation of mitigation measures (i.e. pad drilling and centralized production facilities) on all lands and minerals. The Alternative recognized that adoption of the additional mitigation measures on private and state lands and minerals would be strictly voluntary by Operators and would probably not occur.

The PAPA ROD (BLM, 2000b) ultimately authorized the *Resource Protection Alternative on Federal Lands and Minerals* with expected implementation of the *Project Wide Exploration/Development Scenario* because it included all of the PAPA and would be less restrictive should future exploration warrant development beyond the Anticline Crest. As analyzed in the PAPA DEIS (BLM, 1999a), the *Resource Protection Alternative on Federal Lands and Minerals* would have limited the pace of development by allowing no more than five drilling rigs to operate in the PAPA at any one time. Only two drilling rigs on new locations north of the New Fork River would have been allowed on federal lands and minerals. This limitation was not carried forward in the PAPA ROD (see PAPA ROD: Management Considerations, page 36) using the following rationale:

> *"BLM has concluded that to limit the number of rigs working in the PAPA at any one time (on Federal and non-Federal lands and minerals combined) would be extremely difficult administratively. However of greater consequence and importance is the fact that the Operators are already seasonally restricted over a significant portion of the PAPA, leaving a relatively small window within which to complete field development activities (i.e., May 1 through July 1 restriction in many areas due to sage grouse nesting, mountain plover nesting, bald eagle nesting; July 1 through November 15 no restriction). The EIS proposed action and analysis inherently provides for a control on the pace of development. Many factors enter into this including availability of rigs, availability of workers, market price of natural gas, budgetary constraints, etc. Therefore, the BLM will place no restrictions on the number of rigs drilling within the PAPA at any one time. The Operator must be able to take advantage of the drilling window available."*

4.1.1 Impact Analysis Related to the PAPA DEIS

The brief synopsis of the three Alternatives analyzed in the PAPA DEIS (BLM, 1999a), above, emphasizes the uncertainty of the anticipated future intensity and spatial (geographic) extent of natural gas development in the PAPA at the time. As the BLM explained in the PAPA DEIS:

> *"At this point in time, insufficient information is available to understand exactly how the Pinedale Anticline should ultimately be developed (i.e., it is not currently possible to predict where the actual productive zones are located and what well density will be necessary to drain the reservoir(s) or adequately estimate ultimate production). However, the operators believe that at least 8 and as many as 16 bottom holes per section may be required to adequately drain productive zones which may be discovered in the future……Because so little of the PAPA has been explored and much remains to be understood about the ability of the anticline to economically produce natural gas, the operators have been unable to develop a detailed proposed action that specifies locations of wells and associated facilities (e.g., roads, gathering pipelines, etc.). The lack of available information to quantify development potential requires this EIS to consider a wide range of exploration/development scenarios and potential levels of development. This range includes considering the impacts from wide spread development across the full extent of the PAPA to no further additional exploration or development."*

Even with that acknowledgement, there were assumptions specified in the PAPA DEIS (BLM, 1999a) that were applied to impact evaluations in the document, particularly evaluations of surface disturbance related to future wellfield development. The assumptions, included in Table

4.1-1, were developed in the *700 Productive Well Pad Level of Development Scenario* under the *Standard Stipulations Alternative* and are the maximum of any analyzed in the PAPA DEIS. Assumptions applicable to surface disturbance analyzed for each of the RP Alternatives would have resulted in less short-term and long-term disturbance than for the *Standard Stipulations Alternative* in Table 4.1-1.

Table 4.1-1
Assumptions Utilized in the PAPA DEIS for Analyzing Impact[1]

Wellfield Component	Maximum Number For Any Alternative	Short-Term Disturbance per Unit	Long-Term Disturbance per Unit	Maximum Short-Term Disturbance Analyzed	Maximum Long-Term Disturbance Analyzed
Period of Development	10 to 15 years	N/A	N/A	N/A	N/A
Number of Wells Drilled	60 to 90 wells/year	N/A	N/A	N/A	N/A
Number of Drilling Rigs	average of 8 rigs, year-round	N/A	N/A	N/A	N/A
Producing Well Pads	700 pads	3.7 acres/well	1.5 acres/well	2,590 acres	1,050 acres
Dry Hole Well Pads[2]	200 pads	3.7 acres/well	0 acres/ well	740 acres	0 acres
Collector Roads	6 miles	6.3 acres/mile	4.4 acres/mile	38 acres	26 acres
Local and Resource Roads with Adjacent Gathering Pipelines	280 miles	8.5 acres/mile	2.9 acres/mile	2,380 acres	812 acres
Resource Roads to Dry Holes	80 miles	4.8 acres/mile	0 acres/mile	384 acres	0 acres
Compressor Sites	3 sites	7 acres/site	7 acres/site	21 acres	21 acres
			TOTAL	**6,153 acres**	**1,909 acres**

[1] Impact analysis for implementation of the 700 Productive Well Pad Level of Development Scenario under the Standard Stipulations Alternative.
[2] As of November 2006, 285 well pads were constructed since the issuance of the PAPA ROD.

Over the 10 to 15 year period of development anticipated in the PAPA DEIS (BLM, 1999a), the wellfield components shown in Table 4.1-1 would have disturbed a total of 6,153 acres in the short-term (initial disturbance) and 1,909 acres in the long-term (LOP) under the *Standard Stipulations Alternative*.

Although such disturbance is not static, a best estimate for total wellfield disturbance since the PAPA ROD (BLM, 2000b) was issued is 4,393.3 acres through 2006 in addition to 441.3 acres that had already been disturbed prior to July 2000. Some of the surface disturbance, before and after issuance of the PAPA ROD, has been revegetated, particularly in pipeline corridors, but the amount of reclaimed disturbance changes constantly as new pipelines are placed in existing, revegetated corridors or as roads and well pads are expanded.

Compared to the maximum surface disturbance estimate of 6,153 acres short-term and 1,909 acres long-term over 10 to 15 years of development analyzed in the PAPA DEIS (BLM, 1999a), the total amount disturbed by wellfield development is 4,393.3 acres within the 6 years following issuance of the PAPA ROD (BLM, 2000b). Although the total disturbance has not exceeded the disturbance analyzed in the PAPA DEIS (BLM, 1999a), the pace of development has exceeded the pace of development analyzed in the PAPA DEIS.

4.1.2 Spatial Analysis of Future Surface Disturbance

The inventory of wellfield surface disturbance through 2006 provides the baseline for prediction of potential surface disturbance by wellfield development for all Alternatives. The Proponents provided their plans for future long-term development in the PAPA including the number of new and expanded well pads, number of additional wells for both year-round development and for development within seasonal restrictions for big game and greater sage-grouse seasonal habitats; however, specific locations were not provided. To allow for spatial analysis, a model was developed to estimate the potential surface disturbance in each quarter section (an approximate square 0.5-mile on each side, covering 160 acres) in the PAPA for future development under all Alternatives. The model assumed that the location of potential surface disturbance would be determined by the location of the natural gas resource, under any Alternative. The model also assumed that all surface disturbance caused by proposed wellfield development would be distributed relatively evenly in the space available (previously undisturbed portions) in each of the Proponent's leasehold. Under Alternatives A and E, which do not allow for year-round development (except as approved by BLM's 2004 Decision Record – BLM, 2004a), potential surface disturbance was distributed by Management Area in each of the respective Operator's leaseholds. Potential surface disturbance under Alternatives B, C, and D was distributed both in the Alternative D Core Area and in the PDA of Alternative D, the area assumed to be the most productive on the anticline. The amount and location of initial surface disturbance is assumed to approximate long-term development, on average, in each of the Operator's leaseholds.

4.1.3 Relationship of Spatial Disturbance to Impact Assessment

The modeled distribution of potential surface disturbance under each Alternative is the basis for evaluating impacts to each ground-based resource (land use, soils, vegetation, etc.). In the sections below, the acreage of potential surface disturbance under each of the Alternatives was overlaid with the geographic distribution of each resource (i.e., soils, vegetation, etc.) in order to determine the relative impact levels.

Table 4.1-2 provides the amount (acres) of potential initial surface disturbance in each land surface and mineral ownership category for each Alternative. The No Action Alternative through 2011 results in less disturbance to lands in the Federal Surface/Federal Minerals category and less disturbance in the PAPA overall, compared to all other Alternatives because of the fewer number of wells drilled, fewer new and expanded well pads, and slower pace of development due to seasonal wildlife restrictions. Disturbance under Alternative B, Alternative C, and Alternative D through 2023 would be similar to each other in each ownership category. Although initial disturbance under Alternatives B, C, and D is greater than under Alternative E, LOP disturbance for these three Alternatives is less than under Alternative E, mainly due to the disturbance associated with the liquids gathering system, which would be reclaimed within 1 to 2 years.

Table 4.1-2
Initial Surface Disturbance in Relation to Land and Mineral Ownership by Alternative

Ownership Category	Alternative A (acres)		Alternatives B, C and D (acres)		Alternative E (acres)	
	Federal	Total	Federal	Total	Federal	Total
Federal Surface/Federal Minerals	3,641.8	3,641.8	11,604.8	11,604.8	9,465.5	9,465.5
Federal Surface/State Minerals	0.0	0.0	0.0	0.0	0.0	0.0
State Surface/State Minerals	0.0	147.6	0.0	443.0	0.0	211.2
Private Surface/Private Minerals	0.0	114.8	0.0	266.8	0.0	159.7
Private Surface/State Minerals	0.0	0.0	0.0	0.0	0.0	0.0
Private Surface/Federal Minerals	218.9	218.9	571.0	571.0	590.6	590.6
Total	**3,860.7**	**4,123.1**	**12,175.8**	**12,885.6**	**10,056.1**	**10,427.0**

Even though initial surface disturbance expected under Alternative E is less than that expected by Alternatives B, C, or D (but more than under Alternative A), the relative distribution of disturbance by land and mineral ownership category is very similar for each Alternative. For example, over 88 percent of all initial surface disturbance under all Alternatives is in the Federal Surface/Federal Minerals ownership category (Table 4.1-2). The reason for such consistency is apparent; development of the natural gas resource under any Alternative would focus on areas already known to be productive which are mostly on lands with Federal Surface/Federal Minerals ownership along the Anticline Crest.

Patterns of surface disturbance in different land and mineral ownership categories are expected to be different at any given time, though such patterns cannot be predicted. The amount of total surface disturbance from Alternatives B, C, and D are assumed to be identical because the Alternatives have the same basic assumptions and would likely be in the same location by the end of the development phase in 2023. However, the spatial and temporal progression of disturbance across the landscape between issuance of the ROD and 2023 would differ between the three Alternatives, as well as differing from whatever progression of disturbance might develop under Alternative E. Progressions are related to how development is managed under each Alternative.

Anticipated direct and indirect impacts to each resource are discussed in the sections below. Direct impacts include all effects caused by an action or Alternatives that would occur at the same time and place as the action/Alternative (40 CFR § 1508.8). Indirect impacts are also caused or induced by the action/Alternative but usually involve an intermediate step or process. Indirect impacts occur later in time or are farther removed in distance from the source of impact, but are still reasonably foreseeable (40 CFR § 1508.8).

Cumulative impact analyses in the PAPA applied to the categories in this chapter are presented as the sum of all surface disturbance by "*past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions*" (40 CFR § 1508.7). The analyses include all past and present wellfield disturbance and all existing, non-wellfield disturbance that has been measured in the PAPA. The existing non-wellfield surface disturbance includes agricultural areas, residential areas, industrial sites, Wenz Field (airport), Rendezvous Meadows Golf Course, municipal water treatment facility, gravel pits, stock watering facilities, various residential streets, and arterial highways.

The cumulative impact of surface disturbance in Table 4.1-3 from past and present actions has been added to the surface disturbance estimates for each of the Alternatives in the reasonably foreseeable future. Included in the new disturbance component for each land and mineral ownership category is 426.3 acres of surface disturbance in the PAPA caused by the installation of two new pipelines, RVII and PBC pipelines. In addition, most non-wellfield surface disturbance is located within lands in the Private Surface/Private Minerals ownership category. Because relatively minor amounts of wellfield disturbance have occurred in the past or are likely to occur in the future on lands in this ownership category (including disturbances by the proposed gas sales pipeline), cumulative impact by any Alternative to Private Surface/Private Minerals lands are quite similar. Such similarity does not hold for lands in the Federal Surface/Federal Minerals or Private Surface/Federal Minerals ownership categories (Table 4.1-3). Sections of this chapter discussing spatially-oriented resources include comparative analyses of surface disturbance impacts associated with each Alternative.

Table 4.1-3
Cumulative Surface Disturbance in Relation to Land and Mineral Ownership by Alternative

Ownership Category	Existing Non Wellfield Disturbance (acres)	Existing Wellfield Disturbance (acres)	Proposed Gas Sales Pipeline Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative		
				Alternative A	Alternatives B, C, and D	Alternative E
Federal Surface/Federal Minerals	447.9	3,835.1	377.50	8,302.3	16,265.3	14,126.0
Federal Surface/State Minerals	0.0	0.0	0.00	0.0	0.0	0.0
State Surface/State Minerals	27.9	550.8	0.00	726.3	1021.7	789.9
Private Surface/Private Minerals	5,727.3	142.8	24.90	6,009.8	6,161.8	6,054.7
Private Surface/State Minerals	10.8	0.0	0.00	10.8	10.8	10.8
Private Surface/Federal Minerals	1,425.1	305.9	23.90	1,973.8	2,325.9	2,345.5
Total	**7,639.0**	**4,834.6**	**426.3**	**17,023.0**	**25,785.5**	**23,326.9**

4.1.4 Scoping Issues

Issues pertinent to each resource identified through the public scoping process are included in the introductory impact analysis sections. However, several issues did not fall in a particular resource's domain. The following eight concerns pertain to continued and future development in the PAPA:

1. The pace of development is a concern.
2. A decision should be delayed until BLM has fully evaluated the consequences of previously approved winter drilling projects.
3. BLM should implement Adaptive Management as a means of determining adequacy of existing research and monitoring programs and determine how management of development would be changed (in addition to applying waivers, modifications, or exceptions) once impacts are detected.
4. Current and future operators should be held to commitments and responsibilities through effective monitoring and enforcement.
5. BLM should require all mitigation (directional drilling, liquids gathering systems, reduced surface disturbance) and application of improved technology (drilling and casing techniques to prevent blowouts) without removing seasonal stipulations.
6. There is concern over existing compliance with regulatory standards for air quality and water quality, including residential water sources.
7. BLM should consider at least one conservation Alternative.
8. An Alternative should be considered that protects wildlife habitat in portions of the PAPA while allowing development in other portions.

4.2 ENVIRONMENTAL JUSTICE

Chapter 4 of the PAPA DEIS (BLM, 1999a) provides a discussion of the basis for Environmental Justice, and it is not repeated here. The PAPA DEIS refers to the Bureau of Census 1990 population and determined that the racial composition of Sublette County is predominantly white (approximately 97 percent). There are no Indian Tribal units in the area affected by any of the Alternatives.

Table 3.4-1 in Chapter 3 shows data from the Bureau of Census 2000 Racial Composition. The data indicate that the racial composition of Southwest Wyoming (Sublette, Lincoln, and

Sweetwater counties) has not changed since the PAPA DEIS (BLM, 1999a), and remains predominantly white (greater than 90 percent overall and above 97 percent in Sublette and Lincoln counties). Table 3.4-1 in Chapter 3 shows that across Southwest Wyoming, less than 10 percent of the population is below the poverty line compared to more than 11 percent in Wyoming and more than 12 percent in the United States.

The BLM has determined that none of the Alternatives would result in a disproportionately high and adverse human health or environmental impact on minority populations, low-income populations, or Indian Tribes.

4.3 SOCIOECONOMIC RESOURCES

4.3.1 Scoping Issues

Concerns about impacts to socioeconomic resources received during scoping focused on economic stability and the related issues of stable employment, housing, safety, and the human environment. Concerns related to socioeconomic resources are:

1. Although implementation of the proposal will provide jobs and economic stability for Sublette County residents, there is concern for a potential economic “bust” once development ends.
2. Maintaining winter restrictions would affect seasonal employment, housing, safety, and the human environment in Pinedale and surrounding communities.

4.3.2 Impacts Considered in the PAPA DEIS

Given that little was known about the potential of the PAPA to produce economically recoverable natural gas at the time the PAPA DEIS (BLM, 1999a) was prepared, it was impossible to predict ultimate gas recovery. Without such an estimate, impacts to socioeconomic resources and revenues from the PAPA were impossible to predict. Because of this uncertainty, the analysis of impacts to socioeconomic resources in the PAPA DEIS was based on the following assumptions:

- the positive impact to county-wide employment was not expected to be significant, as most employment would result from drilling and completion activities, which were not expected to rely heavily upon local hires;
- a few new residents could be expected in Pinedale;
- increased direct and indirect local employment was expected to be negligible;
- continued exploration and development was not expected to increase housing demand above that presently available;
- some workers might decide to occupy motels in Pinedale, particularly in the winter when rates and occupancy would be low;
- with the exception of ambulance services, increases in demand for local government facilities and services were not expected to exceed capacity; and
- adequate revenues would be generated by the project to cover any additional costs incurred by local governments.

The PAPA DEIS (BLM, 1999a) considered that the following would be significant positive or negative impacts to socioeconomic resources by implementation of any of the Alternatives evaluated in the PAPA DEIS (BLM, 1999a), except for the *No Action Exploration/Development Scenario*:

- increased demand for housing resulting from project activities which exceed supply;

- short- or long-term increases in demand for local government facilities or services which exceed existing capacity and are not offset by adequate revenues from continued exploration and development; and
- a 10 percent change in county government revenues or in county-wide employment.

Based on the above criteria, the PAPA DEIS (BLM, 1999a), expected that all Alternatives would have a negligible impact on the demand for housing. However, between 2000 and 2006, the population grew 24.3 percent in Sublette County, 12.4 percent in Lincoln County, and 3.1 percent in Sweetwater County (Table 3.5-6 in Chapter 3). Furthermore, between 2007 and 2020, the population of Southwest Wyoming is forecast to grow approximately 21 percent (Table 3.5-8 in Chapter 3). Housing demand in Southwest Wyoming exceeds the currently available supply and the strong demand is expected to continue provided that recoverable reserves continue to be located and developed in the PAPA.

In the PAPA DEIS (BLM, 1999a), all Alternatives, except the *No Action Exploration/Development Scenario*, were expected to have, and have had, a significant positive impact on Sublette County government revenues, due to location and development of significant recoverable reserves in the PAPA. All Alternatives were expected to have a negligible effect on employment. Employment, however, increased between 2000 and 2005 (34.2 percent in Sublette County. In 2006, nearly 20 percent of workers employed in Southwest Wyoming were employed in the PAPA (Table 3.5-4 in Chapter 3).

Several other assumptions made in the PAPA DEIS (BLM, 1999a) have been challenged by development that occurred in the PAPA between 1999 and 2006. Drilling and completion activities were not expected to rely heavily upon locally hired workers, yet 40 percent of those employed in the PAPA reside in Southwest Wyoming. Southwest Wyoming was not expected to have many new residents, yet there were a substantial number of new residents due to net migration in Sublette and Lincoln counties (U.S. Census Bureau, 2008 - Table 3.5-7 in Chapter 3).

The PAPA DEIS (BLM, 1999a), expected that the demand for housing would not exceed the available supply. However, between 2000 and 2006, Sublette County's population increased 24.3 percent while its housing stock increased 16.6 percent. Many local workers report living outside Sublette County because of the lack of affordable housing. Although it was expected that the demand for short-term housing would be met through the available supply of local motels and other lodging facilities, the year-round demand for motel rooms in Pinedale and Big Piney have been at or near full occupancy levels for the past several years.

4.3.2.1 Summary of Impacts Common to All Alternatives

<u>Natural Gas Development in the PAPA</u>

BLM PFO recognizes that state, county, and local governments need to develop plans that address the changing social and economic conditions that affect the level and quality of services they provide. As part of their planning efforts, towns and counties may need to collect more detailed data and specific analyses than those provided through the EIS process. Such planning efforts by local governments typically contain estimates of the financial budgets needed to implement their plans.

Expanded drilling and production activities under all Alternatives will continue to exert upward pressure on socioeconomic resources in affected communities. Employment associated with the PAPA will increase and it is likely that many of the new workers would choose to live in local communities provided affordable housing options are available. The populations of affected communities are expected to increase, which will lead to increases in the demand for local services, most notably schools, medical services, fire protection, and law enforcement. Increasing revenues from the PAPA will help local governments address these demands. Communities are likely to continue to experience growth-related problems, such as drug and alcohol abuse, that impose fiscal and non-pecuniary costs.

It is difficult to predict the long-term impacts to local communities from any of the development alternatives with any degree of reliability. This is because the relatively short period of extensive natural gas extraction in Sublette County (2000 – 2007) provides insufficient data on which to base long-term projections (development activities in the PAPA could extend through 2065). Additionally, the nature of the PAPA's future development workforce is largely unknown. It is difficult to predict the extent to which multi-year development activities and year-round development might transform what has historically been a transitory workforce into one characterized by a substantial number of residents.

Based on recent trends concerning the number of transitory workers employed in the PAPA, the analysis in this Final SEIS developed alternative scenarios to consider a range of population impacts associated with each Alternative. Recognizing the uncertainty inherent in any analysis that attempts to answer the question of what the long-term impacts to local communities would be from any Alternative, the population estimates discussed under each Alternative are intended to provide a potential range of future population shifts to assist in future planning decisions.

Boom-Bust Characteristics of Natural Gas Development. Minimal wellfield development occurred in the PAPA prior to the 1990s. Since then, pipeline expansion, new construction and better fracturing technologies have combined with rising oil and gas prices to drive increased natural gas production in Sublette County (Williams, 2005).

The boom-bust cycle associated with the oil and gas industry concerns many residents in communities affected by PAPA development. In particular, residents are concerned that their communities may experience any or all of the following events (Gay, 2007 and Keslar, 2007):

- Local economic conditions that are highly dependent on external factors affecting the market for natural gas.
- Uncontrollable growth and a subsequent collapse of the local economy due to changes in the worldwide market for oil and gas.
- A sharp increase in the demand for community services and infrastructure that leads to excess capacity when workers in the oil and gas industry leave the area.
- A shortage of labor available to work in local businesses and support services.
- High-paying jobs in the oil and gas industry that exert upward wage pressure on local businesses.

A recent profile of Sublette County issued by the University of Wyoming concludes that Sublette County's mineral workforce has become increasingly transient since 2001 (Taylor and Foulke, 2008). More than in the past, mineral workers maintain homes in other parts of the country and come to Sublette County to work on a temporary basis.

Employment under all Alternatives analyzed in this Final SEIS is strongest during the development phase because of the "lead-lag of production." There is an up-front need for workers associated with wellfield development and infrastructure, compared to the need for production workers. The lead-time may be short, which can reduce worker influx and the amount of time development workers remain in the local area (Foulke et al., 2001). Production has a lower impact than development on employment and earnings trends associated with activity in the PAPA.

Year-Round Development. The socioeconomic impacts of year-round development in the PAPA are largely unknown. Studies have found that temporary non-local workers tend to have weak ties to the communities in which they work. These studies suggest that year-round development may attract a more stable workforce that has stronger links to the impacted communities. Although non-local workers increase the demand for many public and private services, they do not bring additional workers into the community to provide these services. When permanent workers relocate with their families, they become part of the community. Accompanying family members tend to enter the local workforce and help provide required services (Jacquet, 2007).

Quality of Life Considerations. In many ways, Sublette County exemplifies the changing nature of the rural western United States. People are moving to rural areas due largely to quality of life considerations and amenities such as clean air and water, outdoor recreation opportunities, and safe communities. In many areas, including Sublette County, these quality of life considerations are influenced by active mineral extraction industries.

There are some indications that rural communities with active mineral extraction industries have developed more diversified economies, and that more people are moving to these areas to enjoy the recreational opportunities and quality of life benefits that they offer. These factors tend to lessen boom-bust cyclical impacts (Bleizeffer, 2006).

However, the economic benefits of extractive industries can be tempered by social and economic costs associated with environmental degradation and perceived losses in the quality of life. Public lands, including the Bridger-Teton National Forest and Fitzpatrick Wilderness Area in the Wind River Mountains, provide environmental amenities that are significant economic assets for local and regional economic development, and important contributors to residents' quality of life. A recent study by the Sonoran Institute notes that many western communities have healthy economies that are not tied to traditional extractive industries but to the amenities provided by nearby protected public lands (Marlow, 2007).

Non-Market Values for Natural Resources. It is widely recognized that there are some values for natural resources that are not measured in the marketplace. As a result, some values can be excluded from an analysis of the costs and benefits associated with activities that impact natural resources. For example, some people may derive benefits from knowing that clean air, open space and wildlife habitat exist in the PAPA, or from knowing that these amenities will be available for future generations to enjoy. Surveys based on contingent valuation methodologies (CVM) can be used to estimate "non-use" and other values for natural resources that are not expressed in monetary terms (Mitchell and Carson, 1989 and Freeman, 2003).

Numerous CVM studies have been conducted to estimate the monetary value of protecting natural resources (Resources for the Future, 2008). In addition to generating a monetary variable that can be used in a cost-benefit framework, CVM studies gather useful information about peoples' preferences. A 1998 CVM survey conducted by the University of Wyoming found that Sublette County's amenities and quality of life were more appealing to residents than employment opportunities (McLeod, et al., 1998). Respondents gave the following reasons for choosing to live in Sublette County: scenery (62 percent of respondents), recreational opportunities (59 percent), rural lifestyle (57 percent), low population (53 percent), air and water quality (49 percent), family safety (39 percent), low taxes (23 percent), job opportunities (18 percent), climate (16 percent), and quality of K-12 education (14 percent). The survey also found that Sublette County residents prefer recreational/wildlife and agricultural land uses, and that their perceptions of a desirable community in which to live tend to decline when agricultural and wildlife lands are converted to other uses. Although they are not quantified here, non-market values for natural resources are affected by all Alternatives analyzed in this Final SEIS.

Economic Benefits and Job Requirements

Development. Operators report that they spend approximately $4.7 million (2003 $s) for each well drilled in the PAPA. The IMPLAN economic impact model was used to estimate the total economic impact of this spending. The modeling results estimate that direct expenditures on well development in the PAPA generate approximately $820,000 in secondary spending, for a total economic impact to Southwest Wyoming of $5.5 million per well (Minnesota IMPLAN Group, Inc., 2006). This spending generates employment both on- and off the PAPA. On-site, or direct, employment occurs when workers are hired to develop gas wells. Off-site employment results from expenditures by Operators on goods and services used to drill wells (indirect effects) and from expenditures by Operator employees (induced effects). An estimated 47.4 annual job equivalents (AJE) are associated with developing a natural gas well in the PAPA (Table 4.3-1). It is important to note that the IMPLAN model expresses employment in terms of AJE. The estimated AJE represents 12 months of employment, and makes no distinction between full- or part-time jobs. For example, one AJE could represent one job for 12 months or two jobs for 6 months or three jobs for 4 months.

Table 4.3-1
Economic Impacts of PAPA Well Development[1]

Impact	Development jobs per well (AJE)	Development earnings per well
Direct	38	$2,187,536
Direct (local 40%)	15.2	$875,014
Direct (non-local 60%)	22.8	$1,312,522
Indirect	5.3	$152,073
Induced	4.1	$90,570
Total	**47.4**	**$2,430,179**

[1] Source: Minnesota IMPLAN Group, Inc., 2006.

The employment impacts directly associated with well development in the PAPA account for slightly more than 80 percent of total employment (AJE). Information provided by the Proponents indicates that 60 percent of their employees currently live outside Southwest Wyoming (Hoff, 2006). This suggests that 40 percent of the direct employment impacts (15 AJE) occur within the region and that 60 percent (23 AJE) occur outside Southwest Wyoming. This dilutes the local impacts of induced spending. Just under 20 percent of the total estimated employment results from indirect and induced impacts (5 and 4 AJE, respectively).

The economic impacts shown in Table 4.3-1 are derived from estimated expenditures per well and are based on the ratio of employment per dollar of expenditures. Direct earnings account for 90 percent of total earnings per PAPA well, while indirect earnings account for 6.3 percent and induced earnings account for 3.7 percent. These estimated earnings do not necessarily reflect average annual starting wages. Actual wages are determined on an individual basis by employers as influenced by market forces.

Production. The estimated economic impacts (AJE and earnings) of a producing well in the PAPA are based on the productive profile of a typical gas well. For IMPLAN modeling purposes, it was assumed that an average well in the PAPA has a 40-year productive life, during which it would produce approximately 5.0 billion cubic feet of natural gas and 35,000 barrels of condensate. Accordingly, the typical PAPA well can be expected to produce 125 MMSCF of natural gas and 875 barrels of condensate annually. It is important to note that these are annual averages and do not imply that any single well would produce at this level each year. As shown in Figure 4.3-1, production rates are typically highest when a well is first drilled, then decline rapidly and level off after about 10 years.

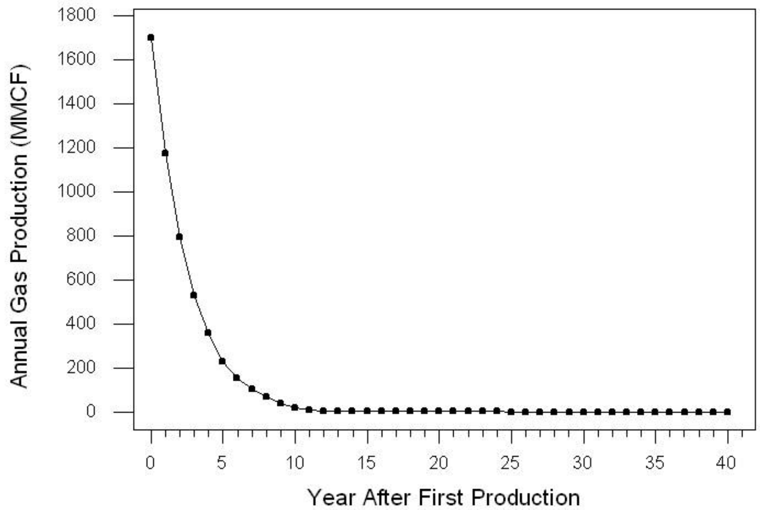


Figure 4.3-1
Estimated Average Well Production Profile

Table 4.3-2 estimates the employment impacts of natural gas production in the PAPA on a per MMSCF and per well basis. This is consistent with the nature of natural gas production, which tends to be steady over the course of a year and requires a permanent workforce. Direct employment (as measured by AJE) accounts for half of all estimated employment impacts, while indirect and induced jobs each account for 25 percent of the total.

Table 4.3-2
Employment Impacts of PAPA
Production Annual Job Equivalents (AJE)[1]

Output	Per MMCF Produced	Per Well
Direct	0.001004	0.1255
Indirect	0.000502	0.06275
Induced	0.000502	0.06275
Total	**0.002008**	**0.251**

[1] Source: Minnesota IMPLAN Group, Inc., 2006.

Workforce Estimates

Development. Chapter 2 discussed Proponents' assessment of the workforce needed to develop a single well in the PAPA. Based on this discussion, the estimated direct-hire workforce per well is presented in Table 4.3-3. Workforce estimates are based on counting heads at the well site and estimating the number of days that each type of worker is at the site. An estimated 1,640 worker-days are needed to develop a single well in the PAPA. The analysis converts worker-days to annual direct workforce estimates by assuming that drilling activity occurs 365 days per year.

Table 4.3-3
Estimated Workforce Requirements Necessary to Develop a Single Well in the PAPA

Category	Average Number of Workers	Average Number of Days	Average Number of Worker-Days
Well Pad and Access Road Construction	15	5	75
Rig Up/Down	15	5	75
Drilling	25	50	1,250
Testing and Completion	20	12	240
Total	**75**	**72**	**1,640**

Production. Chapter 2 also discussed Proponents' estimates of the workforce needed to operate and maintain a single well in the PAPA. As shown in Table 4.3-4, the Proponents estimate that, with a liquids gathering system, 0.076 workers are required per producing well and that without a liquids gathering system, 0.12 workers are needed per producing well. These workers include employees and contractors in the field and office workers who are dedicated exclusively to production operations.

Table 4.3-4
Estimated Workforce Requirements to Operate and Maintain a Producing Well in the PAPA

Liquids Gathering Configuration	PAPA development Alternative	Production Workers per well
Without liquids gathering system	Alternatives A, E	0.120
With liquid gathering system	Alternatives B, C, and D	0.076

Total Workforce. Most socioeconomic impacts, including population, housing, local infrastructure, community services, and the cost-of-living, result from the size of the PAPA workforce and the length of time development and production activities continue in the PAPA. Figure 4.3-2 compares the total workforce requirements estimated under each Alternative. Under the No Action Alternative, employment in the PAPA falls dramatically after 2011. A production workforce of approximately 210 workers is expected to remain through 2051. Under Alternatives B, C, and D, the PAPA workforce increases through 2018. It then falls until 2026, when a production workforce of approximately 380 workers remains through 2065. Under Alternative E, the PAPA workforce increases gradually until 2024 and then falls through 2034, when a production workforce of approximately 600 workers remains through 2073.

Population. Employment associated with future development of the PAPA would have an impact on the population of Southwest Wyoming. These population impacts would, in turn, have an impact on the demand for local services and infrastructure in the affected communities. The WDAI has projected county populations through 2020 (Table 3.5-8 in Chapter 3) that include assumptions about regional trends in mineral development (WDAI, 2007b). The WDAI's population projections were made in 2006, and may underestimate the population impacts associated with recent natural gas development projects.

The analysis in this Final SEIS estimates a range of potential population changes in Southwest Wyoming that may occur due to proposed development in the PAPA. Consistent with the WDAI's population forecasts, population changes associated with PAPA development extend through 2020. The extent to which the population of Southwest Wyoming might grow due to any of the Alternatives is unknown. Potentially, population gains from an expanding PAPA workforce could be reduced by out-migration due to a perceived deterioration in the quality of life. The population estimates discussed in this Final SEIS are not intended to be population forecasts, but are intended to provide a reference point for the potential scale of population change that may occur as a result of implementation of any of the Alternatives.

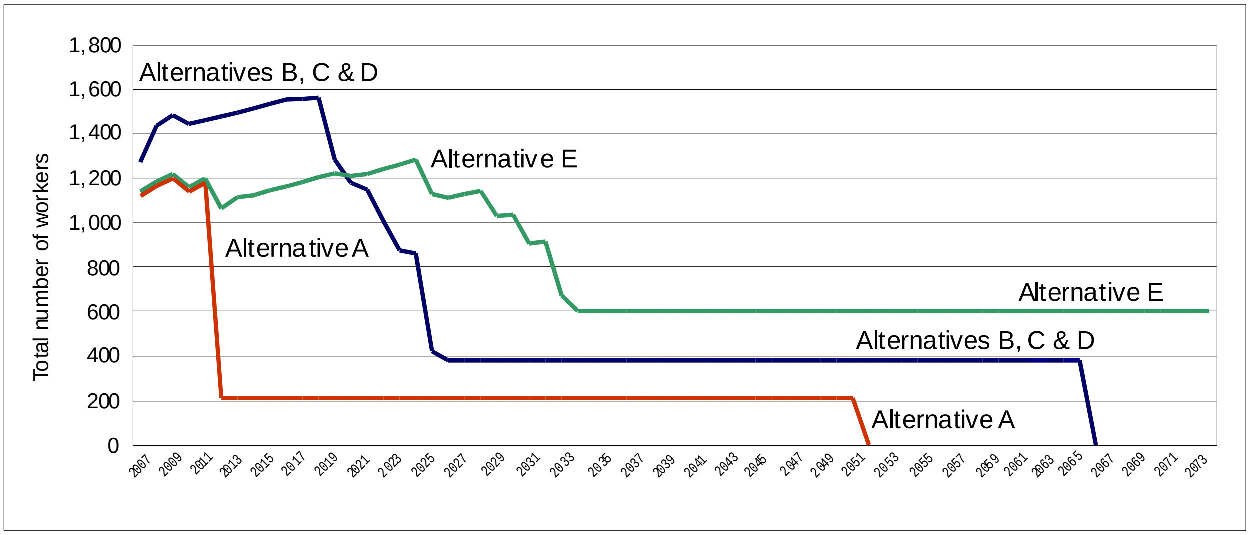


Figure 4.3-2
Total Workforce Requirements under All Alternatives

The analysis estimates population growth under three scenarios (low, medium, and high) and includes permanent workers only. Because of the tight supply of locally-available labor (Table 3.5-10), each scenario assumes that nearly all new development and production workers would be hired from outside Southwest Wyoming. New development workers who relocate to Southwest Wyoming and do not move to Sublette County are expected to live in Sweetwater County. Because of Lincoln County's distance from the PAPA, a negligible portion of new drilling workers is expected to relocate there. Production jobs are permanent, year-round positions that last for several years. Therefore, the analysis assumes that all new production workers would move to Sublette County. The low-, medium-, and high population impact scenarios differ in the number of new development workers expected to relocate to Southwest Wyoming and Sublette County.

Under the low impact scenario, the availability and affordability of housing are expected to continue to constrain the number of new PAPA workers who are able to move to Sublette County. Based on Proponents' estimates that 40 percent of their current development workforce resides locally, the low impact scenario assumes that 40 percent of new development workers would move to Southwest Wyoming. The remaining 60 percent would be non-resident workers. Half of the development workers who relocate to Southwest Wyoming are expected to move to Sublette County and half are expected to move to Sweetwater County. This scenario assumes that 20 percent of all new development workers relocate to Sublette County.

The medium and high impact scenarios are based on the assumption that year-round development would encourage more development workers to move to Southwest Wyoming. The scenarios also assume that Sublette County's housing market would become more responsive to the demand for housing by local workers. These scenarios are generally consistent with the results of a 2005 study in which 50 percent of surveyed non-resident natural gas workers said they were considering moving to Sublette County (Jacquet, 2007). The majority of respondents said that the cost and availability of housing was the major consideration regarding their relocation decision.

The medium impact scenario assumes that 60 percent of new development workers would relocate to Southwest Wyoming, and that 40 percent would be non-resident workers who continue to live outside of Southwest Wyoming. Of the new development workers who move to

Southwest Wyoming, 60 percent are expected to move to Sublette County and 40 percent to Sweetwater County. Accordingly, this scenario assumes that 36 percent of all new development workers would relocate to Sublette County.

The high impact scenario assumes that 80 percent of the new development workers would move to Southwest Wyoming. The remaining 20 percent would be non-resident workers who live outside Southwest Wyoming. Of the new development workers who relocate to Southwest Wyoming, 70 percent are expected to move to Sublette County and 30 percent to Sweetwater County. Accordingly, this scenario assumes that 56 percent of all new development workers would relocate to Sublette County.

Housing. Due to the PAPA's location in Sublette County, implementation of any of the Alternatives is likely to have the greatest impact on Sublette County's housing market. In large part, this is due to the county's relatively limited supply of existing housing, which reflects its historically low population levels. However, between 2000 and 2007, Sublette County's population increased 30 percent, while its housing supply increased 22 percent (U.S. Census Bureau, 2008). In 2006, only 84 houses were sold in Sublette County that were within the affordability level of the average wage-earner in the county (Jacquet, 2007, Economic Research Group, 2008). The availability of affordable housing in Sublette County would influence the number of PAPA development workers who move to Sublette County. Workers who want to relocate to Southwest Wyoming, but are unable to find suitable housing within their price range in Sublette County, are likely to move to Sweetwater County. Sweetwater County has a larger supply of housing (approximately 17,230 units at the end of 2007 compared to approximately 4,340 units in Sublette County) and therefore, can more readily accommodate new residents. Between 2000 and 2007, Sweetwater County's population increased 5 percent and its housing supply increased 8 percent (U.S. Census Bureau, 2008).

Government Revenues. Revenues generated by the PAPA since the time the PAPA DEIS (BLM, 1999a) was completed provide evidence of the economic benefits to federal, state, and local governments from development of the PAPA (Tables 3.5-26, 3.5-27, and 3.5-28).

Table 4.3-5 shows the estimated royalty and tax revenues generated by a PAPA well in 2006.

Table 4.3-5
Annual Royalties and Tax Revenue for a Typical Natural Gas Well in the PAPA[1]

Tax and Royalty Revenues	$/MMCF Gas	$/Bbl Oil	$/Well/Year
Federal Mineral Royalties – Wyoming Share[2]	$312.00	$2.68	$41,342
Severance Tax – State of Wyoming[3]	$304.70	$2.58	$40,341
Ad Valorem (Production) – Sublette County [2]	$320.00	$2.74	$42,398
Total	**$936.70**	**$8.00**	**$124,081**

[1] Based on 2006 revenue rates.
[2] Minerals Management Service, 2007.
[3] Wyoming Department of Revenue, 2007.

Royalties are paid on net revenues (gross revenues minus operating expenses). State severance tax and ad valorem taxes are paid after royalties are deducted. Approximately 78 percent of the existing well pads in the PAPA have been drilled on federal leases; the federal royalty is 12.5 percent of production revenues (after operating costs). Wells on state-owned minerals incur royalties to the State of Wyoming (16.7 percent of production revenues, after operating costs) and royalties on privately-owned minerals are paid to the owner of the mineral rights. A typical PAPA well generated $624 per MMSCF in federal mineral royalty (FMR) payments in 2006. Half of the FMR (minus a 1 percent administrative fee) was returned to the State of Wyoming ($312 per MMSCF). The State of Wyoming distributes the returned portion of the FMR from a typical PAPA well as shown in Table 4.3-6. The total distributions are capped at $200 million per year. Revenues in excess of the cap are allocated to the state's budget reserve and the school foundation program.

Table 4.3-6
State of Wyoming Distribution of Federal Mineral Royalty, 2006

Allocation of State's Share	Amount	Percent	PAPA $/Well/Year
Cities and Towns	$18,562,500	2.2	$892
University of Wyoming	$13,365,000	1.6	$642
Foundation Fund	$305,202,064	35.5	$14,668
Capital Revenue Bonds	$3,614,000	0.4	$174
Highway Fund	$60,142,500	7.0	$2,891
Highway Fund – State Roads	$4,455,000	0.5	$214
Cities, Counties, and Special District Capital Construction	$7,425,000	0.9	$357
School Districts – Grants	$5,346,000	0.6	$257
1% General Fund	$2,000,000	0.2	$96
Budget Reserve Account	$440,092,087	51.2	$21,151
Total	**$860,204,151**	**100.0**	**$41,342**
Source: Lummis et al., 2007.			

Severance taxes from the PAPA are collected and distributed by the Wyoming Department of Revenue. The state distribution is shown in Table 4.3-7.

Ad valorem taxes (i.e., property taxes) from the PAPA are paid to Sublette County. The total ad valorem taxes collected in Sublette County during 2005 were $164 million (Montgomery, 2006). Ninety-four percent of the total ad valorem taxes collected were from mineral production (compared with 75 percent in 1998). As the value of the mineral production in the county increases, the mill levy tends to decrease, creating a situation in which all other taxpayers (residential, commercial, industrial, and agricultural) pay lower taxes. If economically recoverable PAPA reserves continue to be developed and/or if production from the PAPA increases, the portion of total property taxes paid by non-mineral taxpayers would continue to decrease.

Table 4.3-7
State of Wyoming Distribution of Severance Tax, 2006[1]

Allocation	Amount	Percent	PAPA $/Well/Year
General Fund	$240,254,868	24.0	$9,682
Budget Reserve Account	$279,579,500	27.9	$11,266
Permanent Mineral Trust Fund	$406,945,374	40.7	$16,399
Water Accounts	$23,636,580	2.4	$953
Highway Fund	$8,269,185	0.8	$333
Cities and Towns	$16,162,339	1.6	$651
Counties	$6,622,389	0.7	$267
Cities, Counties, and Special District Capital Construction	$3,611,540	0.4	$146
State Aid County Roads	$4,495,031	0.4	$181
Other	$11,500,112	1.1	$463
Total	**$1,001,076,918**	**100.0**	**$40,341**
[1] Source: Wyoming Revenue Consensus Estimating Group, 2007.			

The distribution of ad valorem taxes (using the 2006 mill levy structure) is shown in Table 4.3-8. The calculations assume that, on average, a PAPA well produces 125 MMSCF of natural gas and 875 barrels of condensate per year over the 40-year life of the well.

Table 4.3-8
Distribution of Ad Valorem Taxes for Sublette County, 2006[1]

Allocation	Amount	Mills	PAPA $/Well/Year	Recapture $/Well/Year[2]
Airport Operations	$444,563	0.101	$73	N/A
Civil Defense	$294,908	0.067	$49	N/A
Fair Operations	$281,704	0.064	$46	N/A
County Fire	$909,060	0.208	$151	N/A
County General Fund	$35,948,016	8.167	$5,921	N/A
Library	$919,938	0.209	$152	N/A
Museum	$387,342	0.088	$64	N/A
Public Health	$118,844	0.027	$20	N/A
Recreation	$1,760,647	0.400	$290	N/A
Road & Bridge	$11,747,919	2.669	$1,935	N/A
County Total	**$52,812,941**	**12.000**	**$8,701**	**N/A**
Weed and Pest	$1,082,798	0.246	$178	N/A
Other	$9,791,255	2.224	$1,613	N/A
Special District Total	**$10,874,053**	**2.470**	**$1,791**	**N/A**
State Foundation	$52,819,420	12.000	$8,699	N/A
Mandatory County	$26,409,710	6.000	$4,350	$2,349
Mandatory School District	$110,040,458	25.000	$18,123	$9,787
Board of Cooperative Education	$2,262,110	0.514	$373	$201
Recreation	$2,200,809	0.500	$362	$196
School Total	**$193,732,507**	**44.014**	**$31,907**	**$12,533**
Grand Total	**$257,419,501**	**58.484**	**$42,399**	**$12,533**

[1] Source: Wyoming Department of Revenue, 2007 and Wyoming Department of Education, 2007.
[2] School funding does not consider recapture by the state.

Total ad valorem tax revenue per well is estimated to be more than $42,400 based on 2006 tax rates. Of this total, $8,699 (20.5 percent) goes to the Sublette County General Fund with $1,791 (4.2 percent) going to Special Districts in Sublette County. The majority of the ad valorem tax revenue goes to fund public schools - $31,907 (75.3 percent). Of this total, $8,699 went to the State School Foundation with the local school districts receiving $23,208. However, due to recapture provisions, the local school districts have not been able to retain all of this funding in recent years. In 2006, 54 percent of the local school district revenue was transferred to the State School Foundation; thus, the net revenue to the local school districts was only $10,676 in 2006. As a result, the local school districts netted only one-third of the revenue going to public schools. Due to changes in the statutes regarding recapture, the proportion of local school district revenue being recaptured will likely increase in future years.

Estimated Impacts by Alternative. Estimated impacts specific to each Alternative are presented in the sections below. The IMPLAN model was used to analyze estimates of economic activity (AJE and earnings) for Southwest Wyoming under all Alternatives. Total earnings represent wage and salary payments, including benefits plus proprietor income, and are expressed in 2006 dollars. Population estimates are based on the WDAI's baseline population projections and project-related workforce estimates.

<u>Pipeline Corridors and Gas Sales Pipelines</u>

The effects on socioeconomic resources of establishing transportation corridors and constructing gas sales pipelines are short-term and are expected to last for less than 1 year. A peak workforce of 200 to 300 workers for construction of an individual pipeline is projected for 3 to 5 months. Both qualified local workers and non-local workers are expected to comprise the workforce for each pipeline project. Because these jobs are largely temporary, the majority of the pipeline workforce is expected to consist of non-local hires. At similar pipeline projects in Southwest Wyoming, non-local workers have typically accounted for 50 to 80 percent of the workforce (Northwest Pipeline Corporation, 2005). Based on regional experiences, 30 percent of non-local workers on PAPA-related pipeline projects could be expected to provide their own temporary housing (i.e., recreational vehicles or tents) (Entrega Gas Pipeline, Inc., 2004). A temporary increase in the demand for housing is expected in communities near the proposed pipeline alignments during a period when temporary housing markets are already being strained by demand. There would be increased demand for a limited range of community services, including emergency response, medical services, and law enforcement. Construction of pipelines would generate additional economic benefits of employment and income and subsequent expenditures by workers for goods and services in Southwest Wyoming. Additional public sector revenues for federal, state, and local government entities would be generated. Once constructed, a relatively small number of workers (i.e., five to ten professionals) would be required to operate and maintain the pipelines.

There would be a potential for accidents and fires, including those along transportation/access routes, along pipeline rights-of-way, and at work sites. Accidents or fires would require emergency response (fire suppression and/or ambulance) and law enforcement services.

4.3.2.2 Alternative A (No Action Alternative)

Table 4.3-9 shows the estimated jobs and earnings associated with development in the PAPA under the No Action Alternative. Provided that the price of natural gas makes it economic to recover natural gas reserves in the PAPA, development would continue through 2011 with development earnings and jobs peaking in 2009. Note that employment impacts shown in Table 4.3-9 estimate “average annual job equivalents” (AJE) and not the number of project workers associated with Alternative A. One AJE represents 12 months of employment, and makes no distinction between full- or part-time jobs. For example, one AJE could represent one job for 12 months or two jobs for 6 months or three jobs for 4 months.

Table 4.3-9
Employment (AJE) and Earnings Associated with Development under the No Action Alternative

Year	Total impacts		Direct impacts		Indirect impacts		Induced impacts	
	Jobs (AJE)	Earnings	Jobs (AJE)	Earnings	Jobs (AJE)	Earnings	Jobs (AJE)	Earnings
2007	10,945	$561,371,257	8,775	$450,051,337	1,224	$62,761,307	947	$48,558,614
2008	11,134	$571,091,971	8,926	$457,844,433	1,245	$63,848,082	963	$49,399,455
2009	11,182	$573,522,150	8,965	$459,792,708	1,250	$64,119,776	967	$549,609,666
2010	10,281	$527,348,756	8,242	$422,775,498	1,149	$58,957,591	889	$45,615,667
2011	10,424	$534,639,292	8,357	$428,620,320	1,165	$59,772,673	902	$46,246,299

Under the No Action Alternative, production in the PAPA would continue through 2051, generating the estimated jobs and earnings shown in Table 4.3-10. Jobs are based on the ratio of employment per dollar of expenditures, and are expressed in terms of direct, indirect and induced AJE. Production earnings and AJE would peak in 2011, and begin to decline thereafter.

Table 4.3-10
Employment (AJE) and Earnings Associated with Production under the No Action Alternative

Year	Total AJE	Total Earnings	Direct AJE	Direct Earnings	Indirect AJE	Indirect Earnings	Induced AJE	Induced Earnings
2007	810	$42,297,430	405	$21,148,715	203	$10,574,358	203	$10,574,358
2008	1,375	$71,852,184	688	$35,926,092	344	$17,963,046	344	$17,963,046
2009	1,765	$92,195,473	883	$46,097,737	441	$23,048,868	441	$23,048,868
2010	1,964	$102,610,398	982	$51,305,199	491	$25,652,600	491	$25,652,600
2011	2,111	$110,292,283	1,056	$55,146,142	528	$27,573,071	528	$27,573,071
2012	1,441	$75,277,562	721	$37,638,781	360	$18,819,391	360	$18,819,391
2013	985	$51,449,067	493	$25,724,534	246	$12,862,267	246	$12,862,267
2014	674	$35,219,736	337	$17,609,868	169	$8,804,934	169	$8,804,934
2015	462	$24,155,302	231	$12,077,651	116	$6,038,826	116	$6,038,826
2016	318	$16,603,329	159	$8,301,665	80	$4,150,832	80	$4,150,832
2017	219	$11,441,721	110	$5,720,861	55	$2,860,430	55	$2,860,430
2018	151	$7,908,192	76	$3,954,096	38	$1,977,048	38	$1,977,048
2019	105	$5,484,640	53	$2,742,320	26	$1,371,160	26	$1,371,160
2020	73	$3,818,714	37	$1,909,357	18	$954,679	18	$954,679
2021	51	$2,670,626	26	$1,335,313	13	$667,657	13	$667,657
2022	36	$1,877,049	18	$938,525	9	$469,262	9	$469,262
2023	25	$1,326,634	13	$663,317	6	$331,659	6	$331,659
2024	18	$943,371	9	$471,686	5	$235,843	5	$235,843
2025	13	$675,311	7	$337,656	3	$168,828	3	$168,828
2026-2051	< 10/year	< $5000,000/yr	< 5/year	< $250,000/yr	< 3/year	< $125,000/yr	< 3/year	< $125,000/yr

Tax revenues for the No Action Alternative associated with production, including FMR, severance, and ad valorem, are shown in Table 4.3-11.

Table 4.3-11
Tax Revenues Associated with
Production under the No Action Alternative[1]

Year	Total FMR ($640 per MMSCF)	FMR-Wyoming ($312 per MMSCF)	Severance Tax ($305 per MMSCF)	Ad Valorem Production ($320 per MMSCF)
2007	$228,410,714	$114,205,357	$111,533,244	$117,133,699
2008	$387,925,274	$193,962,637	$189,424,409	$198,936,038
2009	$497,654,190	$248,827,095	$243,005,179	$255,207,277
2010	$553,752,687	$276,876,343	$270,398,147	$283,975,737
2011	$595,099,192	$297,549,596	$290,587,698	$305,179,073
2012	$405,890,276	$202,945,138	$198,196,742	$208,148,860
2013	$277,182,093	$138,591,046	$135,348,371	$142,144,663
2014	$189,563,808	$94,781,904	$92,564,250	$97,212,209
2015	$129,864,680	$64,932,340	$63,413,090	$66,597,272
2016	$89,145,686	$44,572,843	$43,529,953	$45,715,736
2017	$61,337,984	$30,668,992	$29,951,416	$31,455,377
2018	$42,319,805	$21,159,902	$20,664,815	$21,702,464
2019	$29,290,521	$14,645,261	$14,302,599	$15,020,780
2020	$20,346,178	$10,173,089	$9,935,065	$10,433,937
2021	$14,191,584	$7,095,792	$6,929,769	$7,277,735
2022	$9,945,010	$4,972,505	$4,856,161	$5,100,005
2023	$7,005,660	$3,502,830	$3,420,873	$3,592,646
2024	$4,963,733	$2,481,867	$2,423,797	$2,545,504
2025	$3,539,353	$1,769,676	$1,728,271	$1,815,053
2026	$2,541,095	$1,270,548	$1,240,820	$1,303,126
2027	$1,837,806	$918,903	$897,403	$942,465
2028	$1,339,443	$669,722	$654,052	$686,894
2029	$984,043	$492,022	$480,510	$504,638
2030	$728,846	$364,423	$355,897	$373,767
2031	$544,252	$272,126	$265,759	$279,103
2032	$409,693	$204,847	$200,054	$210,099
2033	$310,822	$155,411	$151,775	$159,396
2034	$237,579	$118,790	$116,010	$121,836
2035	$182,878	$91,439	$89,300	$93,784
2036	$141,695	$70,847	$69,190	$72,664
2037	$110,446	$55,223	$53,931	$56,639
2038	$86,556	$43,278	$42,266	$44,388
2039	$68,165	$34,083	$33,285	$34,956
2040	$53,914	$26,957	$26,326	$27,648
2041	$42,804	$21,402	$20,901	$21,951
2042	$34,096	$17,048	$16,649	$17,485
2043	$27,238	$13,619	$13,301	$13,968
2044	$21,814	$10,907	$10,652	$11,187
2045	$17,507	$8,753	$8,549	$8,978
2046	$14,076	$7,038	$6,873	$7,218
2047	$11,334	$5,667	$5,535	$5,813
2048	$7,975	$3,987	$3,894	$4,090
2049	$5,251	$2,626	$2,564	$2,693
2050	$3,051	$1,526	$1,490	$1,565
2051	$1,372	$686	$670	$703

[1] 2006 Tax Rates

Table 4.3-12 shows the estimated number of development and production workers under the No Action Alternative. Development workers would peak at 1,060 in 2009 and fall to zero by 2012, when drilling ends. The number of production workers would peak at 210 in 2011 and remain stable through 2051.

Table 4.3-12
Total Development and Production Workforce
Associated with the No Action Alternative

Year	Drilled Wells	Development Workers	Producing Wells	Production Workers
2007	231	1,038	842	101
2008	235	1,056	1,077	129
2009	236	1,060	1,313	158
2010	217	975	1,530	184
2011	220	988	1,750	210
2012 – 2051	0	0	1,750	210

The population growth projected by the WDAI estimates the population impacts that would occur under the No Action Alternative. The population projections shown in Table 4.3-13 are based on WDAI's moderate growth scenario (WDAI, 2007b). Between 2007 and 2020, the WDAI projects population increases of 53 percent in Sublette County, 22 percent in Lincoln County, and 9 percent in Sweetwater County. Annual growth across Southwest Wyoming is expected to be strongest through 2010, and to fall to approximately 3.3 percent per year in Sublette County, 1.6 percent per year in Lincoln County, and 0.6 percent per year in Sweetwater County, between 2011 and 2020.

Table 4.3-13
Population Projections for Southwest Wyoming
Associated with the No Action Alternative[1]

Year	Sublette County	Pinedale	Big Piney	Marbleton	Sweetwater County	Rock Springs	Green River	Lincoln County
2007	7,690	1,813	517	917	39,540	19,595	12,336	16,800
2008	8,070	1,903	542	962	40,260	19,952	12,561	17,210
2009	8,470	1,997	569	1,010	40,960	20,299	12,779	17,600
2010	8,870	2,092	596	1,057	41,620	20,626	12,985	17,990
2011	9,180	2,165	617	1,094	41,900	20,765	13,072	18,300
2012	9,490	2,238	638	1,131	42,140	20,884	13,147	18,590
2013	9,800	2,311	659	1,168	42,340	20,983	13,210	18,870
2014	10,120	2,386	680	1,206	42,580	21,102	13,285	19,180
2015	10,460	2,467	703	1,247	42,810	21,216	13,356	19,480
2016	10,820	2,552	727	1,290	43,090	21,355	13,444	19,810
2017	11,180	2,636	751	1,333	43,330	21,474	13,519	20,130
2018	11,540	2,721	776	1,376	43,520	21,568	13,578	20,420
2019	11,920	2,811	801	1,421	43,750	21,682	13,650	20,750
2020	12,320	2,905	828	1,469	43,990	21,801	13,725	21,070

[1] Source: WDAI, 2007b.

The No Action Alternative has the potential to intensify the "boom-bust" cycle in the local economy because intense drilling would continue through 2011 and stop abruptly in 2012. All other things held equal, the sudden exit of PAPA wellfield workers in 2012 could lead to excess capacity in many of the local services and supporting industries that have expanded to accommodate the development workforce. Crime rates and the demand for emergency services may also fall. Housing prices and other inflationary pressures that have risen due to the demand of PAPA development workers could moderate, if not weaken. The period of economic expansion under Alternative A is likely to be shorter than the expansion periods associated with Alternatives, B, C, and D or Alternative E.

4.3.2.3 Alternative B, Alternative C, and Alternative D

The economic impacts of Alternatives B, C, and D are similar because each Alternative includes the same number of wells drilled per year, the same number of drilling rigs operating in the PAPA, and the same pace of development. Table 4.3-14 shows the jobs and earnings associated with development in the PAPA between 2007 and 2025 under these three Alternatives. Note that employment impacts shown in Table 4.3-14 estimate (AJE) and not the number of project workers associated with these Alternatives. One AJE represents 12 months of employment, and makes no distinction between full- or part-time jobs. For example, one AJE could represent one job for 12 months or two jobs for 6 months or three jobs for 4 months. Economic impacts associated with development are projected through 2025. Development earnings and jobs (AJE) would peak in 2009.

Table 4.3-15 shows estimated employment and earnings associated with production under Alternatives B, C, and D from 2007 through 2065. Jobs are based on the ratio of employment per dollar of expenditures and are expressed in terms of direct, indirect, and induced AJE. Under Alternatives B, C, and D, production jobs and earnings would peak in 2017.

Table 4.3-14
Employment (AJE) and Earnings Associated with
Development under Alternative B, Alternative C, and Alternative D

Year	Total AJE	Total Earnings	Direct AJE	Direct Earnings	Indirect AJE	Indirect Earnings	Induced AJE	Induced Earnings
2007	12,698	$651,287,865	10,180	$522,137,481	1,420	$72,813,983	1,098	$56,336,400
2008	14,167	$726,623,401	11,358	$582,533,981	1,584	$81,236,496	1,225	$62,852,924
2009	14,451	$741,204,473	11,585	$594,223,626	1,616	$82,866,660	1,250	$64,114,187
2010	13,788	$707,181,973	11,054	$566,947,788	1,541	$79,062,945	1,193	$61,171,241
2011	13,740	$704,751,794	11,015	$564,999,513	1,536	$78,791,251	1,189	$60,961,030
2012	13,693	$702,321,615	10,978	$563,051,239	1,531	$78,519,557	1,184	$60,750,820
2013	13,645	$699,891,437	10,939	$561,102,965	1,526	$78,247,863	1,180	$60,540,609
2014	13,598	$697,461,258	10,902	$559,154,691	1,520	$77,976,169	1,176	$60,330,399
2015	13,598	$695,461,258	10,902	$557,551,291	1,520	$77,752,569	1,176	$60,157,399
2016	13,551	$695,031,080	10,864	$557,206,417	1,515	$77,704,475	1,172	$60,120,188
2017	13,361	$685,310,365	10,712	$549,413,320	1,494	$76,617,699	1,156	$59,279,347
2018	13,219	$678,019,829	10,598	$543,568,497	1,478	$75,802,617	1,143	$58,648,715
2019	10,092	$517,628,042	8,091	$414,982,401	1,128	$57,870,815	873	$44,774,826
2020	8,860	$454,443,398	7,103	$364,327,272	991	$50,806,772	766	$39,309,354
2021	8,386	$430,141,612	6,723	$344,844,530	938	$48,089,832	725	$37,207,249
2022	6,775	$347,515,540	5,432	$278,603,208	757	$38,852,237	586	$30,060,094
2023	5,307	$272,180,003	4,255	$218,206,708	593	$30,429,724	459	$23,543,570
2024	5,070	$272,180,003	4,065	$218,206,708	567	$30,429,724	439	$23,543,570
2025	426	$21,871,607	342	$17,534,467	48	$2,445,246	37	$1,891,894

Table 4.3-15
Employment (AJE) and Earnings Associated with Production under Alternative B, Alternative C, and Alternative D

Year	Total AJE	Total Earnings	Direct AJE	Direct Earnings	Indirect AJE	Indirect Earnings	Induced AJE	Induced Earnings
2007	939	$49,072,344	470	$24,536,172	235	$12,268,086	235	$12,268,086
2008	1,688	$88,187,516	844	$44,093,758	422	$22,046,879	422	$22,046,879
2009	2,220	$115,964,358	1,110	$57,982,179	555	$28,991,090	555	$28,991,090
2010	2,534	$132,367,640	1,267	$66,183,820	634	$33,091,910	634	$33,091,910
2011	2,745	$143,407,401	1,373	$71,703,701	686	$35,851,850	686	$35,851,850
2012	2,886	$150,791,784	1,443	$75,395,892	722	$37,697,946	722	$37,697,946
2013	2,980	$155,682,202	1,490	$77,841,101	745	$38,920,551	745	$38,920,551
2014	3,041	$158,868,849	1,521	$79,434,425	760	$39,717,212	760	$39,717,212
2015	3,083	$161,072,883	1,542	$80,536,442	771	$40,268,221	771	$40,268,221
2016	3,109	$162,419,564	1,555	$81,209,782	777	$40,604,891	777	$40,604,891
2017	3,113	$162,628,449	1,557	$81,314,225	778	$40,657,112	778	$40,657,112
2018	3,106	$162,241,250	1,553	$81,120,625	777	$40,560,313	777	$40,560,313
2019	2,869	$149,908,514	1,435	$74,954,257	717	$37,477,129	717	$37,477,129
2020	2,618	$136,756,797	1,309	$68,378,399	655	$34,189,199	655	$34,189,199
2021	2,411	$125,968,128	1,206	$62,984,064	603	$31,492,032	603	$31,492,032
2022	2,151	$112,387,817	1,076	$56,193,909	538	$28,096,954	538	$28,096,954
2023	1,865	$97,449,785	933	$48,724,893	466	$24,362,446	466	$24,362,446
2024	1,653	$86,342,099	827	$43,171,050	413	$21,585,525	413	$21,585,525
2025	1,164	$60,810,754	582	$30,405,377	291	$15,202,689	291	$15,202,689
2026	799	$41,745,189	400	$20,872,595	200	$10,436,297	200	$10,436,297
2027	550	$28,724,675	275	$14,362,338	138	$7,181,169	138	$7,181,169
2028	379	$19,819,464	190	$9,909,732	95	$4,954,866	95	$4,954,866
2029	263	$13,718,336	132	$6,859,168	66	$3,429,584	66	$3,429,584
2030	182	$9,529,870	91	$4,764,935	46	$2,382,468	46	$2,382,468
2031	127	$6,647,662	64	$3,323,831	32	$1,661,916	32	$1,661,916
2032	89	$4,658,878	45	$2,329,439	22	$1,164,720	22	$1,164,720
2033	63	$3,282,220	32	$1,641,110	16	$820,555	16	$820,555
2034	45	$2,325,808	23	$1,162,904	11	$581,452	11	$581,452
2035	32	$1,658,595	16	$829,298	8	$414,649	8	$414,649
2036	23	$1,190,946	12	$595,473	6	$297,737	6	$297,737
2037	16	$861,448	8	$430,724	4	$215,362	4	$215,362
2038	12	$627,934	6	$313,967	3	$156,984	3	$156,984
2039-2065	<10/year	< $500,000/year	< 5/year	< $250,000/year	< 3/year	< $125,000/year	< 3/year	< $125,000/year

Table 4.3-16 shows the FMR, severance, and ad valorem tax revenues associated with production through 2065 under Alternatives B, C, and D.

Table 4.3-16
Tax Revenues Associated with Production
under Alternative B, Alternative C, and Alternative D[1]

Year	Total FMR ($640 per MMSCF)	FMR-Wyoming ($312 per MMSCF)	Severance Tax ($305 per MMSCF)	Ad Valorem Production ($320 per MMSCF)
2007	$264,995,980	$132,497,990	$129,397,877	$135,895,374
2008	$476,124,336	$238,062,168	$232,492,124	$244,166,326
2009	$625,965,270	$312,982,635	$305,659,644	$321,007,831
2010	$714,362,510	$357,181,255	$348,824,129	$366,339,749
2011	$773,798,426	$386,899,213	$377,846,764	$396,819,706
2012	$813,507,433	$406,753,716	$397,236,722	$417,183,299
2013	$839,766,166	$419,883,083	$410,058,896	$430,649,316
2014	$856,843,400	$428,421,700	$418,397,731	$439,406,872
2015	$868,633,195	$434,316,597	$424,154,703	$445,452,920
2016	$875,810,337	$437,905,169	$427,659,310	$449,133,506
2017	$876,858,810	$438,429,405	$428,171,281	$449,671,185
2018	$874,703,214	$437,351,607	$427,118,701	$448,565,751
2019	$808,053,601	$404,026,801	$394,573,609	$414,386,462
2020	$737,015,866	$368,507,933	$359,885,792	$377,956,854
2021	$678,768,336	$339,384,168	$331,443,449	$348,086,326
2022	$605,464,749	$302,732,375	$295,649,213	$310,494,743
2023	$524,850,341	$262,425,170	$256,285,094	$269,154,021
2024	$464,939,898	$232,469,949	$227,030,748	$238,430,717
2025	$327,148,412	$163,574,206	$159,746,989	$167,768,417
2026	$224,308,280	$112,154,140	$109,530,021	$115,029,887
2027	$154,127,828	$77,063,914	$75,260,816	$79,039,912
2028	$106,171,137	$53,085,568	$51,843,502	$54,446,737
2029	$73,349,140	$36,674,570	$35,816,479	$37,614,944
2030	$50,843,956	$25,421,978	$24,827,169	$26,073,823
2031	$35,379,369	$17,689,685	$17,275,791	$18,143,266
2032	$24,726,002	$12,363,001	$12,073,738	$12,680,001
2033	$17,365,586	$8,682,793	$8,479,638	$8,905,429
2034	$12,263,152	$6,131,576	$5,988,113	$6,288,796
2035	$8,712,375	$4,356,188	$4,254,264	$4,467,885
2036	$6,230,575	$3,115,287	$3,042,398	$3,195,167
2037	$4,487,375	$2,243,688	$2,191,191	$2,301,218
2038	$3,256,231	$1,628,115	$1,590,022	$1,669,862
2039	$2,381,453	$1,190,726	$1,162,866	$1,221,258
2040	$1,755,779	$877,889	$857,349	$900,399
2041	$1,305,092	$652,546	$637,278	$669,278
2042	$978,004	$489,002	$477,561	$501,541
2043	$738,751	$369,375	$360,733	$378,846
2044	$562,327	$281,164	$274,585	$288,373
2045	$431,168	$215,584	$210,540	$221,112
2046	$332,865	$166,433	$162,538	$170,700
2047	$258,599	$129,300	$126,274	$132,615
2048	$200,710	$100,355	$98,007	$102,928
2049	$156,103	$78,052	$76,226	$80,053
2050	$121,586	$60,793	$59,371	$62,352
2051	$94,803	$47,401	$46,292	$48,617
2052	$73,856	$36,928	$36,064	$37,875
2053	$57,392	$28,696	$28,025	$29,432
2054	$44,394	$22,197	$21,678	$22,766
2055	$34,093	$17,046	$16,648	$17,483
2056	$25,896	$12,948	$12,645	$13,280
2057	$19,360	$9,680	$9,453	$9,928

Year	Total FMR ($640 per MMSCF)	FMR-Wyoming ($312 per MMSCF)	Severance Tax ($305 per MMSCF)	Ad Valorem Production ($320 per MMSCF)
2058	$14,150	$7,075	$6,909	$7,256
2059	$9,986	$4,993	$4,876	$5,121
2060	$6,974	$3,487	$3,405	$3,576
2061	$4,682	$2,341	$2,286	$2,401
2062	$2,887	$1,443	$1,410	$1,480
2063	$1,610	$805	$786	$826
2064	$737	$368	$360	$378
2065	$56	$28	$27	$29
[1] 2006 Tax Rates.				

The estimated jobs shown in Tables 4.3-14 and 4.3-15 are expressed in terms of AJE, and include direct, indirect, and induced employment. Workforce estimates, which are based on the number of wells, are more reflective of the number of workers directly associated with well development and production. Under Alternatives B, C, and D, the number of development workers would peak in 2009 and fall to zero by 2026, when drilling ends (Table 4.3-17). The production workforce would peak at 381 workers in 2025, and continue at a steady level through 2065.

Table 4.3-17
Total Development and Production Workforce
Associated with Alternatives B, C, and D

Year	Drilled Wells	Development Workers	Producing Wells	Production Workers
2007	268	1,204	879	67
2008	299	1,343	1,178	90
2009	305	1,370	1,483	113
2010	291	1,308	1,774	135
2011	290	1,303	2,064	157
2012	289	1,299	2,353	179
2013	288	1,294	2,641	201
2014	287	1,290	2,928	223
2015	287	1,290	3,215	244
2016	286	1,285	3,501	266
2017	282	1,267	3,783	288
2018	279	1,254	4,062	309
2019	213	957	4,275	325
2020	187	840	4,462	339
2021	177	795	4,639	353
2022	143	643	4,782	363
2023	112	503	4,894	372
2024	107	481	5,001	380
2025	9	40	5,010	381
2026-2065	0	0	5,010	381

The low-, medium-, and high-impact population estimates under Alternatives B, C and D are shown in Tables 4.3-18 through 4.3-20. Sublette County is expected to have the largest population increases between 2007 and 2020 under all scenarios, with population growth ranging from a low of 66 percent to a high of 71 percent. Sweetwater County's population is estimated to increase by approximately 12 percent under all three scenarios, and Lincoln County's population is expected to increase by approximately 25 percent.

Table 4.3-18
Population Projections for Southwest Wyoming
Associated with Alternatives B, C, and D – Low Impact Scenario

Year	Sublette County	Pinedale	Big Piney	Marbleton	Sweetwater County	Rock Springs	Green River	Lincoln County
2007	7,688	1,813	517	917	39,600	19,625	12,355	16,800
2008	8,099	1,910	544	965	40,365	20,004	12,593	17,210
2009	8,498	2,004	571	1,013	41,073	20,355	12,814	17,600
2010	8,899	2,098	598	1,061	41,741	20,686	13,023	17,990
2011	9,196	2,169	618	1,096	42,014	20,822	13,108	18,300
2012	9,861	2,325	663	1,176	42,612	21,118	13,295	18,590
2013	10,205	2,407	686	1,217	42,811	21,216	13,357	18,870
2014	10,559	2,490	710	1,259	43,049	21,334	13,431	19,180
2015	10,935	2,579	735	1,304	43,279	21,448	13,503	19,480
2016	11,329	2,671	761	1,350	43,557	24,586	13,590	19,810
2017	11,718	2,763	788	1,397	43,791	21,702	13,662	20,130
2018	12,108	2,855	814	1,443	43,976	21,794	13,720	20,420
2019	12,418	2,928	835	1,480	44,098	21,854	13,758	20,750
2020	12,803	3,019	861	1,526	44,296	21,952	13,820	21,070

Table 4.3-19
Population Projections for Southwest Wyoming
Associated with Alternatives B, C, and D – Medium Impact Scenario

Year	Sublette County	Pinedale	Big Piney	Marbleton	Sweetwater County	Rock Springs	Green River	Lincoln County
2007	7,732	1,823	520	922	39,613	19,631	12,359	16,800
2008	8,174	1,927	549	974	40,386	20,014	12,600	17,210
2009	8,578	2,023	577	1,023	41,095	20,366	12,821	17,600
2010	8,985	2,119	604	1,071	41,765	20,698	13,030	17,990
2011	9,278	2,188	624	1,106	42,037	20,833	13,115	18,300
2012	10,199	2,405	686	1,216	42,707	21,165	13,324	18,590
2013	10,542	2,486	709	1,257	42,905	21,263	13,386	18,870
2014	10,895	2,569	732	1,299	43,143	21,381	13,460	19,180
2015	11,270	2,658	758	1,343	43,373	21,495	13,532	19,480
2016	11,663	2,750	784	1,390	43,651	21,633	13,619	19,810
2017	12,047	2,841	810	1,436	43,883	21,748	13,691	20,130
2018	12,434	2,932	836	1,482	44,067	21,839	13,749	20,420
2019	12,666	2,987	851	1,510	44,168	21,889	13,780	20,750
2020	13,021	3,071	875	1,552	44,357	21,982	13,839	20,070

Table 4.3-20
Population Projections for Southwest Wyoming
Associated with Alternatives B, C, and D – High Impact Scenario

Year	Sublette County	Pinedale	Big Piney	Marbleton	Sweetwater County	Rock Springs	Green River	Lincoln County
2007	7,786	1,836	523	928	39,613	19,631	12,359	16,800
2008	8,267	1,949	556	986	40,386	20,014	12,600	17,210
2009	8,679	2,047	583	1,035	41,095	20,366	12,821	17,600
2010	9,093	2,144	611	1,084	41,765	20,698	13,030	17,990
2011	9,380	2,212	630	1,118	42,037	20,833	13,115	18,300
2012	10,621	2,505	714	1,266	42,707	21,165	13,324	18,590
2013	10,962	2,585	737	1,307	42,905	21,263	13,386	18,870
2014	11,314	2,668	760	1,349	43,143	21,381	13,460	19,180
2015	11,689	2,756	786	1,393	43,373	21,495	13,532	19,480
2016	12,080	2,849	812	1,440	43,651	21,633	13,619	19,810
2017	12,459	2,938	837	1,485	43,883	21,748	13,691	20,130
2018	12,841	3,028	863	1,531	44,067	21,839	13,749	20,420
2019	12,977	3,060	872	1,547	44,168	21,889	13,780	20,750
2020	13,294	3,135	894	1,585	44,357	21,982	13,839	20,070

Under Alternatives B, C, and D, the total workforce is expected to peak at 1,562 workers in 2018. Development in the PAPA would continue through 2025, after which time development workers would either leave the area or pursue alternative sources of local employment. Production is anticipated to continue through 2065, with approximately 360 production workers living in the local area between 2023 and 2065. To a large extent, the number of PAPA development workers who relocate to Sublette County, and the resultant population growth, would depend on how the county's housing market responds to the demand for housing by workers in the PAPA and in supporting industries. Population growth would be accompanied by an increase in the demand for local infrastructure and services, including schools, law enforcement, fire protection, and medical services. Because a significant number of development workers remain in the PAPA through 2024, and a sizeable production workforce is in place through 2073, the local economy is likely to expand to accommodate the higher level of demand. The increase in the overall supply of locally-available goods and services would moderate future cost-of-living increases. The period of economic expansion under Alternatives B, C, and D is expected to be longer than the expansion period likely to occur under Alternative A (No Action Alternative), and shorter than the expansion period likely to occur under Alternative E.

4.3.2.4 Alternative E

Table 4.3-21 shows the estimated jobs and earnings associated with drilling in the PAPA under Alternative E. These estimates are based on the assumption that the price of natural gas makes it economic to recover natural gas reserves in the PAPA. Economic impacts associated with development are projected through 2033. Note that the employment impacts shown in Table 4.3-21 estimate AJE and not the number of project workers associated with Alternative E. One AJE represents 12 months of employment, and makes no distinction between full- or part-time jobs. For example, one AJE could represent one job for 12 months or two jobs for 6 months or three jobs for 4 months. Development earnings and jobs (AJE) would peak in 2009.

Table 4.3-22 shows estimated employment and earnings associated with production under Alternative E from 2007 through 2073. Jobs are based on the ratio of employment per dollar of expenditures and are expressed in terms of direct, indirect and induced AJE. Production jobs and earnings would peak in 2013.

Table 4.3-21
Employment (AJE) and Earnings Associated with Development under Alternative E

Year	Total AJE	Total Earnings	Direct AJE	Direct Earnings	Indirect AJE	Indirect Earnings	Induced AJE	Induced Earnings
2007	10,945	$561,371,257	8,775	$450,051,337	1,224	$62,761,307	947	$48,558,614
2008	11,134	$571,091,971	8,926	$457,844,433	1,245	$63,848,082	963	$49,399,455
2009	11,182	$573,522,150	8,965	$459,792,708	1,250	$64,119,776	967	$49,609,666
2010	10,281	$527,348,756	8,242	$422,775,498	1,149	$58,957,591	889	$45,615,667
2011	10,424	$534,639,292	8,357	$428,620,320	1,165	$59,772,673	902	$46,246,299
2012	8,765	$449,583,041	7,027	$360,430,724	980	$50,263,384	758	$38,888,933
2013	9,050	$464,164,113	7,255	$372,120,369	1,012	$51,893,548	783	$40,150,196
2014	8,907	$456,873,577	7,141	$366,275,547	996	$51,078,466	770	$39,519,564
2015	8,907	$456,873,577	7,141	$366,275,547	996	$51,078,466	770	$39,519,564
2016	8,860	$454,443,398	7,103	$364,327,272	991	$50,806,772	766	$39,309,354
2017	8,813	$452,013,220	7,065	$362,378,998	985	$50,535,078	762	$39,099,144
2018	8,813	$452,013,220	7,065	$362,378,998	985	$50,535,078	762	$39,099,144
2019	8,765	$449,583,041	7,027	$360,430,724	980	$50,263,384	758	$38,888,933
2020	8,434	$432,571,791	6,762	$346,792,805	943	$48,361,526	730	$37,417,460
2021	8,292	$425,281,255	6,648	$340,947,982	927	$47,546,444	717	$36,786,829
2022	8,292	$425,281,255	6,648	$340,947,982	927	$47,546,444	717	$36,786,829
2023	8,292	$425,281,255	6,648	$340,947,982	927	$47,546,444	717	$36,786,829
2024	8,292	$425,281,255	6,648	$340,947,982	927	$47,546,444	717	$36,786,829
2025	6,491	$332,934,468	5,204	$266,913,563	726	$37,222,074	561	$28,798,831
2026	6,159	$315,923,218	4,938	$253,275,644	689	$35,320,216	533	$27,327,358
2027	6,159	$315,923,218	4,938	$253,275,644	689	$35,320,216	533	$27,327,358
2028	6,159	$315,923,218	4,938	$253,275,644	689	$35,320,216	533	$27,327,358
2029	4,833	$247,878,217	3,875	$198,723,967	540	$27,712,785	418	$21,441,466
2030	4,785	$245,448,039	3,836	$196,775,693	535	$27,441,091	414	$21,231,255
2031	3,317	$170,112,502	2,659	$136,379,193	371	$19,018,578	287	$14,714,731
2032	3,317	$170,112,502	2,659	$136,379,193	371	$19,018,578	287	$14,714,731
2033	758	$38,882,858	608	$31,172,387	85	$4,347,104	66	$3,363,367

Table 4.3-22
Employment (AJE) and Earnings Associated with Production under Alternative E

Year	Total AJE	Total Earnings	Direct AJE	Direct Earnings	Indirect AJE	Indirect Earnings	Induced AJE	Induced Earnings
2007	810	$42,297,430	405	$21,148,715	203	$10,574,358	203	$10,574,358
2008	1,375	$71,852,184	688	$35,926,092	344	$17,963,046	344	$17,963,046
2009	1,765	$92,195,473	883	$46,097,737	441	$23,048,868	441	$23,048,868
2010	1,964	$102,610,398	982	$51,305,199	491	$25,652,600	491	$25,652,600
2011	2,111	$110,292,283	1,056	$55,146,142	528	$27,573,071	528	$27,573,071

Year	Total AJE	Total Earnings	Direct AJE	Direct Earnings	Indirect AJE	Indirect Earnings	Induced AJE	Induced Earnings
2012	2,089	$109,152,128	1,045	$54,576,064	522	$27,288,032	522	$27,288,032
2013	2,096	$109,505,086	1,048	$54,752,543	524	$27,376,272	524	$27,376,272
2014	2,091	$109,220,969	1,046	$54,610,485	523	$27,305,242	523	$27,305,242
2015	2,087	$109,047,491	1,044	$54,523,746	522	$27,261,873	522	$27,261,873
2016	2,082	$108,762,297	1,041	$54,381,149	521	$27,190,574	521	$27,190,574
2017	2,075	$108,397,797	1,038	$54,198,899	519	$27,099,449	519	$27,099,449
2018	2,070	$108,159,738	1,035	$54,079,869	518	$27,039,935	518	$27,039,935
2019	2,064	$107,822,572	1,032	$53,911,286	516	$26,955,643	516	$26,955,643
2020	2,035	$106,317,554	1,018	$53,158,777	509	$26,579,389	509	$26,579,389
2021	2,005	$104,747,753	1,003	$52,373,877	501	$26,186,938	501	$26,186,938
2022	1,985	$103,681,405	993	$51,840,703	496	$25,920,351	496	$25,920,351
2023	1,971	$102,956,700	986	$51,478,350	493	$25,739,175	493	$25,739,175
2024	1,961	$102,463,899	981	$51,231,950	490	$25,615,975	490	$25,615,975
2025	1,822	$95,170,548	911	$47,585,274	456	$23,792,637	456	$23,792,637
2026	1,702	$88,919,106	851	$44,459,553	426	$22,229,777	426	$22,229,777
2027	1,620	$84,655,740	810	$42,327,870	405	$21,163,935	405	$21,163,935
2028	1,565	$81,744,663	783	$40,872,332	391	$20,436,166	391	$20,436,166
2029	1,428	$74,627,126	714	$37,313,563	357	$18,656,782	357	$18,656,782
2030	1,332	$69,586,959	666	$34,793,480	333	$17,396,740	333	$17,396,740
2031	1,157	$60,467,001	579	$30,233,501	289	$15,116,750	289	$15,116,750
2032	1,038	$54,242,537	519	$27,121,269	260	$13,560,634	260	$13,560,634
2033	768	$40,100,794	384	$20,050,397	192	$10,025,199	192	$10,025,199
2034	527	$27,521,399	264	$13,760,700	132	$6,880,350	132	$6,880,350
2035	362	$18,931,838	181	$9,465,919	91	$4,732,960	91	$4,732,960
2036	250	$13,058,191	125	$6,529,096	63	$3,264,548	63	$3,264,548
2037	173	$9,034,906	87	$4,517,453	43	$2,258,727	43	$2,258,727
2038	120	$6,273,586	60	$3,136,793	30	$1,568,397	30	$1,568,397
2039	84	$4,373,994	42	$2,186,997	21	$1,093,499	21	$1,093,499
2040	59	$3,063,680	30	$1,531,840	15	$765,920	15	$765,920
2041	41	$2,157,019	21	$1,078,510	10	$539,255	10	$539,255
2042	29	$1,527,412	15	$763,706	7	$381,853	7	$381,853
2043	21	$1,088,407	11	$544,204	5	$272,102	5	$272,102
2044	15	$780,885	8	$390,443	4	$195,221	4	$195,221
2045	11	$564,347	6	$282,174	3	$141,087	3	$141,087
2046-2073	< 10/year	< $500,000/year	< 5/year	< $250,000/year	< 3/year	< $125,000/year	< 3/year	< $125,000/year

Tax revenues for Alternative E associated with production, including FMR, severance, and ad valorem, are shown in Table 4.3-23.

Table 4.3-23
Tax Revenues Associated with Production under Alternative E

Year	Total FMR ($640 per MMSCF)	FMR-Wyoming ($312 per MMSCF)	Severance Tax ($305 per MMSCF)	Ad Valorem Production ($320 per MMSCF)
2007	$228,410,714	$114,205,357	$111,533,244	$117,133,699
2008	$387,925,274	$193,962,637	$189,424,409	$198,936,038
2009	$497,654,190	$248,827,095	$243,005,179	$255,207,277
2010	$553,752,687	$276,876,343	$270,398,147	$283,975,737
2011	$595,099,192	$297,549,596	$290,587,698	$305,179,073
2012	$588,816,606	$294,408,303	$287,519,903	$301,957,234
2013	$590,623,368	$295,311,684	$288,402,148	$302,883,778
2014	$589,008,194	$294,504,097	$287,613,456	$302,055,484
2015	$588,006,575	$294,003,288	$287,124,365	$301,541,833
2016	$586,414,459	$293,207,230	$286,346,932	$300,725,364
2017	$584,404,639	$292,202,319	$285,365,534	$299,694,687
2018	$583,086,297	$291,543,149	$284,721,787	$299,018,614
2019	$581,239,534	$290,619,767	$283,820,010	$298,071,556
2020	$573,091,913	$286,545,956	$279,841,516	$293,893,289
2021	$564,601,356	$282,300,678	$275,695,566	$289,539,157
2022	$558,835,217	$279,417,608	$272,879,953	$286,582,163
2023	$554,917,599	$277,458,800	$270,966,975	$284,573,128
2024	$552,254,528	$276,127,264	$269,666,594	$283,207,450
2025	$512,869,087	$256,434,544	$250,434,633	$263,009,788
2026	$479,124,717	$239,562,358	$233,957,213	$245,704,983
2027	$456,125,931	$228,062,966	$222,726,877	$233,910,734
2028	$440,433,573	$220,216,786	$215,064,278	$225,863,371
2029	$402,026,349	$201,013,175	$196,309,982	$206,167,359
2030	$374,845,919	$187,422,959	$183,037,743	$192,228,676
2031	$325,637,117	$162,818,558	$159,009,022	$166,993,393
2032	$292,074,805	$146,037,402	$142,620,502	$149,781,951
2033	$215,761,057	$107,880,529	$105,356,401	$110,646,696
2034	$147,902,137	$73,951,068	$72,220,803	$75,847,250
2035	$101,600,172	$50,800,086	$49,611,494	$52,102,652
2036	$69,965,713	$34,982,856	$34,164,347	$35,879,853
2037	$48,319,026	$24,159,513	$23,594,242	$24,778,988
2038	$33,479,856	$16,739,928	$16,348,257	$17,169,157
2039	$23,285,748	$11,642,874	$11,370,461	$11,941,409
2040	$16,265,332	$8,132,666	$7,942,383	$8,341,196
2041	$11,416,668	$5,708,334	$5,574,773	$5,854,701
2042	$8,056,833	$4,028,416	$3,934,162	$4,131,709
2043	$5,719,831	$2,859,915	$2,793,001	$2,933,246
2044	$4,087,263	$2,043,632	$1,995,816	$2,096,032
2045	$2,941,245	$1,470,622	$1,436,214	$1,508,331
2046	$2,132,400	$1,066,200	$1,041,254	$1,093,538
2047	$1,558,101	$779,050	$760,823	$799,026
2048	$1,146,501	$573,250	$559,838	$587,949
2049	$850,142	$425,071	$415,125	$435,970
2050	$635,163	$317,582	$310,151	$325,725
2051	$478,092	$239,046	$233,453	$245,175
2052	$362,323	$181,162	$176,923	$185,807
2053	$276,484	$138,242	$135,008	$141,787
2054	$212,166	$106,083	$103,601	$108,803
2055	$163,623	$81,811	$79,897	$83,909
2056	$126,693	$63,346	$61,864	$64,971

Year	Total FMR ($640 per MMSCF)	FMR-Wyoming ($312 per MMSCF)	Severance Tax ($305 per MMSCF)	Ad Valorem Production ($320 per MMSCF)
2057	$98,395	$49,198	$48,047	$50,459
2058	$76,565	$38,283	$37,387	$39,264
2059	$59,613	$29,806	$29,109	$30,571
2060	$46,378	$23,189	$22,646	$23,783
2061	$36,021	$18,011	$17,589	$18,472
2062	$27,868	$13,934	$13,608	$14,291
2063	$21,411	$10,706	$10,455	$10,980
2064	$16,279	$8,139	$7,949	$8,348
2065	$12,187	$6,093	$5,951	$6,250
2066	$9,106	$4,553	$4,446	$4,670
2067	$6,674	$3,337	$3,259	$3,422
2068	$4,722	$2,361	$2,306	$2,421
2069	$3,152	$1,576	$1,539	$1,617
2070	$2,030	$1,015	$991	$1,041
2071	$1,130	$565	$552	$579
2072	$560	$280	$273	$287
2073	$100	$50	$49	$51

The estimated jobs shown in Tables 4.3-21 and 4.3-22 are measured in AJE, and include direct, indirect, and induced employment. Workforce estimates are based on the number of wells, and are more reflective of the number of workers directly associated with development and production. Under Alternative E, the number of development workers would peak in 2009 (Table 4.3-24). Development is expected to continue through 2033, and a sizeable development workforce would remain in the area through 2032. The production workforce would peak at 601 workers in 2033 and remain steady through 2073.

Table 4.3-24
Development and Production Workforce Associated with Alternative E

Year	Drilled Wells	Development Workers	Producing Wells	Production Workers
2007	231	1,038	842	101
2008	235	1,056	1,077	129
2009	236	1,060	1,313	158
2010	217	975	1,530	184
2011	220	988	1,750	210
2012	185	831	1,935	232
2013	191	858	2,126	255
2014	188	845	2,314	278
2015	188	845	2,502	300
2016	187	840	2,689	323
2017	186	836	2,875	345
2018	186	836	3,061	367
2019	185	831	3,246	390
2020	178	800	3,424	411
2021	175	786	3,599	432
2022	175	786	3,774	453
2023	175	786	3,949	474
2024	175	786	4,124	495
2025	137	616	4,261	511
2026	130	584	4,391	527
2027	130	584	4,521	543
2028	130	584	4,651	558
2029	102	458	4,753	570
2030	101	454	4,854	582

Year	Drilled Wells	Development Workers	Producing Wells	Production Workers
2031	70	315	4,924	591
2032	70	315	4,994	599
2033	16	72	5,010	601
2034-2073	0	0	5,010	601

The low-, medium-, and high-impact population estimates under Alternative E are shown in Tables 4.3-25 through 4.3-27. Sublette County is expected to have the largest population increases between 2007 and 2020 under all scenarios, with estimated population growth ranging from a low of 68 percent to a high of 74 percent. Sweetwater County's population is estimated to increase by approximately 12 percent under all three scenarios, and Lincoln County's population is expected to increase by approximately 25 percent.

Table 4.3-25
Population Projections for Southwest Wyoming
Associated with Alternative E – Low Impact Scenario

Year	Sublette County	Pinedale	Big Piney	Marbleton	Sweetwater County	Rock Springs	Green River	Lincoln County
2007	7,690	1,813	517	917	39,540	19,595	12,336	16,800
2008	8,070	1,903	542	962	40,260	19,952	12,561	17,210
2009	8,470	1,997	569	1,010	40,960	20,299	12,779	17,600
2010	8,870	2,092	596	1,057	41,620	20,626	12,985	17,990
2011	9,180	2,165	617	1,094	41,900	20,765	13,072	18,300
2012	9,796	2,310	658	1,168	42,442	21,034	13,242	18,590
2013	10,152	2,394	682	1,210	42,652	20,138	13,307	18,870
2014	10,504	2,477	706	1,252	42,887	21,254	13,380	19,180
2015	10,881	2,566	731	1,297	43,117	21,368	13,452	19,480
2016	11,276	2,659	758	1,344	43,396	21,506	13,539	19,810
2017	11,671	2,752	784	1,391	43,634	21,624	13,613	20,130
2018	12,067	2,846	811	1,438	43,824	21,718	13,673	20,420
2019	12,482	2,943	839	1,488	44,052	21,832	13,744	20,750
2020	12,906	3,043	867	1,539	44,281	21,945	13,815	21,070

Table 4.3-26
Population Projections for Southwest Wyoming
Associated with Alternative E – Medium Impact Scenario

Year	Sublette County	Pinedale	Big Piney	Marbleton	Sweetwater County	Rock Springs	Green River	Lincoln County
2007	7,690	1,813	517	917	39,540	19,595	12,336	16,800
2008	8,070	1,903	542	962	40,260	19,952	12,561	17,210
2009	8,470	1,997	569	1,010	40,960	20,299	12,779	17,600
2010	8,870	2,092	596	1,057	41,620	20,626	12,985	17,990
2011	9,180	2,165	617	1,094	41,900	20,765	13,072	18,300
2012	10,012	2,361	673	1,194	42,503	21,064	13,261	18,590
2013	10,375	2,447	697	1,237	42,715	21,169	13,327	18,870
2014	10,724	2,529	721	1,278	42,949	21,285	13,400	19,180
2015	11,101	2,618	746	1,323	43,179	21,399	13,471	19,480
2016	11,494	2,711	773	1,370	43,457	21,536	13,558	19,810
2017	11,888	2,803	799	1,417	43,695	21,654	13,632	20,130
2018	12,284	2,897	826	1,464	43,885	21,749	13,692	20,420
2019	12,698	2,994	853	1,514	44,113	21,862	13,763	20,750
2020	13,114	3,092	881	1,563	44,339	21,974	13,833	21,070

Table 4.3-27
Population Projections for Southwest Wyoming
Associated with Alternative E – High Impact Scenario

Year	Sublette County	Pinedale	Big Piney	Marbleton	Sweetwater County	Rock Springs	Green River	Lincoln County
2007	7,690	1,813	517	917	39,540	19,595	12,336	16,800
2008	8,070	1,903	542	962	40,260	19,952	12,561	17,210
2009	8,470	1,997	569	1,010	40,960	20,299	12,779	17,600
2010	8,870	2,092	596	1,057	41,620	20,626	12,985	17,990
2011	9,180	2,165	617	1,094	41,900	20,765	13,072	18,300
2012	10,282	2,425	691	1,226	42,503	21,064	13,261	18,590
2013	10,654	2,512	716	1,270	42,715	21,169	13,327	18,870
2014	10,998	2,594	739	1,311	42,949	21,285	13,400	19,180
2015	11,375	2,682	765	1,356	43,179	21,399	13,471	19,480
2016	11,767	2,775	791	1,403	43,457	21,536	13,558	19,810
2017	12,160	2,867	817	1,450	43,695	21,654	13,632	20,130
2018	12,556	2,961	844	1,497	43,885	21,749	13,692	20,420
2019	12,968	3,058	872	1,546	44,113	21,862	13,763	20,750
2020	13,374	3,154	899	1,594	44,339	21,974	13,833	21,070

Under Alternative E, the total workforce would peak at 1,281 workers in 2024. Development in the PAPA would continue through 2033, after which time development workers would either leave the area or pursue an alternative source of local employment. Production is anticipated to continue through 2073, with approximately 600 production workers in the local area between 2030 and 2073. To a large extent, the number of PAPA development workers who relocate to Sublette County, and the accompanying population growth, would depend on how the county's housing market responds to the demand for housing by workers in the PAPA field and in supporting industries. Population growth would be accompanied by an increase in the demand for local infrastructure and services, including schools, law enforcement, fire protection, and medical services. Because a significant number of development workers remain in the PAPA through 2033, and a relatively high production workforce remains in place through 2073, the local economy is even more likely to expand to accommodate the higher level of demand as compared to Alternative A or Alternatives B, C, and D. Such an increase in the overall supply of locally-available goods and services would moderate future cost-of-living increases.

4.3.3 Cumulative Impacts

Lincoln, Sublette, and Sweetwater counties comprise the Cumulative Impact Assessment Area for socioeconomics. This three-county region depends upon the oil and gas industry for a large portion of its economic activity and tax base (Tables 3.5-2 and 3.5-8 in Chapter 3). Development of the PAPA, along with other oil and gas development, is associated with increased high-wage employment opportunities, an expanded tax base, and support for local governments to maintain and increase community services and infrastructure. Wells developed in the PAPA contribute directly to the economic benefits in Southwest Wyoming.

Sizeable increases in oil and gas development activity within a short period can cause notable changes in local labor and housing markets, price levels, and economic cycles (e.g. boom/bust cycles). They may also contribute to problems of overbuilding, in that impacted towns may be required to provide a level of infrastructure and services that becomes largely redundant when the pace of development slows. Development activities that ramp up at a slower and steady rate allow planning officials, developers, and providers of local services to accommodate the increased demand without increasing inflationary pressures.

4.3.4 Socioeconomic Additional Mitigation Opportunities

The PAPA DEIS (BLM, 1999a) identified several mitigation measures that could offset the impacts to Socioeconomic Resources. However, BLM and the cooperating agencies lack jurisdiction to impose many of the identified measures and none were carried forward into the PAPA ROD (BLM, 2000b). Any mitigation to offset impacts to Socioeconomic Resources due to expanded natural gas development in the PAPA would be strictly voluntary by the Operators.

Socioeconomic Mitigation Measure 1. To assist local businesses that may be impacted by labor shortages and rising wage rates, the Operators could require that all contractors and subcontractors obtain a sales and use tax license specifically for Sublette County and require that all purchases of materials be made on a Wyoming license and taxes remitted under the Sublette County license. This is generally known as the Direct Payment of Taxes Technique.

Socioeconomic Mitigation Measure 2. To help local communities address the demands placed on them by PAPA wellfield workers, many of whom are transitory, the Operators could provide a worker camp on or near the PAPA field to accommodate temporary wellfield workers. A worker camp could include facilities and services such as housing, dining, and recreational structures, as well as on-site security and safety personnel.

To the extent that PAPA workers would choose to live at the worker camp rather than in nearby communities, a worker camp could alleviate pressures on rental housing markets in the cumulative impact area, especially Sublette County. This would tend to moderate rents for rental housing, including short-term housing at motels and RV parks.

The on-site demands created by a worker camp could shift the location of some employment opportunities away from local communities and toward the wellfield. This could result in an increased demand for contractors and local businesses to provide on-site services and supplies. It could also lead to slightly lower spending levels at some local business establishments.

A worker camp would not impact population growth associated with any of the development alternatives as population changes occur when wellfield workers establish residency in the local area and become part of the permanent, rather than temporary, workforce. Because a worker camp is expected to appeal primarily to transitory workers who do not relocate to the local area, a worker camp is expected to have little impact on residential sales markets in the cumulative impact area.

A worker camp could be expected to have a modest impact on local infrastructure and services. A worker camp would not impact local school enrollments or revenues, as this type of housing arrangement is not likely to appeal to permanent workers who relocate their families to Sublette County. To the extent that Operators provide on-site security and safety personnel, there may be a decrease in the demands placed upon local law enforcement agencies and medical and emergency service providers.

Socioeconomic Mitigation Measure 3. To assist local government agencies in planning, Operators could annually provide 3-year field development forecasts to the BLM. The BLM would, in turn, make these forecasts available to local government agencies to assist in local community/county/state planning efforts.

Socioeconomic Mitigation Measure 4. The Operators could assist local governments with funding for planning and public service projects such as:

- Town of Pinedale road maintenance;
- Safety improvements on roads in the Town of Pinedale, Bargerville, Boulder, Warren Bridge, Ehman Lane, and other residential areas;

- Upgrades and expansions to aging infrastructure such as water and sewer lines, water filtration system, and sewage treatment facilities;
- Law enforcement and emergency and medical services;
- Cooperation with local organizations such as the Sublette Community Partnership; and
- A Sublette County Housing Needs Assessment to evaluate the housing supply that would be required to accommodate expected population growth.

4.4 TRANSPORTATION

4.4.1 Scoping Issues

Increased traffic volume and associated safety risks were concerns received during scoping including:

1. Evaluate further efforts to reduce traffic by busing, stockpiling, or convoys.
2. Concern over increased safety risks on local and county roads with winter drilling and increased winter traffic.

4.4.2 Impacts Considered in the PAPA DEIS

In 1999, the PAPA DEIS (BLM, 1999a) stated that potential impacts from all of the Alternatives, except the *No Action Exploration/Development Scenario*, could include the following:

- increased traffic volume on area highways and roads,
- accelerated deterioration of road surfaces,
- increased road maintenance requirements because of increased traffic,
- increased off-road vehicle use, use of two-tracks, and access to sensitive areas,
- increased likelihood of traffic accidents, vehicle-person, and vehicle-animal collisions,
- increased access to sensitive areas during winter months while big game is abundant and potentially stressed; and
- increased speeding.

The PAPA DEIS (BLM, 1999a) specified that impacts under the Alternatives would be significant if the following occurred:

- increased traffic levels on U.S. Highway 191 or State Highway 351 cause a decrease in Level of Service as defined by the Wyoming Department of Transportation,
- project-related traffic conflicts with existing residential use, or
- project-related traffic would accelerate the deterioration and related maintenance costs of area roads beyond those scheduled by the responsible agency.

The PAPA DEIS (BLM, 1999a) recognized potential conflict between extensive development in the north end of the PAPA near Pinedale and project-related traffic and dust adjacent to the Pinedale South and Mesa roads. The project-related traffic could cause significant impacts to residents and recreation use. Subdivisions and subdivided lands are located adjacent to these roads. Residential streets through the Town of Pinedale provide easy access to the Pinedale South Road. Local residents use areas along roads near and west of the New Fork River for recreation (i.e., walking, jogging, bicycling, etc).

Many of the roads in the PAPA were not designed for the loads they currently support. Increased development traffic would result in further and accelerated deterioration of these roads. Accelerated deterioration of county road surfaces is expected to cause significant impacts.

Based on the significance criteria in the PAPA DEIS (BLM, 1999a), there have been significant impacts to Transportation Resources by existing development in and near the PAPA. Increased traffic levels on U.S. Highway 191 caused a decrease in the Level of Service (Section 3.6.1.1 in Chapter 3). Project-related traffic has conflicted with existing residential use and has accelerated the deterioration of area roads and increased related maintenance costs.

4.4.3 Alternative Impacts

4.4.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development in the PAPA

Each of the Alternatives would require additional construction of local and resource roads to access new well pads and other wellfield components. Arterial and collector roads are assumed to remain constant during future development in the PAPA.

Direct impact to Transportation Resources includes increased traffic in the PAPA under all Alternatives. Increased traffic would result in wear on roads and increased maintenance costs. Each of the Alternatives would require additional traffic throughout the year during development (construction of new well pads, roads, and pipelines, drilling, and completions). During development, traffic would generally be higher in summer than in winter because well pads, roads, pipelines, and ancillary facilities would be constructed during the summer months to avoid frozen ground conditions. For Alternatives that do not include year-round development (Alternatives A and E except for BLM's 2004 Decision Record – BLM, 2004a), traffic would be less in the winter in seasonally restricted areas.

Projected daily traffic volumes during wellfield development in 2009 were provided by the Proponents and are shown in Tables 4.4-1 and 4.4-2 for summer and winter, respectively. Assumptions for estimating traffic are based on projected number of well pads, wells drilled, producing wells, and production of specific quantities of condensate and water. Ongoing production traffic is included in the estimates of traffic during the development phase in 2009. Project traffic volumes for Alternatives A and E do not include a liquids gathering system in the central and southern portions of the PAPA while the additional liquids gathering system and computer-assisted operations is included in traffic estimates for Alternatives B, C, and D. BLM's Practices and Restrictions for the Pinedale Anticline Project Area as they relate to transportation resources would apply to all Alternatives (Appendix 4).

Table 4.4-3 provides estimates of production-related traffic once development is complete for all Alternatives. The liquids gathering system in the central and southern portions of the PAPA and computer-assisted operations is not included in Alternatives A and E but is included in Alternatives B, C, and D. The liquids gathering system would eliminate about 90 percent of truck traffic associated with removal of condensate and produced water. Although the total production is the same under all action Alternatives (B through E), the amount of production at any one time varies because of the time in which wells are drilled. Therefore, the information in Table 4.4-3 does not provide a direct comparison for production-related traffic with and without a liquids gathering system and computer-assisted operations. This comparison is provided below in the discussion for Alternative B.

Table 4.4-1
Projected Traffic Volume in the PAPA (vehicles per day)
During Development for all Alternatives in Summer 2009[1]

	No Action Alternative and Alternative E			Alternatives B, C, and D		
	Light Vehicles	**Heavy Vehicles**	**Total Vehicles**	**Light Vehicles**	**Heavy Vehicles**	**Total Vehicles**
Well Pad Construction [2]	65	97	162	49	73	122
Road Construction [3]	17	26	43	12	18	30
Gathering Pipeline Construction [4]	59	89	148	40	61	101
Rig Moves [5, 6]	7	20	27	2	6	8
Drilling [7, 8]	410	273	683	251	251	502
Completion [9, 10]	342	228	570	100	150	250
Total Development-Related Traffic	**900**	**733**	**1,633**	**454**	**559**	**1,013**
Production Activities [11, 12]	1,017	0	1,017	168	0	168
Liquids Removal [13, 14]	0	328	328	0	41	41
Total Production-Related Traffic	**1,017**	**328**	**1,345**	**168**	**41**	**209**
Grand Total	**1,917**	**1,061**	**2,978**	**622**	**600**	**1,222**

[1] Assumes 183 days of summer construction.
[2] Assumes 400 total vehicle trips per pad, 160 light vehicles trips and 240 heavy vehicle trips. In 2009, assumes 54 new pads and 20 expanded pads (74 pads total) by Alternatives A and E and 37 new pads and 19 expanded pads (56 pads total) by Alternatives B, C, and D.
[3] Assumes 58 light vehicle trips and 88 heavy vehicle trips per new pad constructed and assumes 54 new pads by Alternatives A and E and 37 new pads by Alternatives B, C, and D.
[4] Assumes 200 light vehicle trips and 300 heavy vehicle trips per new pad constructed.
[5] For Alternatives A and E, assumes 8.8 light vehicle trips and 26.3 heavy vehicle trips per well drilled and 139 wells drilled over 183 days.
[6] For Alternatives B, C, and D, assumes 2.2 light vehicle trips and 6.6 heavy vehicle trips per well drilled and 305 wells drilled over 365 days.
[7] For Alternatives A and E, assumes 540 light vehicle trips and 360 heavy vehicle trips per well drilled and in summer 2009, assumes 139 wells drilled over 183 days.
[8] For Alternatives B, C, and D, assumes 300 light vehicle trips and 300 heavy vehicle trips per well drilled and 305 wells drilled over 365 days.
[9] For Alternatives A and E, assumes 450 light vehicle trips and 300 heavy vehicle trips per well completed, and 139 wells completed over 183 days.
[10] For Alternatives B, C, and D, assumes 120 light vehicle trips and 180 heavy vehicle trips per well completed and 305 wells completed over 365 days.
[11] For Alternatives A and E, assumes 1,197 producing wells at mid-year 2009. Assumes 0.85 light vehicle trips per well.
[12] For Alternatives B, C, and D, assumes 1,333 producing wells at mid-year 2009. Assumes 0.125 light vehicle trip per well.
[13] For Alternatives A and E, assumes 11,910,000 bbl water removed in 2009 and 5,565,000 bbl condensate removed (Shell and Ultra only plus 5 percent added for other Operators). Assumes one heavy vehicle trip per 140 bbl of water removed and one heavy vehicle trip per 140 bbl of oil removed.
[14] For Alternatives B, C, and D, assumes 10 percent of water and oil is trucked. Assumes one heavy vehicle trip per 140 bbl of water removed and one heavy vehicle trip per 140 bbl of condensate removed.

Table 4.4-2
Projected Traffic Volume in the PAPA (vehicles per day)
during Development for all Alternatives in Winter 2009[1]

Wellfield Development	Alternatives A and E			Alternatives B, C, and D		
	Light Vehicles	**Heavy Vehicles**	**Total Vehicles**	**Light Vehicles**	**Heavy Vehicles**	**Total Vehicles**
Well Pad Construction	N/A	N/A	N/A	N/A	N/A	N/A
Road Construction	N/A	N/A	N/A	N/A	N/A	N/A
Gathering Pipeline Construction	N/A	N/A	N/A	N/A	N/A	N/A
Rig Moves [2, 3]	5	14	19	2	6	6
Drilling [4, 5]	286	191	477	251	251	502
Completion [6, 7]	239	159	398	100	150	250
Total Development-Related Traffic	**530**	**364**	**894**	**353**	**407**	**760**
Production Activities [8, 9]	1,017	0	1,017	168	0	168
Liquids Removal [10, 11]	0	328	328	0	41	41
Wellfield Development	**Alternatives A and E**			**Alternatives B, C, and D**		
	Light Vehicles	**Heavy Vehicles**	**Total Vehicles**	**Light Vehicles**	**Heavy Vehicles**	**Total Vehicles**
Total Production-Related Traffic	**1,017**	**328**	**1,345**	**168**	**41**	**209**
Grand Total	**1,547**	**692**	**2,239**	**521**	**448**	**969**

[1] Assumes 183 days of winter.
[2] For Alternatives A and E, assumes 8.8 light vehicle trips and 26.3 heavy vehicle trips per well drilled, and assumes 97 wells drilled during winter 2009.
[3] For Alternatives B, C, and D, assumes 2.2 light vehicles and 6.6 heavy vehicles per well drilled, and 305 wells drilled over 365 days.
[4] For Alternatives A and E, assumes 540 light vehicle trips and 360 heavy vehicle trips per well drilled in winter 2009, 97 wells over 183 days.
[5] For Alternatives B, C, and D, assumes 300 light vehicle trips and 300 heavy vehicle trips per well drilled and 305 wells drilled over 365 days
[6] For Alternatives A and E, assumes 450 light vehicle trips and 300 light vehicle trips per well completed and 97 wells completed over 183 days.
[7] For Alternatives B, C, and D, assumes 120 light vehicle trips and 180 heavy vehicle trips per well completed and 305 wells completed over 365 days.
[8] For Alternatives A and E, assumes 1,197 producing wells for direct comparison with summer and 0.85 light vehicle trips per day per well.
[9] For Alternatives B, C, and D, assumes 1,333 producing wells for direct comparison with summer and 0.125 light vehicle trips per day per well.
[10] For Alternatives A and E, assumes 11,910,000 bbl water removed in 2009 and 5,565,000 bbl condensate removed (Shell and Ultra only plus 5 percent added for other Operators). Assumes one heavy vehicle trip per 140 bbl of water removed and one heavy vehicle trip per 140 bbl of condensate removed.
[11] For Alternatives B, C, and D, assumes 10 percent of water and oil is trucked. Assumes one heavy vehicle trip per 140 bbl of water removed and one heavy vehicle trip per 140 bbl of condensate removed.

Table 4.4-3
Projected Traffic Volume in the PAPA
(vehicles per day) During Production for all Alternatives[1]

Alternative A (2012)[2]		Alternatives B, C, and D (2026)[3]		Alternative E (2034)[2]	
Light[4] Vehicles	Heavy[5,6] Vehicles	Light[7] Vehicles	Heavy[5,8,9] Vehicles	Light[4] Vehicles	Heavy[5,9,10] Vehicles
1,489	391	627	21	4,260	92

1 Production-related traffic estimates are for the first year after development is complete under each Alternative.
2 Assumes 1,139 additional producing wells and 613 existing producing wells for a total of 1,752 producing wells.
3 Assumes 4,399 additional producing wells and 613 existing producing wells for a total of 5,012 producing wells.
4 Assumes 0.85 light vehicles per day per well.
5 Assumes one heavy vehicle per 140 bbl water removed and one heavy vehicle per 140 bbl condensate removed.
6 Assumes 13,559,000 bbl water per year and 6,405,000 bbl condensate per year.
7 Assumes 0.125 light vehicles per day per well, and 5,012 wells.
8 Assumes 10 percent of water and condensate is trucked.
9 Assumes 6,886,000 bbl water per year and 3,764,000 bbl condensate per year.
10 Assumes 1,629,000 bbl water per year and 3,060,000 bbl condensate per year.

Under all Alternatives, the development-related traffic is far greater than the production-related traffic. This is most evident during the beginning of development but becomes less evident as development tapers off and production continues to increase with the increase in producing wells. The reduction in overall traffic from installation and use of the liquids gathering system in the central and southern portions of the PAPA and use of computed assisted operations is more evident as development decreases and production increases.

Increased rates of vehicular crashes on roads adjacent to the PAPA (direct impact by wellfield development) have increased with increased traffic volumes (Chapter 3 – Transportation). Assuming that increased traffic volume contributes to the possibility of vehicular crashes, higher crash rates are expected with implementation of any of the Alternatives.

Highway maintenances costs borne by WDOT have increased and in September 2006, the U.S. Department of Transportation cut more than $27 million in highway funds for Wyoming that had already been appropriated (Neary, 2006). Reduced federal funding would limit highway maintenance opportunities on roads used to access the PAPA. Increased traffic in the PAPA would accelerate deterioration of area roads beyond the maintenance capabilities of the responsible agency.

Impacts associated with increased traffic volume, crash rates, road surface deterioration, and maintenance costs on arterial roads would continue under all Alternatives. With the expected increase in traffic due to wellfield development, particularly during summer, rate of impact due to traffic volume would likely accelerate initially through the development phase rather than increase at a constant rate. Once all wells are in production, under any Alternative, wellfield traffic would decline. Production-related traffic would be constant, probably for several decades and would slowly decline toward the end of the production phase under all Alternatives. Impact to arterial roads would likely decline in the same period.

The significant impacts to transportation that have been realized are expected to continue to occur under all of the Alternatives during wellfield development.

Pipeline Corridors and Gas Sales Pipelines

Construction of the proposed pipelines (estimated 3 to 5 months duration) would result in increases in traffic, both light and heavy vehicles, on federal and state highways and county and BLM/U.S. Bureau of Reclamation roads. There is a potential for a corresponding short-term increase in crashes along the highways and roads providing access to pipeline construction locations. However, observance of highway safety rules, regulations, and practices would reduce this potential. Pipeline construction would comply with permit requirements from state, county, and BLM/U.S. Bureau of Reclamation to ensure that roads are repaired after construction and that there is adequate traffic control to protect the traveling public. Detour roads would be constructed and temporarily maintained at existing road crossings to prevent disruption of use. Traffic associated with pipeline operations would be minimal.

4.4.3.2 Alternative A (No Action Alternative)

Implementation of Alternative A would result in 1,139 additional producing wells, 249 new well pads, nearly 100 miles of new roads, and ancillary facilities within 5 years (Table 2.4-8 in Chapter 2). Average traffic volume (light and heavy vehicles) for the peak year of 2009 has been estimated at 2,978 vehicles per day during summer and 2,239 vehicles per day during winter (estimates for traffic in 2009, Table 4.4-1 and 4.4-2). The Transportation Plan in the PAPA ROD (BLM, 2000b) would be followed under this Alternative (Appendix 5A).

Under the terms of BLM's 2004 Decision Record (BLM, 2004a), there is a limitation of two additional well pads allowed within Questar's leasehold in the northern portion of the PAPA which is included in the No Action Alternative. Consequently, most new wellfield roads under the No Action Alternative would be constructed south of the Questar leases (Map 1.1-2 in Chapter 1), in the central and southern portions of the PAPA. Year-round development would be allowed within Questar's leases in the northern portion of the PAPA. A liquids gathering system was installed in Questar's leasehold and would be continued under the No Action Alternative as required by BLM's 2004 Decision Record (BLM, 2004a).

No development-related traffic would occur on big game crucial winter ranges in the central and southern portions of the PAPA during the seasonally restricted periods; however, production-related traffic would continue through each winter. Development could continue in winter on leases outside of seasonally restricted areas.

4.4.3.3 Alternative B

Under Alternative B, the Proponents would drill 4,399 additional wells, construct 250 new well pads, expand 283 well pads, construct 100 miles of new local and resource roads, and construct ancillary facilities (Table 2.4-11 in Chapter 2). Average traffic volume (light and heavy vehicles) for the peak year of 2009 has been estimated at 1,222 vehicles per day during summer and 969 vehicles per day during winter (Tables 4.4-1 and 4.4-2). Ultra, Shell, and Questar have prepared a Transportation Plan that would apply to this Alternative (Appendix 5B).

Year-round development on new well pads and expanded pads would occur in specific CDAs (Map 2.4-3 in Chapter 2) in the Alternative B Core Area. Outside of seasonally restricted areas, development would continue and therefore traffic, although restricted in some areas during winter, could be anywhere during summer and outside of the seasonally restricted areas.

A liquids gathering system would be installed in the central and southern portions of the PAPA within 2 years of the issuance of a ROD. Use of the liquids gathering system and increased use of computer-assisted operations would reduce daily traffic during wellfield development (Tables 4.4-1 and 4.4-2). The amount of traffic reduced by use of the liquids gathering system would not equal the increased traffic generated by development. Consequently, impacts associated with traffic volume, crash rates, road surface deterioration, and maintenance costs would continue to increase under Alternative B throughout the development phase (through 2025).

Once development is complete and all wells are in production (after 2025), the only wellfield traffic in the PAPA would be production-related. The use of the liquids gathering system and increased use of computer-assisted operations both in Questar's leases and in the central and southern portions of the PAPA would reduce traffic by 3,820 vehicles per day in the PAPA (Table 4.4-4).

Table 4.4-4
Projected Daily Traffic Volume in the PAPA
under Alternative B in 2026 with and without a Liquids Gathering System[1]

Without Liquids Gathering System and Computer Assisted Operations		**With Liquids Gathering System and Computer Assisted Operations**	
Light Vehicles[2]	Heavy Vehicles[3,4]	Light Vehicles[5]	Heavy Vehicles[6]
4,260	208	627	21

[1] Assumes 4,399 additional producing wells and 613 existing producing wells for a total of 5,012 producing wells.
[2] Assumes 0.85 light vehicles per day per well.
[3] Assumes 6,886,000 bbl water per year and 3,764,000 bbl condensate per year.
[4] Assumes one heavy vehicle per 140 bbl water removed and one heavy vehicle per 140 bbl condensate removed.
[5] Assumes 0.125 light vehicles per day per well.
[6] Assumes 10 percent of water and condensate is trucked.

4.4.3.4 Alternative C

Under Alternative C, the construction-related impacts (wells, roads, well pads, etc.) and associated traffic would be the same as described for Alternative B (Tables 4.4-1 and 4.4-2). A Transportation Plan for Alternative C is provided in Appendix 5C.

Year-round development with certain restrictions would occur in DAs 1 through 4 under Alternative C. Development-related traffic would not be allowed in DA-5 or outside of the Alternative C Core area on federal lands during the seasonally restricted periods but would be allowed anywhere within DA-5 and all of the PAPA outside of the seasonally restricted periods. Year-round development would be concentrated in the southern two miles of DA-1, within DA-2, and throughout DA-4 (Map 2.4-5 in Chapter 2). Access to these DAs during winter would be from the south, along Paradise Road and the North Anticline Road.

No new roads are likely to be constructed in DA-3 during the first few years under Alternative C or until development is complete in DA-2. Access during winter could be limited to either the Boulder South Road or South Anticline Road. Access to year-round development in DA-4 would probably be from Highway 351 and the Jonah North Road.

As year-round development in the southern portion of DA-1 is completed, year-round development would move to the north within Questar's leases. Access to wellfield development during winter on the north end of DA-1 would be from the north, rather than from the south, along the North Anticline Road. BLM is currently working with Sublette County, WGFD, and local landowners to identify an access route from the north and develop a Transportation Plan.

Once year-round development is complete in DA-2, year-round development would commence in DA-3. With no additional year-round development allowed in DA-2, all traffic to DA-2 would be production-related. Access to DA-3 would be from the Boulder South Road. Once year-round development moves into DA-3, traffic would increase. The traffic may be limited to entering the area from Highway 351 and the South Anticline Road rather than from the Boulder South Road. Year-round development would be allowed in DA-4. Under Alternative C, seasonal restrictions for greater sage-grouse apply in DA-5. Traffic in DA-5 in seasonally restricted periods would be related to production and maintenance.

Alternative C includes use of the liquids gathering system and computer-assisted operations as described for Alternative B with similar reductions in traffic, especially when development is complete and all wells are in production (Table 4.4-4).

4.4.3.5 Alternative D

Under Alternative D, the construction-related impacts (wells, roads, well pads, etc.) and associated traffic would be the same as described above for Alternatives B and C (Tables 4.4-1 and 4.4-2). During the first 5 years after issuance of a ROD, no new roads would be constructed in the federal suspended or term NSO leases in the Flanks; however, new roads could be constructed in other areas in the Flanks but seasonal restrictions for big game (pronghorn and mule deer) and greater sage-grouse would apply. A Transportation Plan for Alternative D is provided in Appendix 5D.

Under Alternative D, year-round development in DA-1 would proceed from south to north, similar to the pattern proposed in Alternative C. Consequently, new road construction would initially be concentrated in the southern two miles of DA-1 then move north during the next 18 months. However, other activities in DA-1 include construction of delineation well pads and drilling in the Stewart Point area, in the north end of DA-1. Although delineation pads and access roads would be constructed without exception to seasonal restrictions for big game and greater sage-grouse, traffic on new roads in the north and south would increase during development (for 2 years) and during production (through 2065).

All wellfield development within DA-2 (pad and road construction, well drilling), including drilling delineation wells, would occur with exception to seasonal restrictions for big game (pronghorn and mule deer) and greater sage-grouse in the Alternative D Core Area. Consequently, traffic during development of DA-2 would probably resemble traffic levels in DA-2 under Alternative C. If year-round development in PDA-1 is approved by the BLM AO, traffic would be allowed in those areas during otherwise seasonally restricted periods. Year-round access to DA-1 and DA-2 would be from the south, along Paradise Road and the North Anticline Road, similar to access under other Alternatives.

Once year-round development is complete within a 2-mile band at the southern end of DA-2, north of the New Fork River, year-round development would begin in DA-3. Alternative D assumes development in DA-3 would increase as development in DA-2 decreases. Consequently, high traffic volumes associated with wellfield development would shift from DA-2 to DA-3. Traffic associated with development in DA-3 would occur concurrently with high development-related traffic volumes in DA-2. Access to DA-3 during winter could be limited to either the Boulder South Road or South Anticline Road.

Year-round development would occur in all areas of DA-4, concurrent with year-round development in the other three development areas discussed. Consequently, traffic volumes on arterial and collector roads would increase during all seasons. Access to year-round development in DA-4 would probably be from State Highway 351 and the Jonah North Road.

Alternative D would allow year-round development in DA-5 and therefore, there would be development-related traffic in DA-5 during the winter as well as production-related traffic. Under Alternative D, there would be no additional development-related traffic in the Flanks for at least the first 5 years on the federal suspended and term NSO leases.

Alternative D includes use of the liquids gathering system and computer-assisted operations as described for Alternative B with similar reductions in traffic, especially when development is complete and all wells are in production (Table 4.4-4).

4.4.3.6 Alternative E

Implementation of Alternative E would result in 4,399 additional producing wells, 415 new well pads, 166 miles of new local and resource, and ancillary facilities. Average traffic volume (light and heavy vehicles) for the peak year of 2009 has been estimated at 2,978 vehicles per day during summer and 2,239 vehicles per day during winter (estimates for traffic in 2009, Tables 4.4-1 and 4.4-2). Limits on numbers of new well pads and amount of surface disturbances at any one time in each Management Area defined in Alternative E would limit traffic over the course of each year. A Transportation Plan for Alternative E is provided in Appendix 5E.

Year-round development would not be allowed under Alternative E except under BLM's 2004 Decision Record (BLM, 2004a) which allows limited year-round development in Questar's leases; therefore, development-related traffic would not occur in seasonally restricted areas during the winter but would be higher during the summer. Production-related traffic would continue year-round. There would be additional traffic associated with rig moves under this Alternative because Operators would be required to move rigs out of seasonally restricted areas and would return to those areas after the seasonally-restricted period.

4.4.4 Cumulative Impacts

Cumulative impact from project-related traffic is considered in combination with other regional development in the Cumulative Impact Assessment Area (CIAA). The CIAA includes secondary roads and major highways within and adjacent to the PAPA. Any additional traffic would increase the disturbance of wildlife, potential for crashes, and the need for maintenance and dust control. Installation of liquids gathering systems in the central and southern portions of the PAPA, under Alternatives B, C, and D would reduce traffic by 3,820 vehicle trips per day once all wells are in production.

Costs of road maintenance would be partly supported by county taxes from the Operators, and partly from state revenues. Increasing maintenance costs, uncertain funding, and increased traffic by any of the Alternatives and other developments in the region are likely to put more responsibility for maintenance of access roads on Operators, and could lead to deterioration of main roads.

4.4.5 Transportation Additional Mitigation Opportunities

Transportation Mitigation Measure 1. All project-related traffic could avoid using South Tyler Avenue through the Town of Pinedale. This restriction could apply to light vehicles as well as heavy truck traffic.

Transportation Mitigation Measure 2. If Transportation Mitigation Measure 1 is not implemented, the bridges on South Tyler Avenue may not be able to withstand the level of traffic. The Operators, working with Sublette County and the Town of Pinedale, could monitor the situation. If circumstances warrant, the Operators could assist in upgrading the bridges.

Transportation Mitigation Measure 3. Speeding is a serious issue in the PAPA and on roads accessing the PAPA, especially on South Tyler Avenue. The Operators, working with Sublette County and the Town of Pinedale could monitor the traffic speeds. If the situation warrants, the Operators could assist in installing speed bumps.

Transportation Mitigation Measure 4. Operators could further minimize traffic through the increased use of busing and carpooling.

Transportation Mitigation Measure 5. Operators could further minimize traffic by the use of liquids gathering systems and computer-assisted operations at all producing well locations.

Transportation Mitigation Measure 6. Operators could maintain daily travel logs of visits to each well. Logs could be submitted to BLM annually for the purposes of determining if traffic is being reduced.

4.5 LAND USE AND RESIDENTIAL AREAS

4.5.1 Scoping Issues

The following concerns related to land uses in the PAPA were received during scoping:

1. Address impacts to ranchers and private property owners from wildlife displaced to their lands by development.
2. Concern that multiple use objectives on BLM land are being overlooked.
3. Concern that extensive wellfield development is occurring on non-federal lands to avoid restrictions on BLM land.

4.5.2 Impacts Considered in the PAPA DEIS

In the PAPA DEIS (BLM, 1999a), BLM recognized that with new development in the PAPA, land use would change because oil and gas development would become the dominant land use under full development and would preclude or interfere with other land uses. BLM further recognized that the PAPA was valued for its open space and as a place of solitude. Some of the area was inaccessible by vehicles, and in those areas and other areas it was difficult to find evidence of human activity. In 1999, the views from most of the PAPA, particularly the Mesa, were exceptional with the Wind River Range to the east and the Wyoming Range to the west. The views were compared to current views available from the adjacent Jonah II Field:

> *"While the views are equally as dramatic in the Jonah II Field, the sense of openness and solitude have been lost. In that portion of the Jonah II Field currently being developed, one is constantly aware that extensive development activities are ongoing. This is not a criticism of oil and gas development but rather a recognition of the difference in the feeling of open space and solitude between the two areas."*

Because it was impossible to predict where economically recoverable oil and gas reserves occur in the PAPA, it was not possible to predict where the changes in open space and solitude would occur. The PAPA DEIS (BLM, 1999a) concluded that wherever development would occur, those characteristics of the landscape would be lost.

The PAPA DEIS (BLM, 1999a) specified that significant impacts to land use would result from project-related activities if those activities:

- were incompatible with land use ordinances, plans, regulations, or controls,
- adversely affected other existing and legitimate land uses, or
- adversely affected the use, enjoyment or value of adjacent property or introduce safety and health risks or a nuisance or annoyance to an area where such risks, nuisance, or annoyance did not previously exist.

The PAPA DEIS (BLM, 1999a) predicted significant impacts to land use would occur from all of the Alternatives except the *No Action Exploration/Development Scenario*. Significant impacts to land use in the PAPA that were predicted in 1999 have occurred.

In addition to values of open space and solitude, the PAPA DEIS (BLM, 1999a) considered that extensive development on many of the private parcels of land in the PAPA would not be compatible with their zoned use as established by the Sublette County Zoning and Development

Regulations. Conflicts were expected to occur between wellfield development and residential uses. The *Resource Protection Alternative on Federal Lands and Minerals* specified that placement of well pads on federal lands and minerals within 0.25 mile of occupied dwellings would be avoided, according to BLM Mitigation Guidelines. On private and state lands and minerals, well pads could be placed as close as 350 feet from occupied dwellings. BLM expanded the 0.25-mile buffer to include areas zoned for residential use by Sublette County and subdivisions and subdivided lands, thus avoiding placement of well pads within the entire Residential Area SRMZ.

4.5.3 Alternative Impacts

4.5.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development in the PAPA

Impacts to land use and residential areas, similar to those predicted in the PAPA DEIS (BLM, 1999a), have occurred during wellfield development since issuance of the PAPA ROD (BLM, 2000b). While the PAPA was valued for its open space and as a place of solitude, the view in the Anticline Crest in 2006 more resembles the Jonah II Field in 1999. Land uses associated with open space, principally recreation, livestock grazing, and wildlife habitat have changed to a landscape of extensive ongoing development activities.

Initial surface disturbance by land use/land cover type under each of the Alternatives is shown in Table 4.5-1 and initial surface disturbance by Sublette County zoning district is shown in Table 4.5-2. Total initial surface disturbance by the end of the wellfield development phase would be greatest under Alternatives B, C, and D, less for Alternative E, and least under Alternative A. However, LOP surface disturbance would be greatest under Alternative E (Table 2.4-16 in Chapter 2). Differences in amount of surface disturbance by Alternative are inherent to the Alternative (see description of Alternatives in Chapter 2) and depend upon length of the development phase, allowance of year-round development, degree of concentrated development, the degree of interim reclamation, and inclusion of a liquids gathering system.

Table 4.5-1
Initial Surface Disturbance in Relation to Land Use/Land Cover Types by Alternative

	Alternative A (acres)		Alternatives B, C , and D (acres)		Alternative E (acres)	
Land Use/Land Cover Type	**Federal**	**Total**	**Federal**	**Total**	**Federal**	**Total**
Cropland and Pasture	87.1	109.6	252.0	292.1	256.8	280.3
Forested Wetlands	18.0	41.8	47.0	91.9	33.3	59.5
Herbaceous Rangeland	0.0	0.0	18.8	18.8	0.9	0.9
Industrial	2.5	3.1	7.9	10.6	5.0	6.7
Mixed Rangeland	112.7	112.7	303.6	303.9	256.2	256.6
Nonforested Wetlands	19.1	71.5	59.4	223	49.0	129.5
Reservoirs	0.0	0.0	0.0	0.0	0.0	0.0
Residential	0.0	0.0	0.4	2.5	0.0	1.4
Sandy Areas other than Beaches	0.0	0.0	0.0	3.7	0.0	0.0
Shrub and Brush Rangeland	3,619.0	3,782.1	11,484.9	11,937.3	9,451.4	9,688.6
Mines, Quarries and Gravel Pits	2.3	2.3	1.8	1.8	3.5	3.5
Transitional Areas	0.0	0.0	0.0	0.0	0.0	0.0
Transportation, Communication, Utilities	0.0	0.0	0.0	0.0	0.0	0.0
Total	**3,860.7**	**4,123.1**	**12,175.8**	**12,885.6**	**10,056.1**	**10,427.0**

Table 4.5-2
Initial Surface Disturbance in Relation to Sublette County Zoning Districts and the Residential SRMZ by Alternative

Sublette County Zoning District	Alternative A (acres)		Alternatives B, C , and D (acres)		Alternative E (acres)	
	Federal	Total	Federal	Total	Federal	Total
Agricultural	596.0	710.7	1,953.9	2,364.6	1,688.9	1,845.0
Highway Commercial	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Industrial	0.0	0.0	0.0	0.0	0.0	0.0
Light Industrial	0.0	0.0	0.8	0.8	0.0	0.0
Rural Residential	0.0	0.0	0.7	1.9	0.0	0.8
Rural Residential 10	0.1	0.1	0.1	1.8	0.1	1.2
Rural Residential 20	0.0	0.0	0.0	0.3	0.0	0.2
Rural Residential 5	0.0	0.0	0.1	7.5	0.1	3.3
Rural Residential Mobile/Manufactured Home 10	0.0	0.0	0.0	0.0	0.0	0.0
Resource Conservation	3,264.6	3,412.3	10,220.0	10,508.7	8,366.8	8,576.5
Rural Mixed	0.0	0.0	0.0	0.0	0.0	0.0
Total in Zoning Districts	**3,860.7**	**4,123.1**	**12,175.6**	**12,885.6**	**10,055.9**	**10,427.0**
0.25-mile Residence Buffer	21.9	82.6	71.9	274.5	46.0	212.6
Residential SRMZ	31.0	91.7	114.9	341.0	67.4	235.5

Implementation of any of the Alternatives would continue to change the characteristics of most land use/land cover types (Table 4.5-1) to a landscape where "*one is constantly aware that extensive development activities are ongoing*." As stated above, the potential significant impacts to land use predicted in the PAPA DEIS (BLM, 1999a) have occurred and would continue to occur under all of the Alternatives.

Under all Alternatives, over 90 percent of the initial disturbance is within the Shrub and Brush Rangeland land use/land cover type (Table 4.5-1). The remainder of the initial disturbance under all Alternatives is mostly in Mixed Rangeland, Cropland, and Pastureland use/land cover types.

Over two-thirds of initial surface disturbance under all Alternatives would occur on lands with federal jurisdiction. Although Sublette County's zoning districts include BLM-administered public lands, the county has no jurisdiction on these lands.

Under all Alternatives, over 80 percent of initial surface disturbance would occur in lands zoned by Sublette County as Resource Conservation (Table 4.5-2) and over 17 percent would be in lands zoned as Agriculture. Wellfield development would be in conflict with the intended use of lands zoned as Resource Conservation in which protection and conservation of environmentally sensitive areas must be limited to prevent degradation (Sublette County, 2002).

Table 4.5-2 shows that wellfield development under any of the Alternatives would have minimal impact to lands zoned as Residential by Sublette County. However, there would be disturbance within the Residential SRMZ by each Alternative including new wellfield disturbance expected within the 0.25-mile buffer surrounding residences (Table 4.5-2). This occurs because many residences, and therefore the 0.25-mile buffer, are outside of the areas zoned Residential by Sublette County.

Under all Alternatives, over two-thirds of the initial surface disturbance within the 0.25-mile residential buffer and Residential SRMZ would be on private lands and minerals where there is no federal jurisdiction. Wellfield development under all Alternatives would be compatible with county zoning in the several rural residential categories. Approximately one-third of the initial surface disturbance within the 0.25-mile residential buffer and Residential SRMZ would be on BLM-administered public lands, where Sublette County has no jurisdiction. It is unknown if planned development under any of the Alternatives, within the Residential SRMZ and 0.25-mile residential buffer, would adversely affect the use, enjoyment, or value of adjacent property or introduce safety and health risks or a nuisance or annoyance to the areas.

Pipeline Corridors and Gas Sales Pipelines

The principal land uses along the proposed corridor/pipeline alignments are livestock grazing, wildlife habitat, and oil and gas development. Establishment of the proposed corridors and construction and operation of pipelines within the corridors would not preclude the current land uses. The proposed corridors represent a proposed expansion of either adjacent or nearby pipeline corridors that connect the PAPA and the Jonah Field Project Area with gas plants in southwest Wyoming. Designation of the corridors would be consistent with past, current, and continued uses of the lands. No changes in land use or conflicts with county zoning regulations are expected as a result of either designation of the corridors or construction and operation of the proposed pipelines.

4.5.3.2 Alternative A (No Action Alternative)

Surface disturbance under the No Action Alternative would be randomly spread across the Anticline Crest, most likely within areas identified as having moderate and higher potential for gas development by BLM's RMG (Map 2.4-4 in Chapter 2). The surface disturbance would occur over 5 years and would not extend past 2011 under the No Action Alternative. Under the No Action Alternative, reclamation would be similar to current management practices under the PAPA ROD (Appendix 8A). Year-round development under this Alternative would be limited to Questar's leasehold in the northern portion of the PAPA as defined by BLM's 2004 Decision Record (BLM, 2004) although development could occur outside of the seasonally restricted areas. All disturbance outside of this leasehold must take place while adhering to seasonal restrictions for big game and greater sage-grouse unless exceptions are granted. Opportunity for interim reclamation under this Alternative is minimal because while drilling within seasonal restrictions for wildlife, Operators would be required to leave well pads open during the seasonally restricted periods returning to them after the seasonally restricted period. Under the No Action Alternative, initial surface disturbance of 4,123.1 acres would result from construction of 249 well pads and associated roads, pipelines, and ancillary facilities. LOP surface disturbance would be 1,622.5 acres.

Similar to all Alternatives, initial disturbance would be greatest in the Shrub and Brush Rangeland (3,782.1 acres) land use/land cover type (Table 4.5-1). Mixed Rangeland (112.7 acres) and Cropland and Pasture (109.6 acres) would be affected less than the Shrub and Brush Rangeland land use/land cover types.

Initial surface disturbance would be greatest in the Resource Conservation (3,412.3 acres) and Agricultural (710.7 acres) zoning districts. Wellfield development under the No Action Alternative would increase initial surface disturbance inside the 0.25-mile residential buffer (82.6 acres) and within the Residential SRMZ (91.7 acres), primarily near residences along the New Fork River.

4.5.3.3 Alternative B

Under Alternative B, year-round development would occur in CDAs within the Alternative B Core Area (Map 2.4-3 in Chapter 2). The three CDAs could be anywhere within the Alternative B Core Area but would not be more than 8 square miles each and the total of all three CDAs would not exceed 19 square miles. Development outside of the Alternative B Core Area would occur with seasonal restrictions for big game and greater sage-grouse unless exceptions are granted. Initial surface disturbance of 12,885.6 acres would be for 250 additional well pads, expansion of existing pads, 100 miles of new roads, 100 miles of new gas gathering pipelines, and associated ancillary facilities. Alternative B includes 471 miles of liquids gathering system from installation of the new liquids gathering system in the central and southern portions of the PAPA and continuation of Questar's liquids gathering system in the northern portion of the PAPA. LOP surface disturbance associated with Alternative B would be 4,012.5 acres. Surface disturbance associated with gas gathering pipelines and liquids gathering pipelines is short-term and would generally be reclaimed within 1 year of disturbance. Under Alternative B, wellfield development would occur over an 18 to 19 year period.

In the Alternative B Core Area, development would include concentrated development which allows for utilization of larger multiple-well pads occurring year-round. This allows for Operations on individual well pads to be completed sooner ultimately allowing for reclamation of wells up to a decade earlier than under development within seasonally restricted periods. Under Alternative B, reclamation would occur according to the Reclamation Plan provided by the Proponents (Appendix 8B).

Initial disturbance under Alternative B would be greatest in the Shrub and Brush Rangeland (11,937.3 acres) land use/land cover type (Table 4.5-1). Other land use/land cover types notably affected would be Mixed Rangeland (303.9 acres) and Cropland and Pasture (292.1 acres).

Resource Conservation and Agriculture zoning districts would be affected the most by Alternative B with 10,508.7 acres and 2,364.6 acres of initial surface disturbance, respectively. Wellfield development under Alternative B would increase initial surface disturbance inside the 0.25-mile residential buffer (274.5 acres) and within the Residential SRMZ (341.0 acres), primarily near residences along the New Fork River.

4.5.3.4 Alternative C

Implementation of Alternative C would result in the same initial and LOP surface disturbance as Alternative B (Tables 4.5-1 and 4.5-2) and it is reasonable that the disturbance would occur in the same location and would affect the same land use/land cover types and zoning districts. Year-round development would be allowed in the Alternative C Core Area (with the exception of DA-5) and development outside of the Alternative C Core Area would be conducted with seasonal restrictions for big game and greater sage-grouse unless exceptions are granted. Rates of wellfield development within different portions of the PAPA (CDAs in Alternative B versus DAs in Alternative C) would be different at different times during the common period of development from 2007 through 2025. Under Alternative C, there is opportunity for full-field development in some DAs to be completed prior to development in other DAs with no additional trends towards a landscape dominated by the wellfield.

Alternative C specifies that wellfield development would progress from south to north in DA-1 and from DA-2 to DA-3, during winter. With wellfield development completed in DAs before new areas could be developed (at least during winter), there is the potential for not just interim reclamation, but final reclamation. A Reclamation Plan for Alternative C is provided in Appendix 8C.

4.5.3.5 Alternative D

Implementation of Alternative D would result in the same initial and LOP disturbance as Alternatives B and C (Tables 4.5-1 and 4.5-2) and it is reasonable that the disturbance would occur in the same location and would affect the same land use/land cover types and zoning districts. Under Alternative D, year-round development would be allowed within the Alternative D Core Area but would also include the PDA where year-round development could occur if approved by the BLM AO. Alternative D includes specific progression for delineation drilling not included in Alternative C (Chapter 2, Section 2.4.3). If year-round development is approved within either all or portions of the PDA, the spatial extent of high intensity development within the PDA would occur earlier than under Alternative C, and may resemble Alternative B which includes a larger core area.

The Proponents have committed to no additional development within the federal suspended and term NSO leases in the Flanks (Map 2.4-9 in Chapter 2) for at least the first 5 years after issuance of the ROD. After 5 years, development could occur in the Flanks on the federal suspended or term NSO leases if approved by the BLM AO.

Under Alternative D, changes to land use in DAs would occur simultaneously. Under Alternative C, development was required to be completed in DA-2 before beginning in DA-3, whereas under Alternative D, development in DA-3 increases as development in DA-2 decreases. Under Alternative D, year-round development would be allowed in DA-4 and DA-5.

4.5.3.6 Alternative E

Year-round development under this Alternative would be limited to Questar's leasehold in the northern portion of the PAPA as defined by BLM's 2004 Decision Record BLM, 2004a) although development could occur outside of the seasonally restricted areas and exceptions could be granted. Therefore, the development period for Alternative E (a full-field development Alternative) would be extended over a longer time, through 2033. Initial surface disturbance of 10,427.0 acres would be for 415 additional well pads, expansion of existing pads, 166 miles of new roads, 166 miles of new gas gathering pipelines, and associated ancillary facilities (Table 2.4-14 in Chapter 2). LOP surface disturbance associated with Alternative E would be 4,185.6 acres, slightly higher than for Alternatives B, C, and D. Alternative E does not include a liquids gathering system in the central and southern portion of the PAPA.

Initial surface disturbance under Alternative E would be greatest in the Shrub and Brush Rangeland land use/land cover type (9,866.6 acres). Mixed Rangeland (256.6 acres) and Cropland and Pasture (280.3 acres) would be affected less than the Shrub and Brush Rangeland land use/land cover types (Table 4.5-1).

Initial surface disturbance would be greatest in the Resource Conservation (8,576.5 acres) and Agricultural (1,845.0 acres) zoning districts. Wellfield development under Alternative E would increase initial surface disturbance inside the 0.25-mile residential buffer (212.6 acres) and in the Residential SRMZ (235.5 acres), primarily near residences along the New Fork River.

Even though only limited year-round development is included in Alternative E, the Alternative D Core Area and the PDA are included in Alternative E as the Alternative E Core Area and the Buffer Area, respectively, for the purpose of delineating restrictions on surface disturbance. Alternative E includes limits on surface disturbance within the Alternative E Core Area, the Buffer Area, and in the Flanks by Management Area (Chapter 2, Section 2.4.4 and Appendix 13). These restrictions could slow the transformation to a landscape of extensive ongoing development activities as anticipated in the PAPA DEIS (BLM, 1999a). Reclamation goals and objectives under Alternative E, would be similar to that under Alternative D (Appendix 8D); however, similar to Alternative A, well pads would be left open during seasonally restricted periods and returned to when seasonal restrictions end, thereby, delaying reclamation. Depending on how successful future revegetation efforts would be during the 27-year period of wellfield development, the PAPA (Anticline Crest) might or might not appear as an industrialized landscape, such as it does in 2006.

4.5.4 Cumulative Impacts

The CIAA for land use/residential areas is confined to the PAPA. Land use within Sublette County was changing before 1999 from an area of open spaces associated with agriculture, wildlife habitat, dispersed recreation, and overall low densities of development – including residential, urban, and natural resource extraction by oil, natural gas, and mining industries (McLeod et al., 1998). Prior to issuance of the PAPA ROD (BLM, 2000b), most of the native landscape in the PAPA had been changed by agricultural use.

The cumulative surface disturbance to land use/land cover types by Alternative (Table 4.5-3) was calculated by adding the existing non-wellfield disturbance, the existing wellfield disturbance, the gas sales pipeline disturbance, and the projected initial surface disturbance by each Alternative.

Table 4.5-3
Cumulative Surface Disturbance in Relation to Land Use/Land Cover Types by Alternative

Land Use/Land Cover Type	Existing Non Wellfield Disturbance (acres)	Existing Wellfield Disturbance (acres)	Proposed Gas Sales Pipeline Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative		
				Alternative A	Alternatives B, C, and D	Alternative E
Cropland and Pasture	4,171.9	63.1	6.9	4351.5	4,534.0	4,522.2
Forested Wetlands	5.8	6.7	3.6	57.9	108.0	75.6
Herbaceous Rangeland	593.2	5.6	0.0	598.8	617.6	599.7
Industrial	0.0	40.4	1.4	44.9	52.4	48.5
Mixed Rangeland	26.0	43.6	6.2	188.5	379.7	332.4
Nonforested Wetlands	632.3	39.8	15.4	759.0	910.5	817
Reservoirs	12.1	0.0	0.0	12.1	12.1	12.1
Residential	102.2	0.0	0.0	102.2	104.7	103.6
Sandy Areas Other than Beaches	0.0	3.9	0.0	3.9	7.6	3.9
Shrub and Brush Rangeland	1,961.6	4,629.9	392.8	10,766.4	18,921.6	16,672.9
Mines, Quarries and Gravel Pits	0.0	1.6	0.0	3.3	2.8	4.5
Transitional Areas	0.0	0.0	0.0	0	0	0
Transportation, Communication, Utilities	133.9	0.0	0.0	133.9	133.9	133.9
Total	**7,639.0**	**4,834.6**	**426.3**	**17,023.0**	**25,785.5**	**23,326.9**

Most cumulative disturbance under all Alternatives is in the Shrub and Brush Rangeland land use/land cover type (Table 4.5-3). Although cumulative effects to Cropland and Pasture appear substantial by each Alternative in Table 4.5-3, it is only a reflection of the existing agricultural development.

Cumulative impact to Sublette County Zoning Districts is based on past, present, and future levels of surface disturbance (Table 4.5-4) with the vast majority of impact within the Resource Conservation zoning district under all Alternatives. There would be cumulative impact to the Agricultural Zoning District by each Alternative as well, but 5,557.2 acres of that is due to agricultural land use, the reason for the lands being zoned Agricultural by Sublette County. Even so, there is existing wellfield development (1,002.7 acres) and future wellfield development that would transform the district to some degree from current zoning.

While existing, non-wellfield disturbance has generated only a minor amount of disturbance within the Resource Conservation zoning district in the PAPA, the majority of existing wellfield development has been concentrated there and the majority of development under all Alternatives is expected there as well.

Existing non-wellfield surface disturbance within the 0.25-mile residence buffer and Residential SRMZ in Table 4.5-4 are from residences and associated infrastructure, mostly roads that were originally used to define the two land use components in the PAPA DEIS (BLM, 1999a). While the impact to each one by present and future wellfield development in the PAPA is not small, the relatively large amount of surface disturbance by each Alternative is the result of including existing residential land uses in the cumulative area of surface disturbance for each Alternative.

Table 4.5-4
Cumulative Surface Disturbance in Relation to Sublette County Zoning Districts and the Residential SRMZ by Alternative

Sublette County Zoning District	Existing Non Wellfield Disturbance (acres)	Existing Wellfield Disturbance (acres)	Proposed Gas Sales Pipeline Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative		
				Alternative A	Alternatives B, C, and D	Alternative E
Agricultural	5,557.2	1,002.7	104.1	7,374.7	9,028.6	8,509.0
Highway Commercial	18.1	0.0	0.0	18.1	18.1	18.1
Heavy Industrial	36.8	0.0	0.0	36.8	36.8	36.8
Light Industrial	272.5	0.0	0.0	272.5	273.3	272.5
Rural Residential	1,052.8	0.1	0.0	1,052.9	1,054.8	1,053.7
Rural Residential 10	135.3	0.0	0.0	135.4	137.1	136.5
Rural Residential 20	143.7	0.0	0.0	143.7	144.0	143.9
Rural Residential 5	11.0	0.0	0.0	11.0	18.5	14.3
Rural Residential Mobile/Manufactured Home 10	33.7	0.0	0.0	33.7	33.7	33.7
Resource Conservation	361.7	3,831.8	322.2	7,928.0	15,024.4	13,092.2
Rural Mixed	16.2	0.0	0.0	16.2	16.2	16.2
Total in Zoning Districts	**7,639.0**	**4,834.6**	**426.3**	**17,023.0**	**25,785.5**	**23,326.9**
0.25-mile Residence Buffer	2,440.2	85.3	0.0	2,608.1	2,800.0	2,738.1
Residential SRMZ	3,856.8	94.7	0.0	4,043.2	4,292.5	4,187.0

4.5.5 Land Use and Residential Additional Mitigation Opportunities

No additional Land Use and Residential mitigation measures have been identified.

4.6 RECREATION RESOURCES

4.6.1 Scoping Issues

Concerns regarding potential impacts to recreation received during public scoping include:

1. Concern that hunting has been affected because wildlife populations have declined.
2. Removal of winter restrictions on drilling will impact the hunting and fishing communities.

4.6.2 Impacts Considered in the PAPA DEIS

In the PAPA DEIS (BLM, 1999a), BLM assumed that there would be a negligible increase in recreational use of the PAPA because wellfield workers typically do not recreate near project sites and generally leave the area when they are not working. BLM acknowledged the potential for immigrant workers to impact recreation resources by parking overnight and camping or setting up residence at recreation sites. Typically, these types of problems are generated when adequate housing is not available, though it was assumed that illegal camping on public lands or at public recreation facilities would be isolated cases. The following is a list of potential impact to Recreational Resources anticipated in the PAPA DEIS:

- project development and operation would affect the visual and aesthetic quality associated with dispersed recreational experiences (e.g. hunting, fishing, mountain biking, etc.) by increasing traffic, producing noise and dust, and by adding production facilities and other disturbances to the landscape which would cause a loss of open space and solitude.
- impacts would be most severe on the north end of the PAPA near Pinedale where residents use the area regularly; however, other areas within the PAPA that are used for dispersed recreation could also be impacted by project development.
- hunters may find it unsafe to use some areas because of the density of development, or they may have a less rewarding experience if project activities affect wildlife populations in the area.
- people fishing or floating on the Green or New Fork rivers in the project area may be discouraged by project activities adjacent to these rivers which could impact their recreational experience.
- individuals visiting the Lander Trail in the PAPA to experience the historic setting of the area may also be affected by the industrial change in the landscape from development.

BLM defined several specific areas where future development in the PAPA would conflict with recreation use as it existed in 1999. BLM considered the following impacts associated with these conflicts significant if:

- project-related activities result in long-term elimination or reduction of recreation use in any of these areas; or
- any of the Alternatives result in a level of development incompatible with the stated objectives of special recreation management areas.

Based on these criteria, significant impact to dispersed recreation use was anticipated for all Alternatives (except the *No Action Exploration/Development Scenario*) in the area immediately south of Pinedale (along the Pinedale South Road) if project development became extensive and use of the Pinedale South or Mesa roads by wellfield traffic increased. A significant impact was predicted for a very small portion of the Wind River Front Special Recreation Management Area (SRMA) under the *Project Wide and Anticline Crest* development scenarios in the PAPA DEIS (BLM, 1999a). Because there are no specific measures of recreation use in the PAPA, it is not possible to determine whether significant impact, based on the criteria in the PAPA DEIS, has occurred.

4.6.3 Alternative Impacts

4.6.3.1 Summary of Impacts Common to All Alternatives

<u>Natural Gas Development in the PAPA</u>

Direct impact to Recreation Resources, specifically public recreation areas in the PAPA, has occurred, primarily through surface disturbance associated with wellfield development. By the end of 2006, surface disturbance by wellfield development in the PAPA was 4,834.6 acres (Table 2.3-4 in Chapter 2) of which 4,111.5 acres (Table 3.8-4 in Chapter 3) are in public recreation areas listed in Table 4.6-1. Approximately 32 acres were impacted by wellfield development in the Wind River Front SRMA by November 2006.

Table 4.6-1
Initial Surface Disturbance in Relation to Public Recreation Areas by Alternative

Public Recreation Area	Alternative A (acres)		Alternatives B, C , and D (acres)		Alternative E (acres)	
	Federal	Total	Federal	Total	Federal	Total
Mount Airy OHV Open Use Area	233.1	233.1	912.2	927.6	339.1	339.1
Area of OHV Use Limited to Existing Roads and Trails	1,282.9	1,312.6	4,114.4	4,253.7	2,843.6	2,930.2
Desert General OHV Open Use Area	1,972.9	2,090.8	5,852.3	6,003.7	5,852.7	5,977.3
Wind River Front SRMA	0.0	0.0	0.4	0.4	0.4	0.4
Total	**3,488.9**	**3,636.5**	**10,879.3**	**11,185.4**	**9,035.8**	**9,247.0**

Initial surface disturbance in other Public Recreation Areas in the PAPA associated with each Alternative is included in Table 4.6-1. Implementation of the Alternatives would continue to change the characteristics of most of the PAPA to a landscape where "*one is constantly aware that extensive development activities are ongoing*" as anticipated in the PAPA DEIS (BLM, 1999a). Though not quantified, one may assume that the development and production of natural gas resources in the PAPA affected the visual and aesthetic quality associated with dispersed recreational experiences, one of several impacts anticipated in the PAPA DEIS (BLM, 1999a; also see Visual Resources, Section 4.7, below). Impacts to Recreation Resources resulting from any of the Alternatives may not be significant but dispersed recreational use of the PAPA would not be enhanced by increased wellfield development. In contrast to the lack of quantifiable recreation impacts, local opinion indicates the public commonly avoids the Anticline Crest for recreation activities (Hudson, 2007). Dispersed recreation in the PAPA is generally most affected by intense wellfield development; however, off-site indirect impacts do occur as the public seeks other access points and areas to enjoy open space and experience recreation opportunities.

Only minimal disturbance is likely within the Wind River Front SRMA by any Alternative. Current restrictions on recreational travel across the Mesa and Mount Airy OHV Open Use Area to protect mule deer and pronghorn on winter range would continue under all Alternatives, if needed. These restrictions imposed by the BLM during the winter might effectively protect mule deer and pronghorn on winter ranges. The BLM's Practices and Restrictions for the Pinedale Anticline Project Area as they relate to recreation resources would apply to all Alternatives (Appendix 4).

Indirect impact to Recreation Resources would include increased traffic and human presence in the PAPA, increased noise, and changes to the visual landscape, making it a less desirable place to recreate. Increase in population overall and specifically to the Town of Pinedale make it more difficult for people to visit the PAPA and surrounding areas because motel rooms are full at different times of they year, possibly causing potential visitors to choose other locations for recreation (Socioeconomics - Section 4.3.2.1).

Pipeline Corridors and Gas Sales Pipelines

The proposed corridor/pipeline alignments would not directly affect existing dispersed recreational opportunities in the project area. Corridor designation would not affect current land uses or overall management direction by federal, state, and private land managers.

Actual disturbance or displacement of the affected area's characteristic, dispersed recreational activity may occur near pipeline construction activities; however, this impact would be limited in both extent and duration as the construction activity would migrate across the landscape and would not be concentrated at a single location for an extended period. Construction of specific pipelines would occur sequentially within a corridor, within a construction season, and over a period of years. Consequently, the area of disturbance and the impact on recreational travel (use of roads) would be minor because disturbance would be reclaimed within 1 to 2 years.

Depending on timing of pipeline construction activities, overall minor conflicts with hunting opportunities could result in localized interruption of activities for a given area. The conflict would be temporary, a matter of a few days, and limited to an area immediately surrounding pipeline construction. Temporary displacement of game animals caused by construction activity and noise may occur. Impacts to recreational use of the rivers would be temporary and would be limited to pipeline construction across the rivers. Conflicts with recreational uses of the Green River would be temporary and would be minimized because the Green River would be crossed by HDD construction techniques.

4.6.3.2 Alternative A (No Action Alternative)

Continued development under the No Action Alternative would affect 2,090.8 acres in the Desert General OHV Open Use Area south of the New Fork River and would generate no new disturbance in the Wind River Front SRMA (Table 4.6-1). Existing wellfield development in recreation areas on the Mesa would approximately double by 2011 under the No Action Alternative, affecting the Mount Airy OHV Open Use Area and other areas of existing roads and trails on the Mesa.

Vehicular access during winter in the recreation areas would be limited to production-related traffic and traffic associated with development in Questar’s leaseholds in the northern portion of the PAPA (BLM, 2004a). Production-related traffic would continue to increase as additional wells are drilled through 2011.

Because Alternative A does not include year-round development (except as stated in BLM’s 2004 Decision Record – BLM, 2004a), concentrated development would not occur. A larger number of new well pads would be required for a given number of wells and they would have associated new roads and gas gathering pipelines. Seasonal restrictions for wildlife would cause Operators to leave well pads open while they move out of the seasonally restricted areas which could affect recreational use.

4.6.3.3 Alternative B

Wellfield development under Alternative B would affect 6,003.7 acres in the Desert General OHV Open Use Area. Surface disturbance in the area of OHV Use Limited to Existing Roads and Trails and in the Mount Airy OHV Open Use Area would be 4,253.7 acres and 927.6 acres, respectively. Vehicular traffic may be extensive during winter in recreation areas where there is year-round development through 2025.

After 2017, there would be a steady decline in winter traffic through 2025 under Alternative B due to decrease in development. Production-related traffic would continue but would be reduced by installation and use of a liquids gathering system in the central and southern portions of the PAPA. Increased use of computer-assisted operations would also reduce production-related traffic possibly making the PAPA a more attractive place for recreational users than if computer-assisted operations were not utilized.

Under Alternative B, concentrated development in three CDAs would reduce traffic and human presence in certain areas of the PAPA during winter; however, there would still be production in areas where development is not occurring. This may or may not impact recreational use depending on the preference of the recreational user.

4.6.3.4 Alternative C

Implementation of Alternative C would result in the same initial and LOP surface disturbance as Alternative B (Table 4.6-1) and it is reasonable that the disturbance would occur in the same location and would affect the same public recreation areas at the end of development. There would be extensive vehicular traffic during winter in recreation areas with year-round development. Initially, this would occur in the southern portion of DA-1 and in all of DA-2. Restrictions on winter recreational traffic, if applied, would be most effective in the Mount Airy OHV Open Use Area.

Similar to Alternative B, after 2017, there would be a steady decline in winter traffic through 2025 due to decrease in development. Production-related traffic would continue but would be reduced by installation and use of a liquids gathering system in the central and southern portions of the PAPA. Increased use of computer-assisted operations would also reduce production-related traffic.

Concentrated development within the Alternative C Core Area would allow the recreational user to find areas where there is no development occurring; however, production would be ongoing. This may or may not impact recreational use depending on the preference of the recreational user.

4.6.3.5 Alternative D

Implementation of Alternative D would result in the same initial and LOP surface disturbance as Alternatives B and C (Table 4.6-1) and it is reasonable that the disturbance would occur in the same location and would affect the same public recreation areas at the end of development. Vehicular traffic would be extensive during winter in recreation areas where there is year-round development especially in the initial years in the southern portion of DA-1 and in all of DA-2. Year-round development would occur in DA-3 simultaneously with year-round development in DA-2 and therefore recreational use in these areas would most likely not occur. Restrictions on winter recreational traffic would be most effective within the Mount Airy OHV Open Use Area.

Similar to Alternatives B and C, after 2017, there would be a steady decline in winter traffic through 2025 due to decrease in development. Production-related traffic would continue but would be reduced by installation and use of a liquids gathering system in the central and southern portions of the PAPA. Increased use of computer-assisted operations would also reduce production-related traffic.

Concentrated development within the Alternative D Core Area and potentially in the PDA (if approved by the BLM AO) would leave other areas open for recreation. The areas outside of the PDA where there are federal suspended or term NSO leases would have no additional development, at least for the first 5 years. This would allow open areas for the recreational user although there may be some existing production in this area.

4.6.3.6 Alternative E

Year-round development would not occur under Alternative E (except for as stated in BLM's 2004 Decision Record – BLM, 2004a), unless exceptions are granted by the BLM. Therefore, Alternative E (a full-field development Alternative) would be extended over a longer time with development through 2033 and production through 2073. Surface disturbance by Alternative E through 2033 would be similar to the other action Alternatives (Table 4.6-1).

Compared to Alternatives B, C, and D, much lower vehicular traffic is expected during winter under Alternative E because development coinciding with recreation areas on the Mesa would be minimal. Restrictions on winter recreational traffic, if applied, are expected to be most effective within the Mount Airy OHV Open Use Area.

Alternative E does not include construction of a liquids gathering system in the central and southern portions of the PAPA. Once all wells are in production mode, after 2032, production-related traffic would continue at a low rate, probably for several decades, then would slowly decline toward the end of the production period in 2073.

Similar to the No Action Alternative, because Alternative E includes limited year-round development, concentrated development would not occur. A larger number of new well pads (415) would be required for a given number of wells and they would have associated new roads and gas gathering pipelines. Seasonal restrictions for wildlife would cause Operators to leave well pads open while they move out of the seasonally restricted areas which could affect recreational use.

4.6.4 Cumulative Impacts

The CIAA for Recreation is the PAPA. Residents of Sublette County placed high value on recreational opportunities and people who moved there cited recreation as one reason for choosing to live there (McLeod et al., 1998). In the past, use of the PAPA included OHV-oriented recreation. OHV use in Sublette County has increased annually from 2002 through 2005 (based on numbers of OHV permits issued) though not as much as in other Wyoming counties, due in part to the relatively small population (Foulke et al., 2006).

Before issuance of the PAPA ROD (BLM, 2000b), most of the OHV use in the PAPA was in three assigned areas; Mount Airy OHV Open Use Area, Area of OHV Use Limited to Existing Roads and Trails, and the Desert General OHV Open Use Area. Past disturbance unassociated with wellfield development in the PAPA (Table 4.6-2) occurred within each of the OHV-use areas, mainly by a variety of roads (arterials, collectors), livestock facilities, and a few gravel quarries. Past disturbances to OHV-oriented recreational areas in the PAPA total 491.9 acres (Table 4.6-2).

Existing surface disturbance associated with wellfield development in the OHV-oriented recreational areas is nearly ten times the disturbance unassociated with wellfield development, amounting to 4,111.5 acres (Table 4.6-2). Reasonably foreseeable development in the PAPA is focused on the disturbance associated with each of the Alternatives. The cumulative impact to public recreation areas in the PAPA (Table 4.6-2) is based on estimates of surface disturbance by wellfield development projected under each Alternative. All Alternatives would generate the most cumulative impact within the Desert General OHV Open Use Area.

Table 4.6-2
Cumulative Surface Disturbance in Relation to Public Recreation Areas by Alternative

Public Recreation Area	Existing Non Wellfield Disturbance (acres)	Existing Wellfield Disturbance (acres)	Proposed Gas Sales Pipeline Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative		
				Alternative A	Alternatives B, C, and D	Alternative E
Mount Airy OHV Open Use Area	87.9	194.0	0.0	515.0	1,209.5	621.0
Area of OHV Use Limited to Existing Roads and Trails	152.4	1,568.9	9.2	3,043.1	5,984.2	4,660.7
Desert General OHV Open Use Area	251.6	2,317.1	349.1	5,008.6	8,921.5	8,895.1
Wind River Front SRMA	0.0	31.5	0.0	31.5	31.9	31.9
Total	**491.9**	**4,111.5**	**358.3**	**8,598.2**	**16,147.1**	**14,208.7**

4.6.5 Recreation Resources Additional Mitigation Opportunities

Recreation Resources Mitigation Measure 1. Well locations could be adjusted so that they are not visible from the float access point on the New Fork River. The parking lot could be restricted for use by Operators or contractors.

Recreation Resources Mitigation Measure 2. To offset the potential impacts to recreation and float-boating use, the Operators could voluntarily fund improved access or improve and maintain recreation facilities.

Recreation Resources Mitigation Measure 3. The Operators could inform their employees, contractors, and subcontractors that camping for more than 14 days on public lands or at public recreation sites is prohibited.

Recreation Resources Mitigation Measure 4. The Operators could inform their employees, contractors, and subcontractors that recreation sites and facilities are not to be used for trash disposal or as a water supply source.

Recreation Resources Mitigation Measure 5. The Operators could voluntarily:

- Work with the BLM to develop All Terrain Vehicle special use areas and Backcountry Touring Routes (see PFO RMP Open OHV Use Areas and seek proposals from OHV user groups, Sublette County Recreation Board, and BLM Recreation Program);
- Contribute to projects for road and trail inventories, transportation planning, reclamation, signing, and monitoring (inquire with BLM Recreation Program);
- Facilitate the acquisition of public access to important recreation opportunities through third party agreements (inquire with BLM Recreation and Lands Programs and Sublette County Recreation Board);
- Develop brochures and guides for river floating, motorized and non-motorized trail use, and cultural resource activities (inquire with BLM, Sublette County Recreation Board, and Tourism Boards);
- Upgrade existing recreation facilities and provide additional amenities (inquire with BLM Recreation Program);
- Develop recreational user products and interpretive facilities at important public access portals with significant cultural or natural resource values (inquire with BLM Recreation and Cultural Programs); and
- Develop new river accesses and improve existing sites for fishing, floating, and camping opportunities (inquire with BLM Recreation Program and WGFD).

4.7 VISUAL RESOURCES

4.7.1 Scoping Issues

Concerns were mostly about the overall impact to the scenic resources and air quality in the region of the PAPA. The community of Pinedale was especially concerned with the effects upon Pinedale's viewshed created by natural gas development.

4.7.2 Impacts Considered in the PAPA DEIS

The Mesa "breaks," foothills, and sandstone ridges form the background west of U.S. Highway 191. The management objective of VRM Class II is to retain the existing character of the landscape, the level of change to the character of the landscape should be low, and management activities should not attract the attention of the casual observer. Management of visual resources in VRM Class III areas allows for moderate change in the character of the landscape while VRM Class IV areas allow for major modification of the landscape.

Viewshed analysis conducted for the PAPA DEIS (BLM, 1999a) determined that a portion of the PAPA would be visible from sensitive viewpoints near Pinedale. Wellfield development, shown on Map 3.9-2 in Chapter 3 and identified as the Sensitive Viewshed SRMZ, would be noticeable as visual resource impacts because the impacted area would be seen from many points in the Town of Pinedale, residential areas, and to travelers driving on U.S. Highway 191. In particular, night lighting effects within the Sensitive Viewshed SRMZ during development would be visible from all of the sensitive viewpoints. BLM noted that night lighting in general can impact areas far from the drilling activity and areas outside of the PAPA.

The PAPA DEIS (BLM, 1999a) considered a significant impact to visual resources on federal lands and minerals would occur if project-related development did not meet BLM's VRM class objectives for an area: Significant visual impacts would occur if:

- oil and gas development becomes the dominant feature in the landscape where objectives for that land are to maintain the existing character of the landscape; or
- there is an apparent change, to the casual observer, from a natural landscape to an "industrialized appearing" landscape in areas visible from U.S. Highway 191, residential areas, and the Town of Pinedale.

Based on the significance criteria, the PAPA DEIS (BLM, 1999a) stated that significant impacts to visual resources in the PAPA could occur for all Alternatives except the *No Action Exploration/ Development Scenario*. Visual resources in localized areas have been significantly impacted, according to impact significance defined in the PAPA DEIS. Some areas that are visible from U.S. Highway 191 and visible from some residential areas have changed from a natural landscape to an "industrialized appearing" landscape – similar in appearance to the Jonah Field in 1999 – since 2000. Significant impact has occurred to visual resources in these locations, according to the significance criteria in the PAPA DEIS.

4.7.3 Alternative Impacts

4.7.3.1 Summary of Impacts Common to All Alternatives

<u>Natural Gas Development in the PAPA</u>

Each of the Alternatives is expected to disturb additional areas within VRM Class II. The most affected VRM Class II land in the PAPA is along the New Fork River near Pinedale and in riparian zones in the central portion of the PAPA. Localized areas have been impacted and these areas would be further impacted by each Alternative (Table 4.7-1).

Table 4.7-1
Initial Surface Disturbance in Relation to VRMs and the Sensitive Viewshed SRMZ by Alternative

	Alternative A (acres)		Alternatives B, C , and D (acres)		Alternative E (acres)	
VRM Classes	Federal	Total	Federal	Total	Federal	Total
VRM II	111.0	222.9	495.4	857.6	240.8	396.0
VRM III	848.7	851.6	2,189.7	2,247.9	1,947.1	1,951.6
VRM IV	2,901.0	3,048.6	9,490.7	9,780.1	7,868.3	8,079.4
Sensitive Viewshed SRMZ	253.6	253.6	1,540.2	1,605.1	410.2	413.9

Most disturbance, by any Alternative, would be within VRM Class IV land. Substantial portions of land in the VRM III class would be affected by all Alternatives, primarily in the northern end of the PAPA and along the New Fork River. Some development in VRM Class III lands on the west side of U.S. Highway 191 has already occurred in the southern end of the PAPA and additional development is expected under all Alternatives. Wellfield development could disturb about 2,000 acres in VRM Class III on BLM-administered public lands by all action Alternatives (Table 4.7-1). This level of development is expected to result in a moderate change in the landscape. Visual resources in the localized areas of VRM Class II and VRM Class III have been significantly impacted (according to impact significance criteria defined in the PAPA DEIS) and would be further impacted under all Alternatives. Based upon the success of existing and continued success of revegetation and existing and further liquids gathering system efforts, the PAPA landscape may not appear as industrial as it does in 2006. Effects to VRM Class II and VRM Class III lands, particularly north of the New Fork River, would be substantially diminished. Under all Alternatives, large facilities such as compressor stations and condensate and water storage tanks would be highly noticeable locally. Construction of new well pads and ancillary facilities would be highly visible during winter if snow cover presents highly contrasting visibility conditions. The BLM's Practices and Restrictions for the Pinedale Anticline Project Area as they relate to visual resources would apply (Appendix 4). According to the significance criteria in the PAPA DEIS, impact to visual resources would continue by implementation of any of the Alternatives.

<u>Pipeline Corridors and Gas Sales Pipelines</u>

Establishment of the proposed pipeline corridors would result in new pipeline construction in lands classified as VRM classes II, III, and IV. Pipeline construction would involve the removal of vegetative cover and blading, excavation, backfilling, and re-spreading of soil materials which would likely create visual contrasts with the surrounding landscape. With selective placement of surface ancillary facilities and successful reclamation and reestablishment of protective vegetative cover, pipeline construction would be consistent with the BLM's VRM objectives.

The proposed corridor/pipeline alignments would cross approximately 11 miles of VRM Class II lands at the New Fork River and the Green River. The objectives of VRM Class II criteria would be maintained at all river crossings because they would be crossed by HDD. Reclamation of the disturbed construction rights-of-way for each pipeline would allow for overall retention of the landscape's existing character. However, due to reentry of existing rights-of-ways for pipeline expansion and repairs, most rights-of-ways would be noticeable to the casual observer for 20 or more years.

Approximately 13 miles of the proposed corridor/pipeline alignments would cross areas designated as VRM Class III. These areas are on either side of the river crossings bordering and extending beyond the VRM Class II areas. The existing character of these lands would be retained following reclamation of the affected rights-of-way. Pipeline construction and operation in VRM Class III lands would be consistent with the class objectives to partially retain the existing character of the landscape. The remaining 126 miles of proposed corridor/pipeline alignments would cross VRM Class IV landscapes that allow for major modifications of the existing character. Consistent application of reclamation procedures would meet and exceed these objectives.

4.7.3.2 Alternative A (No Action Alternative)

Year-round development under the No Action Alternative is limited to Questar's leasehold in the northern portion of the PAPA as stated in BLM's 2004 Decision Record (BLM, 2004a). All disturbance outside of this leasehold must take place while adhering to all seasonal restrictions for wildlife unless exceptions are granted. Implementation of the No Action Alternative would include construction of 249 well pads, 99.6 miles of new roads, and ancillary facilities within 5 years. Initial surface disturbance would be 111.0 acres and 848.7 acres in VRM Class II and VRM Class III on federal lands, respectively. VRM Class IV lands would be most affected with an initial disturbance of 3,048.6 acres on federal lands (Table 4.7-1). Initial surface disturbance in the Sensitive Viewshed SRMZ would be 253.6 acres, all on federal lands (Table 4.7-1).

Under the No Action Alternative, reclamation would be similar to current management practices under the PAPA ROD (Appendix 8A). Operators would be required to leave well pads open during the seasonally restricted periods returning to them after the seasonally restricted period, leaving pads visible without reclamation beyond site stabilization for several years.

Because development must take place generally within all seasonal restrictions for wildlife, concentrated development is limited under this Alternative. Well pads would most likely be spread out over the anticline while adhering to limitations for pad numbers within management areas under the PAPA ROD (BLM, 2000b). Wellfield development would be more spread out, rather than concentrated and to the casual observer may seem like development is occurring over a larger area.

The No Action Alternative does not include a liquids gathering system in the central and southern portions of the PAPA. Both existing and new pads would have highly visible tanks for storage of condensate and water that would be present throughout the production phase.

4.7.3.3 Alternative B

Under Alternative B, year-round development would occur in CDAs in the Alternative B Core Area (Map 2.4-3 in Chapter 2). Development outside of the Alternative B Core Area would occur with all seasonal restrictions for wildlife, unless exceptions are granted. Alternative B includes 250 additional well pads, 100 miles of new local and resource roads, and associated ancillary facilities. Initial surface disturbance under this Alternative would include 495.4 acres in VRM Class II and 2,189.7 acres in VRM Class III on federal lands. The most disturbance would occur in VRM Class IV with 9,490.7 acres on federal lands. Implementation of Alternative B would affect 1,540.2 acres of the Sensitive Viewshed SRMZ on federal lands (Table 4.7-1).

Year-round development within CDAs in the Alternative B Core Area includes concentrated development which allows for utilization of larger multiple-well pads. Development on individual multiple-well pads would be completed sooner allowing for reclamation of well pads sooner than if development were to occur on single-well pads. Concentrated development may give the appearance of greater activity within the area that it is occurring; however, under this Alternative, it would be limited to three CDAs.

Alternative B includes installation and use of a liquids gathering system in the central and southern portion of the PAPA as well as continuation of the liquids gathering system in Questar's leases in the northern portion of the PAPA. High profile tanks required on each well pad for storage of condensate and water would be eliminated on those well pads connected to the gathering system. Once all wells are in the production phase, generally the only equipment visible would be the wellhead and associated treatment facilities which are generally not high profile.

4.7.3.4 Alternative C

Implementation of Alternative C would result in the same initial surface disturbance as Alternative B and it is reasonable that the disturbance would occur in the same location and would affect lands with visual resource management classifications in the same way. Year-round development would be allowed in the Alternative C Core Area (with the exception of DA-5) and development outside of the Alternative C Core Area would be conducted with all seasonal restrictions for wildlife, unless exceptions are granted. Rates of wellfield development in different portions of the PAPA (CDAs in Alternative B versus DAs in Alternative C) would be different at different times during the common period of development from 2007 through 2025. Under Alternative C, there is opportunity for full-field development in DAs to be completed prior to development in other DAs.

Alternative C specifies that wellfield development would progress from south to north in DA-1 and from DA-2 to DA-3. With wellfield development completed in DAs before new areas could be developed (at least during winter), there is the potential for not just interim reclamation, but final reclamation (Appendix 8C). VRM classes II and III would be affected in concentrated areas at one time because initially most development would occur in the southern portion of DA-1 and in all of DA-2, both of which are north of the New Fork River. There is more opportunity for focal points of final reclamation under Alternative C as development moves north from the southern portion of DA-1 and as development moves from DA-2 to DA-3.

Similar to Alternative B, the liquids gathering system in Questar's leases in the northern portion of the PAPA would be expanded. A liquids gathering system would be installed in the central and southern portions of the PAPA reducing or eliminating the need for high profile storage tanks at each well pad.

4.7.3.5 Alternative D

Implementation of Alternative D would result in the same initial surface disturbance as Alternatives B and C (Table 4.7-1) and it is reasonable that the disturbance would affect lands with visual resource management classifications in the same way as Alternatives B and C. Year-round development would be allowed within the Alternative D Core Area but would also include the PDA where year-round development could occur if approved by the BLM AO. Alternative D includes specific progression for delineation drilling not included in Alternative C (Chapter 2, Section 2.4.3). Consequently, visual impacts by development actions could increase during the initial period of implementing Alternative D. However, if year-round development is approved within either all or portions of the PDA, the spatial extent of high intensity development within the PDA may resemble Alternative B which includes a larger core area.

During the first 5 years after issuance of a ROD, under Alternative D, there would be no new wellfield development in the Flanks (outside the boundary of the PDA) in federal suspended and term NSO leases (Map 2.4-9 in Chapter 2) reducing potential impact to visual resources. However, in areas in the Flanks where leases have not been suspended or are not term NSO, development could occur during any time of the year and in any location as long as all seasonal restrictions for wildlife are followed, if they apply. This would also be true for all leases in the Flanks after 5 years if approved by the BLM AO.

Under Alternative D, changes to visual resources within DAs would occur simultaneously and could be concentrated although there is no requirement for it. Concentrated development would allow for interim reclamation of well pads (Appendix 8D) reducing impacts to visual resources. Development including drilling, completion, new well pad construction, and construction of ancillary facilities could occur during winter when those actions are likely to be highly visible.

Similar to Alternatives B and C, the liquids gathering system installed within Questar's leases would be continued. A liquids gathering system would be installed in the central and southern portions of the PAPA eliminating the need for high profile storage tanks at each well pad.

4.7.3.6 Alternative E

Year-round development under Alternative E is limited to Questar's leasehold in the northern portion of the PAPA under BLM's 2004 Decision Record (BLM, 2004a), unless exceptions are granted by BLM. Therefore, the development period for Alternative E (a full-field development Alternative) would be extended over a longer time, through 2033. As with other Alternatives, initial surface disturbance under Alternative E would be greatest in VRM Class IV lands with 8,079 acres (Table 4.7-1).

Even though there is only limited year-round development included in Alternative E, the Alternative D Core Area and the PDA are included as the Alternative E Core Area and the Buffer Area, respectively, for the purpose of delineating restrictions on surface disturbance. Alternative E includes limits on surface disturbance in the Alternative E Core Area, the Buffer

Area, and in the Flanks by Management Area (Chapter 2, Section 2.4.4 and Appendix 13). These restrictions could slow the transformation to an industrialized landscape and limit impact to visual resources, including the Sensitive Viewshed SRMZ. Depending on how successful future revegetation efforts would be during the 27-year period of wellfield development, the PAPA (Anticline Crest) might or might not appear as an industrialized landscape, such as it does in 2006.

The liquids gathering system in Questar's leaseholds in the northern portion of the PAPA would be continued under this Alternative and high profile storage tanks on well pads would be reduced in their leaseholds. Under this Alternative, Shell and Ultra's liquids gathering system in the central and southern portion of the PAPA would not be installed. The need for high profile tanks for storage of water and condensate would remain throughout the production phase under this Alternative. However, there would be no permanent facilities allowed in the Buffer Area. This would concentrate the permanent facilities in the Alternative E Core Area. During winter, the public would be relieved of the sights associated with drilling operations. Some facilities may also be present in the Flanks.

4.7.4 Cumulative Impacts

Residents of Sublette County placed high value on the surrounding scenery and people who moved there cited scenery associated with the Wind River Range to the east and the Wyoming Range to the west as one reason for choosing to live there (McLeod et al., 1998). Reflecting on and reinforcing the scenic values held by residents of Sublette County, the BLM established management objectives in portions of the PAPA that would retain the visual characteristics of some landscapes.

Prior to natural gas development that followed the PAPA ROD in July 2000, most surface disturbance within VRM II and VRM III lands in the PAPA had been by agriculture with some disturbance by roads and residences. This disturbance contributes to the existing non-wellfield surface disturbance listed in Table 4.7-2. Most, if not all, of this disturbance was present when the BLM classified the VRM II and VRM III lands in the Pinedale RMP (BLM, 1988b). Similar existing non-wellfield disturbance occurred within the Sensitive Viewshed SRMZ that was identified for the area's visual qualities in the PAPA DEIS (BLM, 1999a).

The cumulative impact to VRM Classes in the PAPA (Table 4.7-2) is based on estimates of surface disturbance by wellfield development projected into the future through the end of development phase for each Alternative. There is a large influence of existing non-wellfield disturbance in the VRM II Class. Likewise, cumulative surface disturbance within the Sensitive Viewshed SRMZ is somewhat similar among Alternatives, also due to the large influence of existing non-wellfield disturbance. The influence of wellfield development in VRM Class III is substantial and most apparent in MA 4. The majority of VRM III is on steeper slopes and therefore more visible to the community and visitors of Pinedale. The difference in level of cumulative impact among the Alternatives is most apparent in the effects to VRM Class IV lands.

Table 4.7-2
Cumulative Surface Disturbance in Relation to
VRMs and the Sensitive Viewshed SRMZ by Alternative

VRM Classes	Existing Non Wellfield Disturbance (acres)	Existing Wellfield Disturbance (acres)	Proposed Gas Sales Pipeline Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative		
				Alternative A	Alternatives B, C, and D	Alternative E
VRM II	4,054.6	250.4	27.7	4,555.6	5,190.3	4,728.7
VRM III	3,266.5	1,101.6	63.3	5,283.0	6,679.3	6,383.0
VRM IV	317.9	3,482.6	335.4	7,184.4	13,915.9	12,215.2
Sensitive Viewshed SRMZ	4,870.3	363.5	426.4	5,487.4	6,838.9	5,647.7

4.7.5 Visual Resources Additional Mitigation Opportunities

Visual Resources Mitigation Measure 1. BLM could require Operators to develop Visual Resource Protection Plans before constructing in visually sensitive areas.

Visual Resources Mitigation Measure 2. BLM could require design and implementation of a viewshed monitoring program to ascertain efficacy of mitigation efforts, refine mitigation opportunities, and determine if VRM objectives are being met. In conjunction with the monitoring program, KOPs and monitoring protocol would be established using the best available guidance and technology. Monitoring results would be presented at the Annual Planning Meeting for consideration and approval by the BLM AO. Twelve KOPs have been selected for potential future viewshed monitoring, analysis, and visual resource mitigation. The new KOPs are shown on Map 4.7-1, and are in addition to the KOPs (viewpoints) established in the PAPA ROD. They do not change the current Sensitive Viewshed SRMZ.

4.8 CULTURAL AND HISTORIC RESOURCES

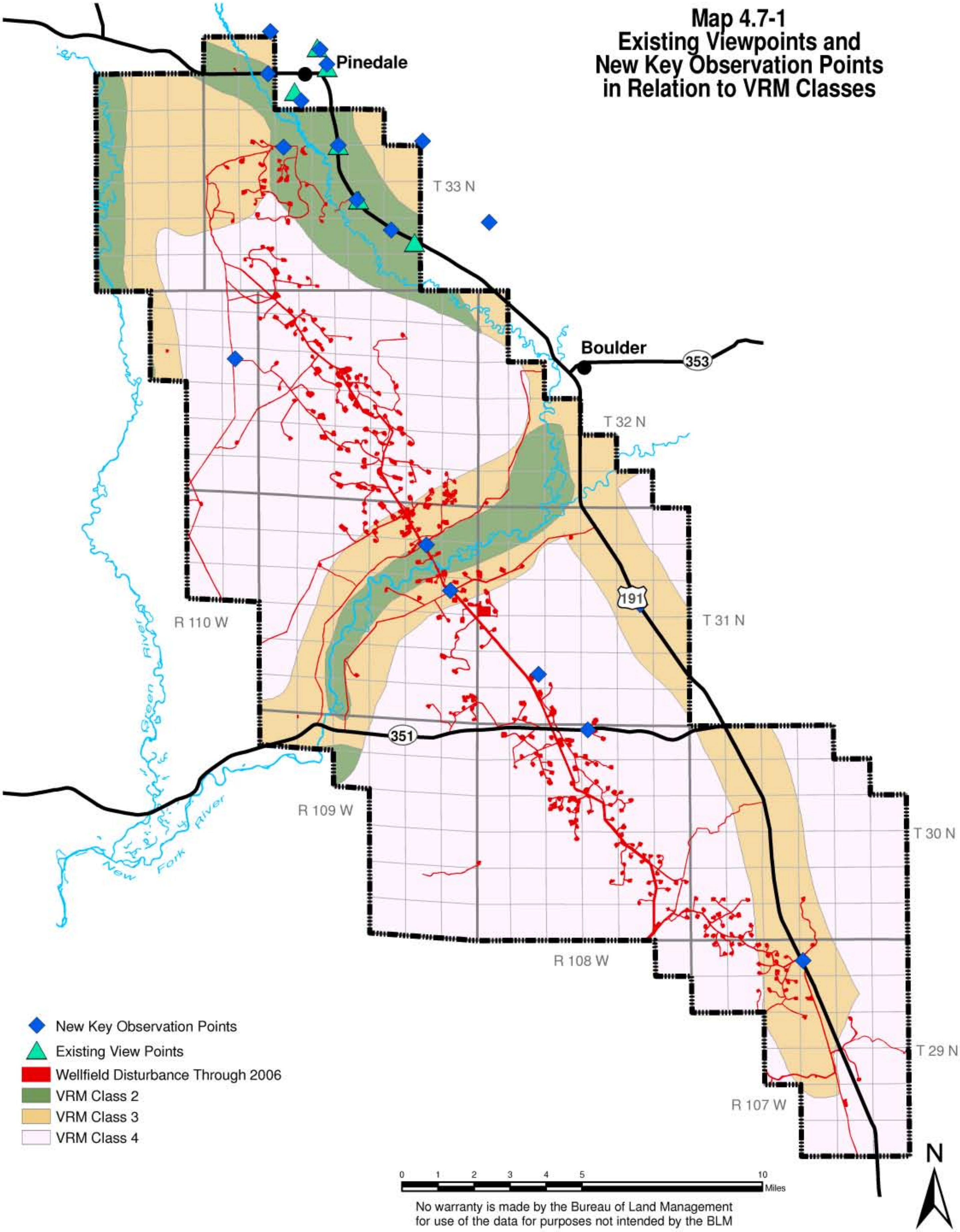
4.8.1 Scoping Issues

The BLM received scoping comments related to cultural and historic resources from the Wyoming SHPO and the OCTA. These comments focused on the need for BLM to protect cultural resources and historic trails from development impacts in the PAPA.

4.8.2 Impacts Considered in the PAPA DEIS

Because of the requirement for compliance with Section 106 of the National Historic Preservation Act (NHPA) and with the Archeological Resources Protection Act (ARPA), all areas on federal lands and minerals proposed for surface disturbance will be surveyed for cultural resources. Procedures for identifying and protecting cultural resources on private or State of Wyoming lands are not in place. Federal historic preservation requirements apply if a project involves a federal permit or authorization (e.g., a pipeline crossing on both BLM and private land). On federal lands, any undertaking by Operators would follow the BLM National Programmatic Agreement Process, as identified in BLM's State Protocol Agreement between the BLM and the Wyoming SHPO (Appendix 14), prior to any surface disturbing activity and would either avoid or protect cultural resource properties and sacred sites.

As stated in the PAPA DEIS (BLM, 1999a), the preferred strategy for treating potential adverse effects on cultural properties is "avoidance." Avoidance has been used in some circumstances


Map 4.7-1
Existing Viewpoints and
New Key Observation Points
in Relation to VRM Classes
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
New Key Observation Points
Existing View Points
Wellfield Disturbance Through 2006
VRM Class 2
VRM Class 3
VRM Class 4
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

during wellfield development through 2006. If avoidance was imprudent or unfeasible, appropriate mitigation has included excavation (data recovery), monitoring, protection barriers and signs, Native American consultation, or other physical and administrative measures. Traditional tribal elders were consulted regarding the importance of specific features identified and for their recommendations on appropriate avoidance distances. Distances were established through consultation with the Shoshone Tribe and tribal guidelines for buffer zones for development near Native American sites as described in Chapter 3 (Section 3.10).

The PAPA DEIS (BLM, 1999a) recognized that a significant impact to cultural or historical resources, as defined by 36 CFR § 800.5 (July, 1999 version) would include:

- An undertaking that alters, directly or indirectly, characteristics of a historic property that qualify the property for inclusion in the National Register (of Historic Places) in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register.
- Adverse effects on historic properties include, but are not limited to: (i) physical destruction of or damage to all or part of the property; (ii) alteration of a property, including restoration, rehabilitation, repair, maintenance, and stabilization; (iii) removal of the property from its historic location; (iv) change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance; and (v) introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features.

Significant impacts based on one or more of the criteria above have occurred. Complete documentation of all significant impacts to all affected cultural resources is available at the BLM PFO. Further, impact to cultural resources is a dynamic occurrence, with new discoveries being made.

4.8.3 Alternative Impacts

4.8.3.1 Summary of Impacts Common to All Alternatives

<u>Natural Gas Development in the PAPA</u>

A substantial amount of disturbance within the Lander Trail SRMZ and Lander Trail viewshed would occur under all Alternatives (Table 4.8-1). Disturbance would probably change the character of the Lander Trail’s use and physical features within the Trail's setting that contribute to its historic significance, a significant impact according to criteria defined by 36 CFR § 800.5, above. There would be no disturbance from well pads within the 0.25-mile buffer of the Lander Trail under any Alternative on federal lands. The only disturbance would be associated with the gas sales pipeline (7.3 acres) and other linear facilities, probably in existing corridors.

Impact to cultural resources would most likely be direct, resulting from any of the adverse effects stated above. Indirect impacts are likely if historic properties and other cultural resources are adversely affected because of increased human access and subsequent vandalism.

Table 4.8-1
Initial Surface Disturbance in Relation to the
Lander Trail SMRZ and 0.25-Mile Buffer by Alternative

Lander Trail SRMZ Category	Alternative A (acres)		Alternatives B, C , and D (acres)		Alternative E (acres)	
	Federal	Total	Federal	Total	Federal	Total
Lander Trail 0.25-mile Buffer	0.0	0.0	0.0	0.0	0.0	0.0
Lander Trail SRMZ (PAPA DEIS)	458.0	458.8	1,307.9	1,329.8	1,383.3	1,389.5
Lander Trail Viewshed (PAPA ROD)	333.6	334.4	995.0	1,016.8	1,045.7	1,051.9

Construction in archaeologically sensitive soils when the ground is frozen, or under other adverse environmental situations such as muddy site conditions, results in a high likelihood of resource impacts. If winter drilling is continued in certain areas of archaeologically sensitive soils, then the course of action should be to construct well pads and access roads in the summer and/or fall to avoid impacts that cannot be mitigated. Mitigation, most commonly done through salvage excavations, cannot take place during the winter months when the ground is frozen and often snow-covered. Under law, construction activities could be halted because of resource discoveries in the winter months, if mitigation techniques cannot take place during those times. Not only does this threaten to adversely impact the resource by prolonged exposure to extreme weather and potential vandalism or theft, it may cause additional expense to the Operator. If extensive need for winter mitigation arises, alternative methods of resource protection could be researched and implemented (Vlcek, 2006). Major finds in areas such as those at the sandy bluffs on the south side of the New Fork River and on the north and south ends of the PAPA, would continue to be impacted under all Alternatives. Wellfield disturbance in these areas would invariably result in more discoveries.

Further, with extensive surface disturbance (disturbance in many quarter-sections exceeding 50 percent) throughout the PAPA, it is likely that more major finds would be discovered under all Alternatives. Currently, there are nearly 4,141.0 acres of wellfield surface disturbance on federal lands in the PAPA, with several new major site discoveries (Chapter 3, Section 3.10.1). Each discovery has been evaluated for significance and subjected to appropriate mitigation. Additional surface disturbance on federal lands in the PAPA could result in not only several more discoveries in areas of existing development, but also discoveries in areas not known for significant archaeological resources. Overall, it is anticipated that resource discovery and damage trends would continue under all Alternatives, although exact figures are impossible to determine. Potentially, large numbers of unexpected discoveries could slow down development due to the need for increased mitigation. Currently, most mitigation occurs as excavations supervised by permitted archeologists. If several excavations are necessary within a given quarter-section, Operators may be forced to postpone construction and drilling activities.

The BLM's Practices and Restrictions for the Pinedale Anticline Project Area as they relate to cultural resources would apply to all Alternatives (Appendix 4). These standards for surface-disturbing activities tend to favor cultural resource protection in several ways. Because sites tend to be located near perennial water sources (rivers, springs), the standard avoidance buffers for perennial water also potentially benefit cultural resource protection. Similarly, restrictions on constructing with frozen materials (discussed above), along intermittent drainages and on ridge edges favors these higher site probability areas. The standards involving steep slopes, unstable soils and select wildlife restrictions (lek buffers, protecting sagebrush areas, winter ranges) are neutral from a cultural resources standpoint in that they do not bear on the presence or absence of cultural resources.

Under all Alternatives, cultural resources are managed in accordance with the Wyoming Protocol (as ratified, April, 2006) implementing the BLM National cultural resources Programmatic Agreement (Appendix 14). The “Wyoming Protocol” streamlines energy development (and other surface-disturbing activity) permitting by consolidating determinations of National Register eligibility and potential project effect onto the field office cultural resources specialist, at a local level of control. This categorical acceptance of “eligibility and effect” determinations by the Wyoming SHPO to BLM applies predominantly for prehistoric sites, i.e. sites whose significance derived from the important scientific data they possess, (i.e. “Criterion “D” sites). Cultural resources with derived significance that are associated with events that have made a significant contribution to broad patterns of history (Criterion “A” sites), or are associated with people significant in past (Criterion “B” sites) or works of a matter that possess high artistic value [rock art sites, for example] or distinctive methods of construction (Criterion “C” sites) still undergo the normal review process involving consultation among the Wyoming SHPO. If nationally significant historic properties are potentially affected (such as the Lander National Historic Trail), the Advisory Council on Historic Preservation and other Interested Parties, such as the OCTA and/or the Alliance for Historic Wyoming will enter into the consultations.

The Shell/Ultra Lander Trail Programmatic Agreement (Appendix 15) would be followed under all Alternatives. While well pad size and configuration may require the Lander Trail Programmatic Agreement to be modified or amended, preliminary consultation among the Wyoming SHPO, the National Park Service, Long Distance Trails Office, and the OCTA indicates that the original Programmatic Agreement is working well and modification or amendment could be effected with facility.

<u>Pipeline Corridors and Gas Sales Pipelines</u>

Specific Class III cultural resource inventories have not been completed in the proposed pipeline corridors. The Class III inventories will address potential impacts to and mitigation for the specific trail crossings described below. However, information compiled from inventories completed adjacent to proposed corridors indicate that impacts to cultural and historical resources would likely result from pipeline construction. An estimated 35 cultural resource sites recommended as eligible for nomination to the NRHP could be affected by construction of the two pipelines in the BCC and the single pipelines in the BFGC and OPC. An estimated 11 crossings of eligible historic trails/roads would result from construction of the proposed RVII, PBC, and Opal Loop III pipelines.

The impacts anticipated at each of the historic trail crossings are discussed by trail below. The setting for all trail segments at the proposed pipeline crossings are compromised by past and/or ongoing disturbances.

Lander Cutoff. The proposed BCC and proposed RVII and PBC pipeline alignments cross the Lander Cutoff in Section 29, T. 31 N., R. 108 W. on BLM-administered public lands. Surface disturbance in the 0.25-mile buffer of the Lander Trail would be 15.6 acres. The proposed BBC and RVII (staked) and PBC pipelines would be located on the west side of the existing pipeline corridor at the trail crossing. The area where the historic trail would be crossed by the proposed pipelines would be fenced to prohibit construction damages to the trail ruts. For each pipeline, the fences would extend a minimum of 50 feet each side of the trail center point for a total of 100 feet. A permitted archaeologist would determine the position of the fence. The crossing method (bore, HDD, or open-cut) for this trail would be decided at a later date in consultation with the PFO archaeologist.

Oregon Trail. The proposed BCC and RVII Pipeline would cross the Oregon Trail in two locations. The southernmost crossing of the Oregon Trail occurs in Section 28, T. 19 N., R. 111

W. on land owned by Anadarko Land Corporation. The area has been disturbed. The proposed RVII Pipeline is staked on the west side of the existing pipeline corridor at the historic trail crossing. The trail would be crossed by HDD and the HDD would include the crossings of the Union Pacific Mainline Railroad, State Highway 375, and the Blacks Fork River. The proposed HDD would be 1,000 feet in length. The second crossing of the Oregon Trail/Pony Express Route occurs in Section 33, T. 20 N., R. 111 W., on land owned by Uinta Development. The area has been disturbed. The proposed pipeline is staked on the west side of the existing pipeline corridor at the historic trail crossing. The pipeline would be installed using conventional ditching methods and would parallel the east edge of the existing pipeline rights-of-way. No fencing is proposed at either of the trail crossing sites. Construction would be contained within previous disturbance.

The East Bank Kinney Cutoff. The proposed BCC and RVII Pipeline would cross the East Bank Kinney Cutoff in Section 9, T. 23 N., R. 111 W., on land administered by the U.S. Bureau of Reclamation. The proposed RVII Pipeline is staked on the east side of the existing pipeline corridor at the crossing of the trail. The area where the historic trail is crossed would be fenced to prohibit construction damages to the trail ruts. The fences would extend a minimum of 50 feet on each side of the trail center point for a total of 100 feet. A permitted archaeologist would determine the location of the fencing. The trail crossing would be bored from outside the fenced areas, eliminating new impacts to the historic ruts.

The proposed OPC and Opal Loop III Pipeline would cross the East Bank Kinney Cutoff. The proposed pipeline is not staked, and therefore, specific methods of pipeline crossing have not been determined. However, approved discovery plans would be followed to minimize or avoid impacts to the historic trail.

The Baker Davis Road/Slate Creek Cutoff. The proposed BBC and RVII Pipeline would cross the Baker Davis Road/Slate Creek Cutoff in Section 34, T. 24 N., R. 111 W., on land administered by the U.S. Bureau of Reclamation. The proposed RVII Pipeline is staked on the east side of the existing pipeline corridor at the trail crossing. The area where the historic trail would be crossed would be fenced to prohibit construction damage to the trail ruts. The fences would extend a minimum of 50 feet on each side of the trail center point for a total of 100 feet. A permitted archaeologist would determine the position of the fence. A bore under the historic trail from outside the fenced areas would eliminate new impacts to the historic ruts.

The proposed OPC and Opal Loop III Pipeline would cross the Baker Davis Road/Slate Creek Cutoff. The proposed pipeline is not yet staked and specific methods of pipeline crossing have not been determined. However, approved discovery plans would be followed to minimize or avoid impacts to the historic trail.

Sublette Cutoff. The proposed pipeline would cross the Sublette Cutoff in Section 9, T. 26 N., R. 111 W., on BLM-administered public land. The proposed RVII Pipeline is staked on the east side of the existing pipeline corridor at the trail crossing, east of the County Line Road. The area where the historic trail is crossed by the proposed pipeline would be fenced to prohibit construction damages to the trail ruts. The fences would extend a minimum of 50 feet on each side of the trail center point for a total of 100 feet. A permitted archaeologist would determine the position of the fence. A bore under the historic trail from outside the fenced areas would eliminate new impacts to the historic ruts.

4.8.3.2 Alternative A (No Action Alternative)

Wellfield development in the PAPA under the No Action Alternative would generate 4,123.1 acres of initial surface disturbance, which includes new well pads, pipelines, and roads. Because surface disturbing activities are directly associated with impacts to cultural resources, it is likely that these resources, especially archaeological artifacts, would continue to be impacted in much the same way and at similar rates as they have since the issuance of the PAPA ROD.

The No Action Alternative would disturb 459 acres in the Lander Trail SRMZ and 334 acres in the trail viewshed (Table 4.8-1). This Alternative continues a trend of minimal new surface disturbance along the Lander Trail although it would continue to alter the Trail's historically significant setting.

The Sensitive Viewshed and Mesa Breaks management areas (MA 4 and MA 2, respectively) near Stewart Point in the northern portion of the PAPA would remain protected under the No Action Alternative. This region of the PAPA has been documented as having potential for archaeological discoveries (see discussion in Chapter 3). Although year-round development would continue near these areas, there would be no additional well pads allowed under BLM's 2004 Decision Record (BLM, 2004a), and further surface disturbance would be limited to expansion of existing well pads.

4.8.3.3 Alternative B

Impacts to cultural and historic resources are based largely on surface disturbance, therefore, with 12,885.6 acres of initial surface disturbance under Alternative B, it is expected that cultural resources, especially archeological artifacts would continue to be affected but at an even greater rate than they are currently. Unexpected discoveries would also occur at a greater rate. Unexpected discoveries and subsequent resource damage could significantly increase in areas of large, concentrated surface disturbances (Vlcek, 2006).

Development under Alternative B is expected to bring substantial surface disturbance within the Lander Trail SRMZ and trail viewshed. This Alternative would initially disturb 1,307.9 acres within the SRMZ on federal lands and 995.0 acres within the Lander Trail Viewshed on federal lands (Table 4.8-1). The level of development could adversely impact the Trail's setting and historical significance, according to the criteria described above. Additionally, development under Alternative B would likely lead to considerably more surface disturbance in the Blue Rim Area, the Mesa Breaks, and the terraces of the New Fork River. These areas are considered likely to contain significant historic and archeological sites.

4.8.3.4 Alternative C

Implementation of Alternative C would result in the same initial surface disturbance as Alternative B and it is reasonable that the disturbance would occur in the same location and would affect the same cultural and historic resources (Table 4.8-1).

4.8.3.5 Alternative D

Implementation of Alternative D would result in the same initial surface disturbance as Alternatives B and C and it is reasonable that the disturbance would occur in the same location and would affect the same cultural and historic resources (Table 4.8-1).

Under Alternative D, there would be no additional surface disturbance in federal suspended and term NSO leases in the Flanks, at least for the first 5 years.

4.8.3.6 Alternative E

Alternative E would carry forward the Management Areas established in the PAPA ROD (BLM, 2000b). For cultural and historic resources, this would potentially lessen impacts in the areas of the Blue Rim, Mesa Breaks, and the Sensitive Viewshed Area near Stewart Point. Alternative E has further restrictions on surface disturbance mainly in the Flanks and Buffer Area as shown in Table 2.4-13 in Chapter 2 and Appendix 13. Surface disturbance under Alternative E would initially disturb 1,383.3 acres in the Lander Trail SRMZ and 1,045.7 acres in the Lander Trail Viewshed on federal lands (Table 4.8-1).

4.8.4 Cumulative Impacts

The CIAA for cultural and historic resources in the PAPA DEIS (BLM, 1999a) was an approximate 330,740-acre area which included the PAPA and a surrounding 2-mile buffer. The buffer was based on the assumption that roads could be constructed anywhere within the PAPA, and 2 miles past its boundaries would provide a reasonable limit to the distance that cultural or historic artifacts may be impacted by visitors to the PAPA. As of 2006, the majority of development and subsequent surface disturbance and roads have occurred along the Anticline Crest. It is projected, under all Alternatives, that this would continue to be the case through full-field development. However, development since the PAPA DEIS and ROD has directly increased access to cultural resources and some instances of looting have been documented. Because of this, coupled with the region's population expansion, the expected subsequent increase in impacts to cultural resources warrants that the CIAA remains the same size (Vlcek, 2007).

In the PAPA, surface disturbance is the major factor determining adverse impacts for cultural and historic resources. Estimated cumulative surface disturbance within the Lander Trail SMRZ and trail viewshed is summarized in Table 4.8-2. It is projected that cumulative impacts to the Lander Trail would result in significant degradation to its setting and use under all action Alternatives. Further, under all Alternatives, cumulative impacts would increase with increased surface disturbance and human activity, and significant cumulative effects to cultural resources could occur if undocumented and unrecognized NRHP-eligible sites are impacted and unmitigated. Because of the unpredictable nature of archaeological discoveries made during construction in the PAPA, adverse effects could occur on sites not identified by customary inventory and evaluation work.

Inventory, recording, and data recovery projects triggered by surface disturbance would continue to increase the cultural resource database, likely improving future cultural resource management decisions. In the last few years, several major new archeological discoveries have been documented, greatly increasing knowledge of the prehistoric period of the PAPA and Upper Green River Basin. Generally, the greater the increase in permitted activity, the greater the data acquisition of cultural resource information.

Table 4.8-2
Cumulative Surface Disturbance in Relation to the Lander Trail SMRZ and 0.25-Mile Buffer by Alternative

Lander Trail SRMZ Category	Existing Non Wellfield Disturbance (acres)	Existing Wellfield Disturbance (acres)	Proposed Gas Sales Pipeline Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative		
				Alternative A	Alternatives B, C, and D	Alternative E
Lander Trail 0.25-mile Buffer	6.6	49.8	15.6	72.0	72.0	72.0
Lander Trail SRMZ (PAPA DEIS)	105.3	455.8	97.9	1,117.8	1,988.8	2,048.5
Lander Trail Viewshed (PAPA ROD)	82.2	343.7	55.6	815.9	1,498.3	1,533.4

4.8.5 Cultural and Historic Resources Additional Mitigation Opportunities

No additional mitigation opportunities for cultural and historic resources have been identified.

4.9 AIR QUALITY

4.9.1 Scoping Issues

Air quality related concerns have increased in the Upper Green River Basin, including Pinedale, as natural gas development continues in the PAPA and in the Jonah Field. Because of this awareness, a number of comments were received during scoping. They are summarized below:

1. There should be a detailed air quality analysis including a cumulative analysis for southwest Wyoming.
2. Utilize most recent modeled and monitored ozone concentrations in the Pinedale area to address regional haze and to determine compliance with National Ambient Air Quality Standards.
3. Model and disclose impacts to PSD Class I and sensitive PSD Class II areas by winter drilling, completions, and flaring in the PAPA and in the cumulative impact analysis area.
4. Compare emissions estimated from the original PAPA EIS to those from the proposed action.
5. Address cumulative impacts to high mountain lakes and downstream impact to trout and water users.
6. Provide evaluations of how effective the ASU Year-Round Drilling Demonstration Project emission mitigation has been and effectiveness of the Naughton Power Plant Unit 3 retrofit on regional air quality.
7. Concern regarding emissions from flaring operations.
8. Discuss use of low emission drilling rigs, best available technology, and other mitigation measures to comply with Wyoming Department of Environmental Quality regulations.
9. Address trade-offs between directional drilling and increased air quality impact.
10. Increase air quality monitoring.

4.9.2 Impacts Considered in the PAPA DEIS

An Air Quality Impact Assessment Protocol was developed for the PAPA DEIS (BLM, 1999a). The Protocol specified the methodologies for quantifying potential air quality impacts from the project and surrounding development. The protocol was prepared with input and review from the BLM, EPA, USFS, NPS, and WDEQ-AQD, thereby ensuring that the assessment methodology would be acceptable to the federal land managers. The criteria for evaluating the significance of the potential air quality impacts were also addressed. The PAPA DEIS stated significant impacts to air quality would result from project-related activities if:

- PSD increments for Class I and Class II areas have been exceeded;
- National Ambient Air Quality Standards or Wyoming Ambient Air Quality Standards have been exceeded;
- increased toxin concentrations are above designated thresholds;
- lifetime incremental increase in cancer risk of one additional person in 1 million from the most likely exposure scenario is exceeded;
- visibility impacts to sensitive areas are above the designated 0.5 and 1.0 dv change thresholds; or
- change in sensitive lake acid neutralizing capacity is above the designated 10 percent level of acceptable change.

According to the significance criteria in the PAPA DEIS (BLM, 1999a), significant impacts to air quality have occurred. Visibility impacts to sensitive areas are above the designated 0.5 and 1.0 dv change thresholds.

4.9.3 Alternative Impacts

4.9.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development in the PAPA

Direct, indirect, and cumulative air quality impacts were analyzed to predict maximum potential near-field (surrounding the PAPA) and far-field (PSD Class I and sensitive PSD Class II areas) ambient air pollutant concentrations, as well as maximum impacts to visibility (regional haze), and atmospheric deposition (acid rain) impacts. Analyses were also performed to predict maximum in-field (within the PAPA) pollutant concentrations and maximum mid-field (regional communities of Boulder, Cora, and Pinedale) visibility impacts.

Air quality impacts from the project would occur from pollutants emitted during construction (due to potential surface disturbance by earthmoving equipment, vehicle traffic fugitive dust, well completion and testing, and drilling rig and vehicle engine exhaust) and production (production equipment, compressor engine exhausts, vehicle traffic engine exhausts, and fugitive dust). Pollutants emitted from these activities include NO_x, CO, SO_2, PM_{10}, and $PM_{2.5}$, VOCs, and HAPs.

Ozone may develop from NO_x and VOC emissions. The Draft SEIS (BLM, 2006a) included an ozone modeling analysis that utilized the CALGRID model to estimate ozone formation from project sources. This Final SEIS includes a more refined modeling analysis for ozone using the CAMx modeling system.

In the PAPA, greenhouse gases are emitted from three main sources: internal combustion engines, combustion of fuel or waste gases, and vented gases. CO_2 is the main emission from internal combustion engines (diesel, gasoline, natural gas), the combustion of fuel gas in various production process burners/heaters, and the combustion of waste gases for safety or WDEQ-AQD requirements. Currently, WDEQ-AQD does not have specific rules regulating greenhouse gas emissions.

The assessment of greenhouse gas emissions and climate change is still in its formative phase; therefore, it is not yet possible to know with confidence the net impact to climate. However, the Intergovernmental Panel on Climate Change (IPCC, 2007) recently concluded that “warming of the climate system is unequivocal” and “most of the observed increase in globally average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic [man-made] greenhouse gas concentrations.”

The lack of scientific tools designed to predict climate change at regional or local scales limits the ability to quantify potential future impacts. However, potential impacts to air quality due to climate change are likely to be varied. For example, if global climate change results in a warmer and drier climate, increased particulate matter impacts could occur due to increased wind blown dust from drier and less stable soils. Cool season plant species’ spatial ranges are predicted to move north and to higher elevations, and extinction of endemic threatened/endangered plants may be accelerated. Due to loss of habitat, or due to competition from other species whose ranges may shift northward, the population of some animal species may be reduced. Less snow at lower elevations would be likely to impact the timing and quantity of snowmelt, which, in turn, could result in a longer wildfire season. Greenhouse gas emissions are a concern; however, because of these limitations and because they are outside the scope of this analysis, they were not analyzed in this Final SEIS.

This air quality impact assessment is based on the operations and engineering data and assumptions available at the time of the analysis, the best available meteorology data, and currently accepted dispersion modeling procedures, as well as professional and scientific judgment. Assumptions representing most likely operating conditions were incorporated into the analysis whenever possible. For example, compression in the field was assumed to operate at 90 percent of fully permitted capacity, and drilling rig engines were assumed to operate at an average of 42 percent of maximum capacity. In cases where operating projections were not provided by the Proponents, parameters were assumed to occur at maximum proposed levels. For example, impact assessments assume that all proposed wells would be productive (no dry holes).

Regulatory Authority. Air pollution impacts are limited by state and federal regulations, standards, and implementation plans established under the Clean Air Act and administered by the applicable air quality regulatory agency (WDEQ-AQD and EPA). The states of Utah, Colorado, and Idaho have similar jurisdiction over potential air pollutant emissions sources in those states, which can have a cumulative impact when combined with WDEQ-AQD regulated sources. The applicable air quality regulatory agencies have the primary authority and responsibility to review permit applications and to require emission permits, fees, and control devices prior to construction and/or operation. The U.S. Congress (through the Clean Air Act Section 116) also authorizes local, state, and tribal air quality regulatory agencies to establish air pollution control requirements of equal or greater stringency than federal requirements. Proposed emission sources are required to undergo a permit review by applicable air quality regulatory agencies (including state, tribal, and/or EPA) before construction can begin. The agencies review the proposed air pollutant emission sources and, depending upon the magnitude of emissions and other factors, the air quality regulatory agencies may require additional site-specific air quality analysis and/or additional emission control measures. The measures may include a BACT analysis and determination to ensure protection of air quality.

Although WDEQ-AQD has the regulatory authority for air quality in Wyoming, BLM also has responsibility in regard to air quality. For example, under the Federal Land Policy Management Act (FLPMA) and the Clean Air Act, the BLM cannot authorize activities that do not conform to all applicable local, state, tribal, and federal air quality laws, statutes, regulations, standards, and implementation plans. An extensive air quality impact assessment technical support document was prepared to analyze potential impacts from the Alternatives, as well as other reasonably foreseeable emission sources. Additional detail regarding this air quality evaluation is provided in the Air Quality TSD.

The significance criteria for potential air quality impacts include state and federally-enforced legal requirements to ensure that air pollutant concentrations remain within specific allowable levels. Legal requirements include the NAAQS and WAAQS, which set maximum limits for several air pollutants, and PSD increments, which limit the incremental increase of certain air pollutants (including NO_2, PM_{10}, and SO_2) above legally defined baseline concentration levels. These standards and increments are presented in Table 3.11-1 in Chapter 3.

Where legal limits have not been established, the BLM uses best available scientific information to identify thresholds of significant adverse impacts. Thresholds or levels of concern are identified for HAP exposure, incremental cancer risks, a “just noticeable change” in potential visibility impacts, and potential atmospheric deposition impacts. These thresholds or levels of concern are described later in this chapter.

Impact Analysis. The assessment of direct project impacts includes near-field analyses and far-field analyses which were completed separately for the No Action Alternative, Alternative B, and Alternative C. Alternative C is similar to Alternative B; however, it includes two mitigation options (Phase I and Phase II) to reduce air quality impacts. The mitigation options for Alternative C are discussed in Section 4.9.3.4.

All near-field analyses used the AERMOD model; the far-field analyses used the CALPUFF model. In-field modeling (within the PAPA) and mid-field modeling (regional community locations) were part of the far-field analyses. A modeling analysis to assess potential ozone formation from Alternative B and Alternative C sources was performed using the CAMx modeling system was performed to estimate ozone formation from Alternative B and Alternative C sources. Detailed information regarding the modeling methodologies used in the near-field, far-field, and ozone analyses is provided in the Air Quality TSD.

Near-Field Analysis. The near-field analysis includes impact assessments of NO_2, CO, SO_2, PM_{10}, and $PM_{2.5}$ for comparison to applicable ambient air quality standards and for comparison to PSD increments. It also includes assessments of HAP impacts for comparison to applicable health-based levels for non-cancer compounds and cancer risks for carcinogens. The EPA guideline dispersion model, AERMOD was used to assess near-field impacts of NO_2, CO, SO_2, PM_{10}, and $PM_{2.5}$ and to estimate short-term and long-term HAP impacts. AERMOD was applied using 1 year of meteorological data that was collected during 1999 and 2000 in the Jonah Field.

Ambient Air Quality Standards. Impacts were assessed from the phases of well pad construction or field production that produce the highest emissions. Near-field analyses for NO_x, CO, SO_2, PM_{10}, and $PM_{2.5}$ focused on localized impacts from construction, drilling, and compression. Maximum predicted concentrations of these criteria pollutants were added to the ambient background pollutant concentrations for comparison to WAAQS and NAAQS and are provided in Section 4.9.3.2 and in Appendix 18. Results in Appendix 18 are also presented as the maximum impacts expressed as a percentage of the NAAQS and WAAQS.

Comparison to PSD Increments. The near-field analyses include impact assessments for comparison to PSD increments. Ambient background concentrations were not added to modeled concentrations for comparison to PSD Class II increments. These comparisons are shown in Section 4.9.3.2 and in Appendix 18.

HAP Analysis. The near-field analysis also includes assessments of HAP impacts for comparison to applicable health-based levels for non-cancer compounds and cancer risks for carcinogens. The near-field analysis assesses direct impacts in the immediate vicinity of project activities resulting from a single phase and multiple phases of construction or production reflective of maximum emissions. Maximum acute (short-term), long-term (chronic) health-based, and long-term (chronic) cancer risk impacts were modeled. The model used project Alternative field-wide HAP emissions and nearest residence locations within and near the PAPA. Modeled HAP impacts representative of all project Alternatives is provided in Section 4.9.3.2 and in Appendix 18.

Potential maximum acute (short-term; 1-hour) HAP concentrations were compared with the acute Reference Exposure Levels (RELs) (EPA, 2007a). RELs are defined as concentrations at or below which no adverse health effects are expected. RELs are not available for ethylbenzene and n-hexane; instead, the available Immediately Dangerous to Life or Health divided by 10 (IDLH/10) values were used. The IDLH values are determined by the National Institute for Occupational Safety and Health (NIOSH) and were obtained from EPA's Air Toxics Database (EPA, 2007a).

Potential long-term (annual) HAP concentrations were compared to non-carcinogenic Reference Concentrations for Chronic Inhalation (RfCs) (EPA, 2007b). An RfC is defined by EPA as the daily inhalation concentration at which no long-term adverse health effects are expected.

Long-term exposures to emissions of suspected carcinogens (benzene and formaldehyde), were evaluated based on estimates of the increased latent cancer risk over a 70-year lifetime. This analysis presents the potential incremental risk from these pollutants and does not represent a total risk analysis. The cancer risks were calculated using the maximum predicted annual concentrations and EPA's chronic inhalation unit risk factors (URF) for carcinogenic constituents (EPA, 2007b). Estimated cancer risks were evaluated based on the Superfund National Oil and Hazardous Substances Pollution Contingency Plan (EPA, 1990), where a cancer risk range of 1 to 100 x 10^{-6} is generally acceptable. Two estimates of cancer risk were made; one that corresponds to a most-likely-exposure (MLE) over a national residency average of 9 years with some time spent away from home, and one reflective of the maximally-exposed-individual (MEI) residing at one location for a lifetime with no time spent away from home (EPA, 1993). The MEI estimate is adjusted for the expected 60-year LOP. For each constituent, the cancer risk is computed by multiplying the maximum predicted annual concentration by the URF and by the overall exposure adjustment factor. The cancer risks for both constituents are then summed to provide an estimate of the total inhalation cancer risk.

When reviewing predicted near-field impacts, it is important to understand that results reported reflect the maximum pollutant emission rates calculated for the field. The resulting concentrations are combined with monitored background ambient pollutant concentrations. Maximum monitored background air pollutant concentrations were assumed to occur throughout the LOP at all locations in the region year-round. In addition, the maximum predicted air quality impacts from project emission sources would occur near the PAPA. Because impacts typically lessen with distance from an emissions source, impacts at locations more distant from the PAPA would be less than the predicted maximum concentrations. Finally, total air pollutant concentrations for comparison to WAAQS and NAAQS were assumed to be the sum of the maximum modeled concentration and the maximum background concentration. This methodology is used for both long-term and short-term averaging periods. For short-term averaging periods, the maximum concentrations may occur under very different meteorological conditions and may not occur simultaneously.

Far Field Analysis. The far-field analysis utilized the EPA CALMET/CALPUFF modeling system to predict maximum potential air quality impacts at mandatory federal PSD Class I and other sensitive PSD Class II areas, as well as designated acid-sensitive lakes. This analysis includes assessments of ambient air quality standards, PSD increments, visibility, and acid deposition. The far-field analysis includes in-field (within the PAPA) analyses which are additional near-field impact assessments of field-wide source emissions for comparison to applicable ambient air quality standards and to PSD increments, and a mid-field (regional community) visibility impact assessment. The mid-field visibility assessment includes the regional communities of Boulder, Cora, and Pinedale. Although these communities are classified as sensitive PSD Class II areas, no visibility protection exists under local, state, or federal law.

PSD Class I areas and sensitive PSD Class II areas analyzed in the far-field analyses include the following:

- Bridger Wilderness Area (Class I),
- Fitzpatrick Wilderness Area (Class I),
- North Absaroka Wilderness Area (Class I),
- Teton Wilderness Area (Class I),
- Washakie Wilderness Area (Class I),
- Grand Teton National Park (Class I).
- Yellowstone National Park (Class I),
- Gros Ventre Wilderness Area (Class II),

- Popo Agie Wilderness Area (Class II), and
- Wind River Roadless Area (Class II).

Seven lakes within the PSD Class I and sensitive PSD Class II areas were designated as being sensitive to acid deposition. These lakes are those for which the most recent and complete data are available and include the following:

- Black Joe Lake in the Bridger Wilderness Area,
- Deep Lake in the Bridger Wilderness Area,
- Hobbs Lake in the Bridger Wilderness Area,
- Lazy Boy Lake in the Bridger Wilderness Area,
- Upper Frozen Lake in the Bridger Wilderness Area,
- Ross Lake in the Fitzpatrick Wilderness Area, and
- Lower Saddlebag Lake in the Popo Agie Wilderness Area.

The far-field analysis uses 3 years (2001, 2002, and 2003) of hourly windfields which were developed with the CALMET meteorological model for the modeling domain (Map 3.11-1 in Chapter 3). The CALPUFF dispersion model was used to model project Alternative NO_x, SO_2, PM_{10}, and $PM_{2.5}$ emissions for each year of meteorology to estimate maximum potential air quality impacts. Detailed information regarding the modeling methodologies used in the analysis is provided in the Air Quality TSD.

Project emissions inventories were developed for the No Action Alternative and Alternative B. Annual emissions estimates were determined for each year over the LOP for both the No Action Alternative and Alternative B based on estimates of field development provided by the Operators. Modeling scenarios were developed for each project Alternative for the year with the maximum emissions. The maximum emissions scenarios include both construction and production activities. The maximum emissions year under the No Action Alternative is year-2007 and for Alternative B the maximum emissions are expected to occur in year-2009. For comparison purposes, an analysis of the PAPA in full production, after all construction activities have ceased (year-2026), is also presented for Alternative B. The air emissions modeled for project sources in the far-field analysis are presented in Table 4.9-1 and complete emissions inventories are provided in the Air Quality TSD (Appendices F and G).

Table 4.9-1
Project and Non-Project Emissions (tpy) included in Far-field Analysis

Source Category	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Project Sources				
No Action Alternative	6,253.2	70.8	1,567.0	521.0
Proposed Action Alternative	5,885.1	79.3	1,158.3	469.0
Proposed Action Alternative – Maximum Field Production	2,424.9	2.5	1,149.2	391.4
Non-Project Sources				
RFD[1]	6,465.3	406.1	2,923.9	802.8
State-permitted and RFFA[1]	-2,574.6	110.7	476.4	476.4
[1] RFD and RFFA are described in Section 4.9.4.				

Comparison to Ambient Air Quality Standards and PSD Increments. The far-field analyses include impact assessments for comparison to applicable ambient air quality standards and for comparison to PSD increments. Predicted concentrations were added to the ambient background pollutant concentrations for comparison to the WAAQS and NAAQS. Ambient background concentrations were not added to modeled concentrations for comparison to PSD

Class I and II increments. These comparisons are shown in Section 4.9.3.2 and in Appendix 18.

Visibility. Far-field analyses assess potential change to regional haze at PSD Class I and sensitive PSD Class II areas. Regional haze is caused by light scattering and light absorption by fine particles and gases. Potential changes to regional haze were calculated in terms of a perceptible "just noticeable change in visibility" when compared to background conditions, expressed in dvs. The BLM considers a 1.0 dv change to be a significance threshold for visibility impairment, although there are no applicable local, state, tribal, or federal regulatory visibility standards. Other federal agencies use a 0.5 dv change as a screening threshold for significance. The USFS and NPS compare direct project impacts to the 0.5 dv level, and those comparisons are included in the Air Quality TSD.

Predicted changes in regional haze at PSD Class I and sensitive PSD Class II areas were estimated by comparing CALPUFF modeled concentration impacts to background visibility conditions representative of each PSD Class I or sensitive PSD Class II area. At the request of the BLM, WDEQ-AQD, and USFS, three separate visibility calculation methods were performed. Two additional visibility calculation methods were also performed (VISTAS, 2006). These methods follow recent CALPUFF modeling guidance for BART analyses developed for the VISTAS RPO. The BLM and USFS requested methods that use visibility values provided in the FLAG Report for each PSD Class I area to represent natural background visibility. The WDEQ-AQD requested a method that uses representative monitoring data, for the quarterly average of the 20 percent best visibility days, collected from the IMPROVE network for the time period (2000 to 2004). This coincides with the time period that will be used to establish "baseline conditions" under the EPA Regional Haze Rule (EPA, 2003a). The two BART methods use background visibility conditions representative of each PSD Class I area as provided in the Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule (EPA, 2003b). Visibility impacts for the calculation method requested by BLM are presented in Section 4.9.3.2 and in Appendix 18. These are compared to a 1.0 dv change, the BLM's significance threshold for visibility impairment. All other visibility calculation methods and comparisons are detailed and presented in the Air Quality TSD.

Acid Deposition. Far-field analyses assess potential change to acid deposition and potential increase in acidification of designated acid-sensitive lakes within the PSD Class I and sensitive PSD Class II areas. The USFS (Fox et al.,1989) has defined thresholds below which no adverse impacts from acid deposition are likely; however, the USFS has concerns that these deposition thresholds are set too high (Svalberg, 2006). These thresholds (herein referred to as levels of concern), defined as 3 kg/ha-yr for nitrogen and 5 kg/ha-yr for sulfur, are used for comparison of potential impacts from direct project impacts combined with background deposition values. CALPUFF-predicted nitrogen and sulfur deposition impacts combined with background deposition values were compared to LOCs and are provided in Section 4.9.3.2 and in Appendix 18. The NPS (2001) has identified Deposition Analysis Threshold (DAT) for total nitrogen and sulfur deposition in the western U.S. as 0.005 kg/ha-year for both nitrogen and sulfur. The DAT is used as an analysis threshold for evaluating potential impacts from project-related emissions. Comparisons of deposition impacts to the DAT are provided in the Air Quality TSD. The USFS Rocky Mountain Region has developed a screening method (USFS, 2000) that identifies a LAC in lake chemistry. The LACs are 1) no more than a 10 percent change in ANC for lakes with an existing ANC greater than 25 µeq/l and 2) no more than a 1 µeq/l change for extremely acid-sensitive lakes where the existing ANC is less than or equal to 25 µeq/l. Of the seven lakes designated by the USFS as acid-sensitive, Upper Frozen and Lazy Boy lakes are considered extremely acid-sensitive. Predicted nitrogen and sulfur deposition values at acid-sensitive lakes were used to estimate change in ANC for comparison to LAC and are provided in Section 4.9.3.2 and in Appendix 18.

In-field Modeling. In-field analyses are additional near-field impact assessments of field-wide source emissions for comparison to applicable ambient air quality standards and to PSD increments and are provided in Section 4.9.3.2 and in Appendix 18.

Mid-Field Modeling. Predicted changes to regional haze resulting from project source emissions were estimated for the regional community locations (Boulder, Cora, and Pinedale). Model predicted concentration impacts and recent (year 2005-2006) background visibility data collected at Boulder were used to estimate potential visibility impairment in these residential locations. Predicted visibility impacts were compared to the BLM 1.0 dv threshold and are provided in Section 4.9.3.2 and in Appendix 18.

Ozone Analysis. An analysis of potential ozone formation from project Alternative sources was performed using the CAMx photochemical grid model. Maximum emissions scenarios for Alternative B and Alternative C (with Phase II mitigation) were modeled. A 12 kilometer (km) grid with a refined 4 km nested grid (12/4 km) was used for the modeling domain. The CAMx modeling system was run for the year-2002 meteorological year with the 4 km grid focused on southwestern Wyoming (Map 4.9-1). Hourly windfields developed for the modeling domain with the CALMET and MM5 meteorological models were used for the ozone modeling analysis.

The CAMx analysis uses the Western Regional Air Partnership (WRAP) year-2002 emissions database in addition to project and cumulative emissions in southwest Wyoming and vicinity for simulating ozone impacts. Pollutants modeled for estimating ozone formation include NO_x, CO, and VOCs. Cumulative emission sources include state-permitted projects, reasonable foreseeable future actions (RFFA), and reasonably foreseeable development (RFD) located within the model domain. The emissions inventories are described in the Air Quality TSD.

The ozone impact assessment includes two tests for determining compliance with the ozone NAAQS and WAAQS. The first approach follows current EPA guidance for estimating potential 8-hour ozone concentrations for determining attainment (EPA, 2007c), and the second approach uses the absolute model predictions and compares the modeled fourth-highest 8-hour concentrations with the NAAQS and WAAQS.

The EPA guidance method for ozone modeling compliance demonstrations involves using measured ozone concentrations collected at representative ambient monitoring locations along with modeled ozone concentrations from base case emissions and from future emissions scenarios. The ratios of the future predicted concentrations and the base case predicted concentrations are applied to the measured ozone concentrations to determine future year ozone concentration impacts. Compliance demonstrations with the NAAQS and WAAQS are determined by comparing the “scaled” background ozone concentrations to the 8-hour NAAQS and WAAQS.

Ambient ozone concentrations, in the vicinity of the PAPA, collected at locations near Boulder, Daniel, within the Jonah Field, and at Pinedale near the Bridger Wilderness Area were used in this analysis.

The WRAP year-2002 emissions were modeled with CAMx to determine base case modeled ozone impacts. Future year ozone impacts for Alternative B and Alternative C (with Phase II Mitigation) were determined by modeling the emissions for each Alternative with WRAP 2002 emissions and other cumulative emissions. Concentration ratios based on the future year modeling of the Alternatives and base case modeling were determined and applied to the background ozone concentrations for each of the modeled project Alternatives.

Map 4.9-1
Modeling Domain for the Pinedale Anticline Ozone Analysis

No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM

The absolute model prediction compliance test included modeling the WRAP year-2002 emissions along with Project Alternative and other cumulative emissions with CAMx and determining the maximum fourth highest 8-hour ozone concentrations.

The estimated maximum predicted ozone impacts for the two modeling analyses, along with comparisons to the 8-hour ozone NAAQS and WAAQS, are shown in Table 4.9-2. The maximum predicted ozone impacts using the EPA guidance approach occur near the PAPA.

The maximum predicted ozone impacts for the absolute model prediction test occur in northern Colorado away from the PAPA, and these impacts do not likely result from project emissions. Detailed information regarding the modeling methodologies used for these analyses is provided in the Air Quality TSD.

Table 4.9-2
Maximum Modeled 8-hour Ozone Concentrations

Pinedale Project Alternative	EPA Guidance Approach (ppb)	Absolute Model Prediction (ppb)	8-Hour Ozone NAAQS/WAAQS (ppb)
Alternative B	78.2	83.8	85 (75) [1]
Alternative C (with Phase II Mitigation)	76.5	83.8	85 (75) [1]
[1] Revised NAAQS effective May 27, 2008.			

This Final SEIS ozone air quality analysis was conducted under NEPA for the purposes of allowing the BLM to evaluate and disclose potential environmental impacts from the project. WDEQ-AQD has embarked on further evaluation of ozone formation in the Upper Green River Basin, including the PAPA, through a field study and modeling project to understand previously monitored elevated ozone events and gather additional information. It should be noted that to date, there is no finding of an ozone air quality standard violation at the monitoring sites adjacent to the PAPA. The results of the field study and modeling project would form the basis for WDEQ-AQD to develop strategies to manage ozone formation in the Upper Green River Basin to ensure that the area remains in compliance with the WAAQS and NAAQS for ozone.

Since the Revised Draft SEIS was released for public comment, 2007 BACT requirements have been implemented, which requires full control of production emissions associated with all wells. This will reduce emission levels compared to the model inventory.

Pipeline Corridors and Gas Sales Pipelines

Construction of the proposed gas sales pipelines would result in intermittent and short-term emissions from the operation of diesel-fired heavy construction equipment.

While air emissions from fugitive dust and diesel combustion could occur at increased levels at locations adjacent to construction and development areas of these linear projects, potential impacts would be temporary and occur in isolation, and would not cause or significantly contribute to a violation of any applicable ambient air quality standard, or significantly impact AQRVs.

4.9.3.2 Alternative A (No Action Alternative)

Near-field Impacts. As shown in Appendix 18 (Tables 18.1 through 18.5), predicted near-field pollutant concentrations from the No Action Alternative sources are below the applicable WAAQS and NAAQS. Model-predicted NO_2 concentrations are above the PSD Class II increment. All NEPA PSD demonstrations are for information purposes only and do not constitute a regulatory PSD increment consumption analysis.

The predicted acute and chronic (long-term) impacts are below applicable health-based levels for non-cancer compounds (Table 18.5). Under both the MLE and MEI scenarios, the estimated incremental and combined cancer risk associated with long-term exposure to benzene and formaldehyde fall at the lower end of the 1 to 100 x 10^{-6} cancer risk range (Table 18.5).

Far-field Impacts. Predicted pollutant concentrations under the No Action Alternative are below applicable ambient air quality standards (Tables 18.8 through 18.11).

Predicted impacts are below the applicable PSD increments (Tables 18.12 through 18.14).

Visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from No Action Alternative source emissions (Table 18.16) are predicted to be above the "just noticeable visibility change" 1.0 dv threshold at the following locations:

- Bridger Wilderness Area 62 days,
- Fitzpatrick Wilderness Area 8 days,
- Grand Teton National Park 2 days,
- Gros Ventre Wilderness Area 6 days,
- Popo Agie Wilderness Area 12 days,
- Teton Wilderness Area 1 day,
- Washakie Wilderness Area 2 days, and
- Wind River Roadless Area 9 days.

There are no predicted impacts above the 1.0 dv threshold at any of the other analyzed sensitive areas.

Predicted maximum deposition impacts from the No Action Alternative (Table 18.18 and Table 18.19) are well below the 3 kg/ha-yr (nitrogen)and 5 kg/ha-yr (sulfur) LOC at all PSD Class I and sensitive PSD Class II areas. The No Action Alternative source emissions do not result in a predicted increase in ANC above the LAC at any of the designated acid-sensitive lakes (Table 18.20).

<u>In-field Impacts</u>. Predicted project-related impacts are below applicable ambient air quality standards (Table 18.15). Annual NO_2 concentrations are above the applicable PSD Class II increment. Modeled PM_{10} impacts are above the 24-hour PM_{10} increment and below the annual increment. Predicted SO_2 concentrations are below the applicable SO_2 increments. All NEPA PSD demonstrations are for information purposes only and do not constitute a regulatory PSD increment consumption analysis.

<u>Mid-field Impacts</u>. Visibility impacts at mid-field regional community locations from the No Action Alternative source emissions (Table 18.17) are predicted to be above the 1.0 dv threshold for up to 126 days at Boulder, 89 days at Pinedale, and 58 days at Cora.

Ozone Impacts. Ozone concentrations under the No Action Alternative would be similar to those modeled for Alternative B (Table 4.9-2). Ozone concentrations under the No Action Alternative are predicted to be below the ambient air quality standards for ozone that were in effect at the time the Revised Draft SEIS was released for public comment but is slightly above the new National ambient air quality standard for ozone (Table 4.9-2). Given this modeled prediction, Air Quality Mitigation Measure 2 (Section 4.9.5) would be employed to ensure that the project would not contribute to an ozone violation.

4.9.3.3 Alternative B

Near-field Impacts. As shown in Appendix 18 (Tables 18.1 through 18.5), predicted near-field pollutant concentrations from Alternative B sources are below the applicable WAAQS and

NAAQS. Model-predicted NO_2 concentrations are above the PSD Class II increment. All NEPA PSD demonstrations are for information purposes only and do not constitute a regulatory PSD increment consumption analysis.

Tables 18.6 and 18.7 summarize modeled HAP impacts based on emissions representative of Alternative B. The predicted acute and chronic (long-term) impacts are below applicable health-based levels for non-cancer compounds. Under both the MLE and MEI scenarios, the estimated incremental and combined cancer risk associated with long-term exposure to benzene and formaldehyde fall at the lower end of the 1 to 100 x 10^{-6} cancer risk range.

Far-field Impacts. Predicted pollutant concentrations under Alternative B are below applicable ambient air quality standards (Tables 18.8 through 18.11).

Predicted impacts are below the applicable PSD increments (Tables 18.12 through 18.14).

Modeled visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from Alternative B source emissions (Table 18.16) are predicted to be above the “just noticeable visibility change” 1.0 dv threshold at the following locations:

- Bridger Wilderness Area 67 days,
- Fitzpatrick Wilderness Area 10 days,
- Grand Teton National Park 3 days,
- Gros Ventre Wilderness Area 8 days,
- Popo Agie Wilderness Area 14 days,
- Teton Wilderness Area 1 day,
- Washakie Wilderness Area 2 days, and
- Wind River Roadless Area 10 days.

There are no predicted impacts above the 1.0 dv threshold at any of the other analyzed sensitive areas.

Predicted maximum deposition impacts from Alternative B (Tables 18.18 and 18.19) are well below the 3 kg/ha-yr (nitrogen) and 5 kg/ha-yr (sulfur) LOC at all PSD Class I and sensitive PSD Class II areas. Alternative B source emissions are not predicted to result in an increase in ANC above the LAC at any of the designated acid-sensitive lakes (Table 18.20).

<u>In-field Impacts</u>. Predicted project-related impacts are below applicable ambient air quality standards (Table 18.15). Predicted annual NO_2 concentrations are above the applicable PSD Class II increment. Modeled SO_2 and PM_{10} concentrations are below the applicable PSD increments. All NEPA PSD demonstrations are for information purposes only and do not constitute a regulatory PSD increment consumption analysis.

<u>Mid-field Impacts</u>. Visibility impacts at mid-field regional community locations from Alternative B source emissions are predicted to be above the 1.0 dv threshold for up to 138 days at Boulder, 91 days at Pinedale, and 62 days at Cora (Table 18.17).

Ozone Impacts. Modeled ozone concentrations under Alternative B are predicted to be below the ambient air quality standards for ozone that were in effect at the time the Revised Draft SEIS was released for public comment but slightly above the new National ambient air quality standard for ozone (Table 4.9-2). Given this modeled prediction, Air Quality Mitigation Measure 2 (Section 4.9.5) would be employed to ensure that the project would not contribute to an ozone violation.

4.9.3.4 Alternative C

Air quality impacts associated with Alternative C are similar to those for Alternative B; however, Alternative C includes two additional air quality modeling analyses with mitigation to reduce visibility impacts:

- Phase I Mitigation is based on year-2005 actual project emissions and the source locations of PAPA development activities that occurred during 2005. The analysis assumes year-2005 actual emissions levels would be achieved combined with the estimated PAPA source locations for year-2009.
- Phase II Mitigation includes year-2005 actual emissions levels modeled with an additional 80 percent reduction in drilling rig emissions combined with the estimated source locations for year-2009.

The results for these two model analyses are summarized below, followed by a discussion of the mitigation options.

Near-field Impacts. Near-field impacts from Alternative C would be similar to Alternative B results shown in Appendix 18 (Tables 18.1 through 18.7).

Far-field Impacts. Predicted pollutant concentrations under Alternative C are below applicable ambient air quality standards (Tables 18.8 through 18.11).

Predicted impacts are below the applicable PSD increments (Tables 18.12 through 18.14).

Modeled visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from Alternative C Phase I mitigation (Table 18.16) are predicted to be above the “just noticeable visibility change” 1.0 dv threshold at the following locations:

- Bridger Wilderness Area 40 days,
- Fitzpatrick Wilderness Area 5 days,
- Grand Teton National Park 1 day,
- Gros Ventre Wilderness Area 2 days,
- Popo Agie Wilderness Area 6 days, and
- Wind River Roadless Area 5 days.

Predicted impacts are less than the 1.0 dv threshold at all of the other analyzed sensitive areas.

Modeled visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from Alternative C Phase II Mitigation (Table 18.16) are predicted to be above the “just noticeable visibility change” 1.0 dv threshold at the following locations:

- Bridger Wilderness Area 10 days,
- Fitzpatrick Wilderness Area 1 day,
- Gros Ventre Wilderness Area 1 day, and
- Wind River Roadless Area 1 day.

Predicted impacts are less than the 1.0 dv threshold at all of the other analyzed sensitive areas.

Predicted maximum deposition impacts from Alterative C with mitigation (Tables 18.18 and 18.19) are well below the 3 kg/ha-yr (nitrogen) and 5 kg/ha-yr (sulfur) LOC at all PSD Class I and sensitive PSD Class II areas. Alternative C source emissions are not predicted to result in an increase in ANC above the LAC any of the designated acid-sensitive lakes (Table 18.20).

In-field Impacts. Table 18.15 compares the maximum impacts from Alternative C (includes mitigation) to ambient air quality standards. Predicted project-related impacts are below applicable ambient air quality standards. Predicted annual NO_2 concentrations are above the applicable PSD Class II increment for the Alternative C Phase I Mitigation and are below the PSD increment for Alternative C Phase II Mitigation. Modeled SO_2 and PM_{10} concentrations are below the applicable PSD increments for Alternative C Phase I Mitigation and Alternative C Phase II Mitigation.

Mid-field Impacts. Visibility impacts at mid-field regional community locations from Alternative C Phase I Mitigation (Table 18.17) are predicted to be above the 1.0 dv threshold for up to 107 days at Boulder, 70 days at Pinedale, and 47 days at Cora. Under Alternative C Phase II Mitigation, there are up to 45 days at Boulder, 25 days at Pinedale, and 12 days at Cora.

Ozone Impacts. Modeled ozone concentrations under Alternative C are predicted to be below the ambient air quality standards that were in effect at the time the Revised Draft SEIS was released for public comment but slightly above the new National ambient air quality standard for ozone (Table 4.9-2). Given this modeled prediction, Air Quality Mitigation Measure 2 (Section 4.9.5) would be employed to ensure that the project would not contribute to an ozone violation.

Mitigation. Air quality impact assessment modeling was conducted for existing conditions in the PAPA and the results are summarized in Chapter 3. The modeling analysis was based on year-2005 actual emissions. Impact modeling results show 45 days of visibility impairment over 1.0 dv at Bridger Wilderness Area (Appendix 16).

Year-2009 (the maximum emissions year) for Alternative B was modeled for visibility impacts. Impact modeling results predict 67 days of visibility impairment over 1.0 dv at Bridger Wilderness Area.

Alternative C Phase I Mitigation would begin immediately after issuance of the ROD. Within 1 year of issuance of the ROD, Operators would be required to show a reduction in modeled visibility impacts to 2005 actual impact levels. This modeling would be based on modeling of year-2009 Alternative B emissions mitigated to 2005 actual emissions levels – a prediction of 40 days of visibility impairment over 1.0 dv at Bridger Wilderness Area. Modeled reductions are based on future year models, which include expanded development activities and development areas beyond what occurred during year-2005. Therefore, modeling emissions levels that are reduced to 2005 levels shows modeling results (40 days over 1.0 dv) that are different from what was modeled for the PAPA during year-2005 (45 days over 1.0 dv). The reduction of modeled air quality impacts to 2005 levels would effectively mitigate the potential increase in visibility impacts for Alternative B. This reduction would be the starting point for further mitigation of the modeled visibility impacts of development that occurred in the PAPA since issuance of the PAPA ROD (BLM, 2000b) through 2005.

The objective for Alternative C Phase II Mitigation would be to achieve minimal days of predicted visibility impairment over 1.0 dv at Bridger Wilderness Area, with a goal of 0 days. Operators would be required to reduce visibility impact levels associated with modeling 20 percent drilling rig emissions reductions each year for the next 4 years after 2005 impact levels are achieved, within 1 year of issuance of the ROD. Modeling results using the BLM FLAG test for the Bridger Wilderness Area show that in year 1, with 20 percent mitigation, impacts would be reduced to 35 days of visibility impairment over 1.0 dv. Further emissions reductions of 20 percent per year for the next 3 years would result in 23, 17, and 10 days, respectively, of modeled visibility impairment over 1.0 dv at Bridger Wilderness Area. The predicted impact levels are a result of reducing only drilling rig emissions by 20, 40, 60, and 80 percent, respectively. Reductions in compression and fugitive (well site, including well completions, and traffic) emissions as well as drilling rig emissions would further reduce predicted visibility impacts, however, there are limitations to obtain reductions in compression and fugitive emissions. Existing compression in the PAPA is BACT as permitted through WDEQ-AQD.

Most of the engines used in portable equipment during well completions have Tier 2 equivalent emissions. The BLM modeled future emissions with the assumption that future compression would also use BACT. However, in order to achieve the goal of 0 days of visibility impairment, further emission reductions in these and other areas, in addition to the drilling rig emission reductions, may be required.

Predicted impact reduction by modeling is based on a reduction in drilling rig emissions, however, Operators would be able to reduce emissions from any source. The objective for mitigation is based on impact reduction (reduction in predicted visibility impairment) rather than reduction in specific emissions, such as NO_x. Implementation of one or more of the following examples would result in reduction of predicted visibility impact:

- natural gas-fired drilling rig engines,
- fuel additives,
- gas turbines rather than internal combustion engines for compressors,
- reduction in the number of drilling rigs,
- Tier 2 equivalent emissions drilling rig engines,
- selective catalytic reduction on drilling rig engines,
- electric drilling rigs,
- electric compression,
- centralization of gathering facilities to reduce truck traffic,
- cleaner technologies on completion activities, and other ancillary sources, and
- advancements in drilling technology.

The Operators should continue to innovate by demonstrating and using new techniques for controlling emissions to reduce potential visibility impact. Within 5 years after issuance of the ROD, the Operators must demonstrate annually through modeling that their plan to further reduce visibility impairment at the Bridger Wilderness Area is effective. If the goal of 0 days over 1.0 dv of modeled visibility impairment at the Bridger Wilderness Area cannot be demonstrated, the Operators, BLM, EPA, and WDEQ-AQD would jointly agree to a mitigation plan that complies with the goal, using any and all available means.

The method by which the Operators would determine project visibility impact would be determined by the BLM in consultation with WDEQ-AQD, EPA, USFS, and NPS. BLM would rely on the Operators to determine how they would attain the reduction in visibility impacts from the PAPA.

At any time, the BLM and/or the Operators may run air dispersion models to reassess air quality impacts. The BLM would use the results of the model to assess whether the air quality impact objective and goal described in this Final SEIS have been achieved.

4.9.3.5 Alternative D

Air quality impacts associated with Alternative D are similar to those for Alternative B; however, there are two additional air quality modeling analyses in Alternative D that include mitigation to reduce visibility impacts (similar to Alternative C):

- Phase I Mitigation is based on year-2005 actual project emissions and the source locations of PAPA development activities that occurred during 2005. The analysis assumes year-2005 actual emissions levels would be achieved combined with the estimated PAPA source locations for year-2009.

- Phase II Mitigation includes year-2005 actual emissions levels modeled with an additional 80 percent reduction in emissions combined with the estimated source locations for year-2009.

The results for these two model analyses are summarized below, followed by a discussion of the mitigation options.

Near-field Impacts. Near-field impacts from Alternative D would be similar to Alternative B results shown in Appendix 18 (Tables 18.1 through 18.7).

Far-field Impacts. Pollutant concentrations under Alternative D would be similar to Alternative C results shown in Appendix 18 (Tables 18.8 through 18.11). Predicted pollutant concentrations are below applicable ambient air quality standards and below the applicable PSD increments (Tables 18.12 through 18.14).

Modeled visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from Alternative D Phase I mitigation would be similar to Alternative C Phase I mitigation impacts (Table 18.16).

Modeled visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from Alternative D Phase II Mitigation would be similar to Alternative C Phase II mitigation.

Predicted maximum deposition impacts from Alterative D with mitigation would be similar to Alternative C (Tables 18.18 and 18.19) which are well below the 3 kg/ha-yr (nitrogen) and 5 kg/ha-yr (sulfur) LOC at all PSD Class I and sensitive PSD Class II areas. Alternative D source emissions would be similar to Alternative C emissions and would not result in an increase in ANC above the LAC at any of the designated acid-sensitive lakes (Table 18.20).

In-field Impacts. Maximum impacts from Alternative D would be similar to the impacts from Alternative C shown in Table 18.15. Predicted project-related impacts are below applicable ambient air quality standards. Predicted annual NO_2 concentrations are above the applicable PSD Class II increment for Alternative D Phase I Mitigation and below the PSD increment for Alternative D Phase II Mitigation. Modeled SO_2 and PM_{10} concentrations are below the applicable PSD increments for Alternative D Phase I Mitigation and Alternative D Phase II Mitigation.

Mid-field Impacts. Visibility impacts at mid-field regional community locations from Alternative D would be similar to those modeled for Alternative C.

Ozone Impacts. Modeled ozone concentrations under Alternative D would be similar to those predicted for Alternative C and are below the ambient air quality standards for ozone that were in effect at the time the Revised Draft SEIS was released for public comment but slightly above the new National ambient air quality standard for ozone (Table 4.9-2). Given this modeled prediction, Air Quality Mitigation Measure 2 (Section 4.9.5) would be employed to ensure that the project would not contribute to an ozone violation.

Mitigation. The final goal of the air quality mitigation for this Alternative is to ensure that emissions from the project result in zero days of visibility impairment over 1 dv at the Bridger Wilderness Area. Because visibility monitoring takes into account all sources of emissions, the only mechanism to determine visibility impairment from project emissions is to use air dispersion models.

Two phases of mitigation are proposed under this Alternative to reach the final goal of zero days of visibility impairment at the Bridger Wilderness Area. These phases are similar to Alternative C mitigation.

Phase I mitigation would begin immediately after issuance of the ROD. Within 1 year of issuance of the ROD, Operators would be required to show a reduction in modeled visibility impacts to 2005 actual impact levels. This modeling would be based on modeling of year-2009 Alternative B emissions mitigated to 2005 actual emissions levels – a prediction of 40 days of visibility impairment over 1.0 dv at Bridger Wilderness Area. Modeled reductions are based on future year models, which include expanded development activities and development areas beyond what occurred during year-2005. Therefore, modeling emissions levels that are reduced to 2005 levels shows modeling results (40 days over 1.0 dv) that are different from what was modeled for the PAPA during year-2005 (45 days over 1.0 dv). The reduction of modeled air quality impacts to 2005 levels would effectively mitigate the potential increase in visibility impacts for Alternative B. This reduction would be the starting point for further mitigation of the modeled visibility impacts of development that occurred in the PAPA since issuance of the PAPA ROD (BLM, 2000b) through 2005. One year after the ROD, the Operators would be required to fund a model run to determine if the reduced visibility impairment goal for Phase I has been achieved.

Phase II mitigation would be similar to Alternative C Phase II mitigation. Operators would be required to reduce visibility impact levels according to the schedule in Table 4.9.3 with the final goal of visibility impact levels of zero days greater than 1.0 dv at the Bridger Wilderness Area. Operators have committed to achieve the reduction in visibility impact associated with the 80 percent reduction in drilling rig emissions within 42 months after reaching 2005 visibility impact levels (required 1 year after issuance of the ROD). Based upon modeling results using the BLM FLAG test for the Bridger Wilderness Area, a 20 percent reduction in NO_x emissions from drilling rigs would result in 35 days of visibility impairment over 1.0 dv. Further, emission reductions of 20 percent each year would result in 23, 17, and 10 days of modeled visibility impairment over 1.0 dv at Bridger Wilderness Area (Table 4.9-3).

Table 4.9-3
Alternative D Mitigation Schedule

One Year After Signing of ROD[1]	Reduction in Drill Rig Emissions from 2005 Levels	Days of Visibility Impairment over 1.0 dv
2	20 %	35
3	40 %	23
4	60 %	17
5	80%	10

[1] Ultra, Shell, and Questar have voluntarily agreed to an accelerated reduction schedule as described in item #3 under Implementation.

Reductions in compression and fugitive (well site, including well completions, and traffic) emissions as well as drilling rig emissions would further reduce predicted visibility impacts; however, there are limitations to reducing compression and fugitive emissions.

Existing compression in the PAPA is BACT (best available control technology) as permitted through WDEQ-AQD. Most of the engines used in portable equipment during well completions have Tier 2 equivalent emissions. BLM modeled future emissions with the assumption that future compression would also use BACT. However, in order to achieve the goal of zero days of visibility impairment above 1.0 dv at the Bridger Wilderness Area, further emission reductions in these and other areas, in addition to the drilling rig emission reductions, may be required.

The predicted impact reduction by modeling described above would be based on a reduction in drilling rig emissions; however, Operators would be able to reduce emissions from any source. The objective for mitigation is based on impact reduction (reduction in predicted visibility impairment) rather than reduction in specific emissions, such as NO_x. BLM is committed to assuring that any mitigation necessary to achieve the goal of zero days of modeled visibility impairment will be implemented. BLM, WDEQ-AQD, and the Operators will work together to evaluate impacts and if needed sequentially review and employ the most effective technologies available to address impacts to visibility. Absent an effective technology to achieve further reductions beyond the 80 percent described in this Final SEIS, adjustments in the pace of development will be utilized to achieve zero days of modeled visibility impairment. It is therefore the goal of this plan to achieve zero days of visibility impairment over 1.0 dv at the Bridger Wilderness Area. Mitigation could include, but would not be limited to:

- replacing diesel-fired drilling rig engines with natural gas-fired drilling rig engines,
- fuel additives,
- gas turbines rather than internal combustion engines for compressors,
- reduction in the number of drilling rigs,
- Tier 2 equivalent emissions on drilling rig engines,
- selective catalytic reduction on drilling rig engines,
- electric drilling rigs,
- electric compression,
- centralization of gathering facilities to reduce truck traffic,
- cleaner technologies on completion activities, and other ancillary sources; and
- advancements in drilling technology.

Implementation. The following measures would be implemented to ensure that air quality impacts are mitigated:

1. To provide more predictability during the development phase, Operators would annually develop a 10-year rolling forecast or development plan for submission to the BLM and WDEQ-AQD. The forecast or development plan should report the anticipated activity levels and projected air emissions from emitting sources in the PAPA as identified by WDEQ-AQD, including compression, for each year during the upcoming 10-year period. The annual forecast would continue through the development period. Operators would meet annually with the BLM and WDEQ-AQD and in consultation with EPA to review the annual forecast and monitoring data and evaluate alternate ways to achieve the visibility impact reduction goal specified in paragraph #4 (below), beyond the 80 percent drilling rig engine NO_x emission reductions specified in paragraph #3 (below). Upon consideration of the annual forecast, the BLM and WDEQ-AQD in consultation with EPA would determine any necessary air dispersion modeling to be run by the Operators for the coming year. Modeling would be performed using protocols approved by WDEQ-AQD. Any modeling would be summarized and submitted to the BLM and WDEQ-AQD no later than the 11th month following the Annual Planning Meeting.

2. No later than 1 year after signing of the ROD, Operators would adopt air emission strategies which reduce predicted visibility impacts to levels predicted for “2009 Alternative B emissions mitigated to 2005 actual emissions levels” described above (i.e., which are modeled to result in no more than 40 days greater than 1.0 dv of visibility impairment). This would provide an almost immediate reduction of visibility impacts from current development. This would accomplish Phase I Mitigation.

3. Ultra, Shell, and Questar would accelerate the use of advanced technologies to reduce NO_x emissions, as defined in Table 4.9-3, to reduce predicted visibility impacts to the 80 percent drilling rig engine NO_x emissions reduction scenario, which is modeled to result in no more than 10 days greater than 1.0 dv of visibility impairment. Such reductions would occur no later than 42 months following issuance of the ROD. To ensure that any drilling rig NO_x emission reductions are enforceable, WDEQ-AQD would establish permitting requirements for all drilling rig engines operating in PAPA.

4. During the Annual Planning Meeting, as specified in paragraph #1 in this section, Operators, WDEQ-AQD, and the BLM in consultation with EPA would collaboratively identify methods to reduce air emissions beyond the 80 percent drilling rig engine NO_x emissions goal. No later than the fifth annual planning session following signing of the ROD, Operators would submit to the collaborative group an evaluation of alternatives, and recommend a plan that addresses all sources from project activities, and whose aim is to meet a predicted visibility impact objective of no more than zero days greater than 1.0 dv of visibility impairment. The Operators' evaluation would include modeling of the expected reduction in predicted visibility impairment which can be achieved by each alternative as well as an implementation schedule. All visibility modeling shall be performed using protocols approved by WDEQ-AQD. BLM is committed to assuring that any mitigation necessary to achieve the goal of zero days of modeled visibility impairment will be implemented. BLM, WDEQ-AQD, and the Operators will work together to evaluate impacts, and if needed, sequentially review and employ the most effective technologies available to address impacts to visibility. Absent an effective technology to achieve further reductions beyond the 80 percent described in the SEIS, adjustments in the pace of development will be utilized to achieve zero days of modeled visibility impairment. The collaborative group would also specify a schedule for completely implementing the plan.

5. All Operators would comply with WDEQ-AQD permitting regulations to establish emission limitations for production equipment and compression facilities and would voluntarily institute any other emission reduction measures that have been proposed as part of the alternate method selected by the collaborative group.

6. The monitoring and mitigation fund (Appendix 11) would be used to pay for the following activities, to be carried out by WDEQ-AQD:

   a. Supplement WDEQ-AQD's existing field inspection staff by adding an inspector dedicated to monitoring compliance in PAPA for a period of 5 years at a cost not to exceed $400,000 for the five-year period. Thereafter, if continued compliance monitoring in the PAPA is determined to be needed it would be paid out of the expected mitigation and monitoring fund.
   b. WDEQ-AQD would conduct a formal “network assessment” of the adequacy of the existing ambient monitoring network in southwest Wyoming. Based on the results of the “network assessment,” the expected mitigation and monitoring fund would provide a funding contribution to WDEQ-AQD not to exceed $1,250,000 over a five-year period to establish and/or operate monitors recommended by the “network assessment” for pollutants of interest from the PAPA project. WDEQ-AQD would, to the extent practicable, use monitor data collected by any new, and all existing local monitors, in performing future air quality modeling. WDEQ-AQD and Operators would cooperate to collect ambient ammonia data for use in modeling, including

modeling to evaluate the adequacy of alternate emission reduction options required under paragraph #4.

c. Supplement WDEQ-AQD's existing capability to analyze and report on ambient monitoring data, by funding an analyst (1) in WDEQ-AQD's monitoring group for a period of 2 years, at a cost not to exceed $160,000 for the two-year period, and providing $200,000 as a contribution to the expected costs of $400,000 to allow WDEQ-AQD to upgrade its ambient air quality data management systems. WDEQ-AQD would agree to use such staff and funds to improve its ability to analyze data to more effectively disseminate those data to the general public and to use ambient monitor data in future air quality modeling associated with the project.

4.9.3.6 Alternative E

Near-field Impacts. Predicted near-field pollutant concentration from Alternative E sources would be similar to those modeled for the No Action Alternative as shown in Appendix 18 (Tables 18.1 through 18.5). Predicted near-field pollutant concentrations from Alternative E sources are below the applicable WAAQS and NAAQS. Model predicted NO_2 concentrations are above the PSD Class II increment. All NEPA PSD demonstrations are for information purposes only and do not constitute a regulatory PSD increment consumption analysis.

The predicted acute and chronic (long-term) impacts are below applicable health-based levels for non-cancer compounds (Table 18.6). Under both the MLE and MEI scenarios, the estimated incremental and combined cancer risk associated with long-term exposure to benzene and formaldehyde fall at the lower end of the 1 to 100 x 10^{-6} cancer risk range (Table 18.7).

Far-field Impacts. Pollutant concentrations under Alternative E would be similar to the No Action Alternative impacts. Predicted concentrations are below applicable ambient air quality standards (Tables 18.8 through 18.11), and below the applicable PSD increments (Tables 18.12 through 18.14).

Visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from Alternative E source emissions would be similar to those shown in Table 18.16 for the No Action Alternative.

Predicted maximum deposition impacts from Alternative E would be similar to the impacts modeled for the No Action Alternative (Table 18.18 and Table 18.19) and would be well below the 3 kg/ha-yr (nitrogen)and 5 kg/ha-yr (sulfur) LOC at all PSD Class I and sensitive PSD Class II areas. In addition, the impacts from Alternative E source emissions would not result in a predicted increase in ANC above the LAC at any of the designated acid-sensitive lakes (Table 18.20).

<u>In-field Impacts</u>. Predicted impacts from Alternative E sources would be similar to those predicted for the No Action Alternative. Impacts are below applicable ambient air quality standards (Table 18.15). Annual NO_2 concentrations are above the applicable PSD Class II increment. Modeled PM_{10} impacts are above the 24-hour PM_{10} increment and below the annual increment. Predicted SO_2 concentrations are below the applicable SO_2 increments. All NEPA PSD demonstrations are for information purposes only and do not constitute a regulatory PSD increment consumption analysis.

<u>Mid-field Impacts</u>. Visibility impacts at mid-field regional community locations from Alternative E source emissions would be similar to those shown in Table 18.17 for the No Action Alternative.

Ozone Impacts. Ozone concentrations under Alternative E would be similar to those modeled for Alternative B (Table 4.9-2). Ozone concentrations under Alternative E are predicted to be below the ambient air quality standards for ozone that were in effect at the time the Revised Draft SEIS was released for public comment but slightly above the new National ambient air quality standard for ozone (Table 4.9-2). Given this modeled prediction, Air Quality Mitigation Measure 2 (Section 4.9.5) would be employed to ensure that the project would not contribute to an ozone violation.

4.9.4 Cumulative Impacts

CALPUFF Analysis. The CALPUFF model was used to quantify the impacts of NO_x, SO_2, PM_{10}, and $PM_{2.5}$ resulting from cumulative emission sources associated with the project Alternatives, state-permitted projects, RFFA, and RFD located within the model domain (Map 3.11-1 in Chapter 3). Project source emissions and other regional emissions included in the cumulative study are shown in Table 4.9-1. The cumulative study considers 2005 as a baseline year for emissions from non-project sources due to the availability of background air quality data for 2005 measured within and nearby the PAPA. The cumulative analysis assesses potential impacts to air quality that could occur beyond 2005 levels.

State-permitted projects include NO_x, SO_2 and/or PM_{10}/$PM_{2.5}$ sources that began operation after January 1, 2005, and were permitted before February 1, 2006. Projects permitted within the 18 months prior to January 1, 2005, but not yet operating were included as RFFA. RFD is defined as the undeveloped portion of 1) an approved NEPA project or 2) a proposed NEPA project for which quantified air emissions data were available at the time of the analysis. State-permitted projects, RFFA, and RFD emissions modeled in the cumulative analysis are quantified in Table 4.9-1. RFD projects included in the cumulative analysis are listed in Appendix 18, Table 18.21. RFD projects were analyzed utilizing the quantified proposed action emissions scenarios available in NEPA documents or the maximum production scenario identified for each project. Emissions from field development (the construction phase) of RFD were not analyzed for all projects because estimates were not available. The development phases of individual RFD projects have the potential to cause or contribute to higher localized ambient air impacts than those demonstrated in this analysis. RFD project development rates and schedules vary for each project and are difficult to define with certainty. Therefore, it was determined that emission sources operating at maximum production rates were the most reasonable representation of cumulative impacts occurring in the future, when based on RFD information available at the time of analysis.

While there may be additional gas processing and/or transmission requirements due to development within the PAPA and other natural gas projects regionally and nationally, the potential effects of these developments are not quantified herein because these developments are speculative and would require additional WDEQ-AQD permitting if they eventually are proposed. A portion of the Powder River Basin Oil and Gas Development Project (PRBP), located more than 200 km east-northeast of the PAPA, is located within the far-field modeling domain defined in Map 3.11-1 in Chapter 3. A ratio of total PRBP field development equal to the geographical portion within the PAPA far-field modeling domain was included as RFD in this analysis. The PRBP identified significant project-specific and cumulative impacts in the Bridger Wilderness Area and other sensitive areas analyzed for this project. The air quality impacts associated with the PRBP have been described by BLM (2003d).

Ozone Analysis. An analysis of potential ozone formation from project Alternative and cumulative sources was performed using the CAMx photochemical grid model. The analysis of potential ozone formation from project Alternative and cumulative sources is identical to the analysis performed for project Alternatives, described earlier in Section 4.9.3.1. Maximum cumulative emissions scenarios for Alternative B and Alternative C were modeled. The CAMx analysis uses the WRAP year-2002 emissions database in addition to project and cumulative emissions in southwest Wyoming and vicinity for simulating ozone impacts. Pollutants modeled for estimating ozone formation include NO_x, CO, and VOCs. Cumulative emission sources include state-permitted projects, RFFA, and RFD located within the model domain. Detailed information regarding the modeling methodologies used in the analysis is provided in the Air Quality TSD.

4.9.4.1 Alternative A (No Action Alternative)

As shown in Appendix 18 (Tables 18.22 through 18.28), cumulative pollutant concentrations from the No Action Alternative and regional source emissions are predicted to be below applicable ambient air quality standards for those pollutants and PSD increments at all analyzed PSD Class I and sensitive PSD Class II areas. Predicted cumulative impacts are below applicable ambient air quality standards at in-field locations (Table 18.29). Predicted cumulative ozone concentrations under the No Action Alternative would be similar to those modeled for Alternative B (Table 4.9-2) and would be below the ambient air quality standards that were in effect at the time the Revised Draft SEIS was released for public comment but slightly above the new National ambient air quality standard for ozone.

Cumulative visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from the No Action Alternative and regional source emissions (Table 18.30) are predicted to be above the “just noticeable visibility change” 1.0 dv threshold at the following locations:

- Bridger Wilderness Area 75 days,
- Fitzpatrick Wilderness Area 13 days,
- Grand Teton National Park 4 days,
- Gros Ventre Wilderness Area 12 days,
- North Absaroka Wilderness Area 1 day,
- Popo Agie Wilderness Area 21 days,
- Teton Wilderness Area 2 days,
- Washakie Wilderness Area 2 days,
- Wind River Roadless Area 12 days, and
- Yellowstone National Park 1 day.

There are no predicted impacts above the 1.0 dv threshold at any of the other analyzed sensitive areas.

Cumulative visibility impacts at mid-field regional community locations for the No Action Alternative and regional source emissions (Table 18.31) are predicted to be above the 1.0 dv threshold for up to 141 days at Boulder, 94 days at Pinedale, and 65 days at Cora.

Predicted maximum cumulative deposition impacts from the No Action Alternative (Table 18.32 and Table 18.33) are well below the 3 kg/ha-yr (nitrogen) and 5 kg/ha-yr (sulfur) LOC at all PSD Class I and sensitive PSD Class II areas. Cumulative emissions from the No Action Alternative and regional sources would not result in an increase in ANC above the LAC at any of the designated acid-sensitive lakes (Table 18.34).

4.9.4.2 Alternative B

As shown in Appendix 18 (Tables 18.22 through 18.28), predicted cumulative pollutant concentrations from Alternative B and regional source emissions are below applicable ambient air quality standards and PSD increments at all analyzed PSD Class I and sensitive PSD Class II areas. Predicted cumulative impacts are below applicable ambient air quality standards at in-field locations (Table 18.29). Predicted cumulative ozone concentrations are below the ambient air quality standards that were in effect at the time the Revised Draft SEIS was released for public comment but slightly above the new National ambient air quality standard for ozone (Table 4.9-2).

Cumulative visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from Alternative B and regional source emissions (Table 18.30) are predicted to be above the 1.0 dv threshold at the following locations:

- Bridger Wilderness Area 77 days,
- Fitzpatrick Wilderness Area 15 days,
- Grand Teton National Park 5 days,
- Gros Ventre Wilderness Area 12 days,
- North Absaroka Wilderness Area 1 day,
- Popo Agie Wilderness Area 25 days,
- Teton Wilderness Area 2 days,
- Washakie Wilderness Area 3 days,
- Wind River Roadless Area 19 days, and
- Yellowstone National Park 1 day.

There are no predicted impacts above the 1.0-dv threshold at any of the other analyzed sensitive areas.

Cumulative visibility impacts at mid-field regional community locations from Alternative B and regional source emissions (Table 18.31) are predicted to be above the 1.0 dv threshold for up to 153 days at Boulder, 96 days at Pinedale, and 68 days at Cora.

Predicted maximum cumulative deposition impacts from Alternative B (Table 18.32 and Table 18.33) are well below the 3 kg/ha-yr (nitrogen) and 5 kg/ha-yr (sulfur) LOC at all sensitive PSD Class I and sensitive PSD Class II areas. Cumulative emissions from Alternative B and regional sources would not result in an increase in ANC above the LAC at any of the designated acid-sensitive lakes (Table 18.34).

4.9.4.3 Alternative C

As shown in Appendix 18 (Tables 18.22 through 18.28), predicted cumulative pollutant concentrations from the Alternative C Phase I Mitigation and Alternative C Phase II Mitigation, both with regional source emissions, were below applicable ambient air quality standards at the time the Revised Draft SEIS was released for public comment and PSD increments at all analyzed PSD Class I and sensitive PSD Class II areas. Predicted cumulative impacts are below applicable ambient air quality standards at in-field locations at the time the Revised Draft SEIS was released for public comment (Table 18.29). Predicted cumulative ozone concentrations are below the ambient air quality standards that were in effect at the time the Revised Draft SEIS was released for public comment but slightly above the new National ambient air quality standard for ozone (Table 4.9-2).

Cumulative visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from Alternative C Phase I Mitigation and regional source emissions (Table 18.30) are predicted to be above the “just noticeable visibility change” 1.0 dv threshold at the following locations:

- Bridger Wilderness Area 56 days,
- Fitzpatrick Wilderness Area 7 days,
- Grand Teton National Park 2 day,
- Gros Ventre Wilderness Area 8 days,
- Popo Agie Wilderness Area 14 days,
- Teton Wilderness Area 1 day,
- Washakie Wilderness Area 2 days,
- Wind River Roadless Area 10 days, and
- Yellowstone National Park 1 day.

Predicted impacts are less than the 1.0 dv threshold at all of the other analyzed sensitive areas.

Cumulative visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from Alternative C Phase II Mitigation and regional source emissions (Table 18.30) are predicted to be above the “just noticeable visibility change” 1.0 dv threshold at the following locations:

- Bridger Wilderness Area 25 days,
- Fitzpatrick Wilderness Area 4 days,
- Grand Teton National Park 1 day,
- Gros Ventre Wilderness Area 2 days,
- Popo Agie Wilderness Area 6 days, and
- Wind River Roadless Area 6 days.

Predicted impacts are less than the 1.0 dv threshold at any of the other analyzed sensitive areas.

Cumulative visibility impacts at mid-field regional community locations from Alternative C Phase I Mitigation and regional source emissions (Table 18.31) are predicted to be above the 1.0 dv threshold for up to 118 days at Boulder, 79 days at Pinedale, and 60 days at Cora. For Alternative C Phase II Mitigation and regional source emissions, cumulative visibility impacts at mid-field regional community locations are predicted to be 69 days at Boulder, 45 days at Pinedale, and 25 days at Cora.

Predicted maximum cumulative deposition impacts from Alternative C Phases I and II Mitigation and regional sources (Table 18.32 and Table 18.33) are well below the 3 kg/ha-yr (nitrogen) and 5 kg/ha-yr (sulfur) LOC at all sensitive PSD Class I and sensitive PSD Class II areas. Cumulative emissions from Alternative C Phases I and II Mitigation and regional sources would not result in an increase in ANC above the LAC at any of the designated acid-sensitive lakes (Table 18.34).

4.9.4.4 Alternative D

Cumulative pollutant concentrations from the Alternative D Phase I Mitigation and regional sources would be similar to those modeled for Alternative C Phase I Mitigation and regional sources, shown in Appendix 18 (Tables 18.22 through 18.28). Cumulative pollutant concentrations from Alternative D Phase II Mitigation and regional sources would be less than the cumulative concentration modeled for Alternative C Phase II Mitigation and regional source emissions (Tables 18.22 through 18.28). Cumulative concentrations for both Alternative D Phase I and Phase II mitigation cases were below applicable ambient air quality standards at the time the Revised Draft SEIS was released for public comment and PSD increments at all analyzed PSD Class I and sensitive PSD Class II areas. Predicted cumulative impacts would be below applicable ambient air quality standards at in-field locations at the time the Revised Draft SEIS was released for public comment (Table 18.29). Cumulative ozone concentrations under Alternative D would be similar to those modeled for Alternative B (Table 4.9-2). Predicted cumulative ozone concentrations would be below the ambient air quality standards that were in effect at the time the Revised Draft SEIS was released for public comment but slightly above the new National ambient air quality standard for ozone (Table 4.9-2).

Cumulative visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from Alternative D Phase I Mitigation and regional source emissions would be similar to those modeled from Alternative C Phase I Mitigation and regional source emissions (Table 18.30).

Cumulative visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from Alternative D Phase II Mitigation and regional source emissions would be less than those modeled for Alternative C Phase II Mitigation and regional sources (Table 18.30).

Cumulative visibility impacts at mid-field regional community locations from Alternative D Phase I Mitigation and regional source emissions would be similar to those modeled for Alternative D Phase I Mitigation and regional sources (Table 18.31). Cumulative visibility impacts at mid-field regional community locations from Alternative D Phase II Mitigation and regional source emissions would be less than those modeled for Alternative D Phase I Mitigation and regional sources (Table 18.31).

Predicted maximum cumulative deposition impacts from Alternative D Phase I Mitigation and regional sources would be similar to the impacts modeled for Alternative C Phase I Mitigation (Table 18.32 and Table 18.33). Maximum cumulative deposition impacts from Alternative D Phase II Mitigation and regional sources would be less than the impacts modeled for Alternative C Phase I Mitigation and regional sources. The predicted cumulative deposition impacts for Alternative D Phase I and II Mitigation would be well below the 3 kg/ha-yr (nitrogen) and 5 kg/ha-yr (sulfur) LOC at all sensitive PSD Class I and sensitive PSD Class II areas. Cumulative deposition impacts from Alternative D Phases I and II Mitigation and regional sources would not result in an increase in ANC above the LAC at any of the designated acid-sensitive lakes (Table 18.34).

4.9.4.5 Alternative E

Pollutant concentrations for Alternative E and regional source emissions would be similar to the concentrations modeled for the No Action Alternative and regional sources, as shown in Appendix 18 (Tables 18.22 through 18.28). Cumulative pollutant concentrations would be below applicable ambient air quality standards at the time the Revised Draft SEIS was released for public comment and PSD increments at all analyzed PSD Class I and sensitive PSD Class II areas. Predicted cumulative impacts would be below applicable ambient air quality standards at in-field locations at the time the Revised Draft SEIS was released for public comment (Table 18.29). Cumulative ozone concentrations under Alternative E would be similar to those modeled for Alternative B (Table 4.9-2). Predicted cumulative ozone concentrations would be below the ambient air quality standards that were in effect at the time the Revised Draft SEIS was released for public comment but slightly above the new National ambient air quality standard for ozone.

Cumulative visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from Alternative E and regional source emissions would be similar to the cumulative impacts modeled for the No Action Alternative (Table 18.30).

Cumulative visibility impacts at mid-field regional community locations resulting from Alternative E and regional source emissions would be similar to the cumulative impacts modeled for the No Action Alternative (Table 18.31).

Predicted maximum cumulative deposition impacts from Alternative E would be similar to the impacts modeled for the No Action Alternative (Table 18.32 and Table 18.33) and would be well below the 3 kg/ha-yr (nitrogen)and 5 kg/ha-yr (sulfur) LOC at all PSD Class I and sensitive PSD Class II areas. In addition, the impacts from Alternative E and cumulative sources would not result in an increase in ANC above the LAC at any of the designated acid-sensitive lakes (Table 18.34).

4.9.5 Air Quality Additional Mitigation Opportunities

Air Quality Mitigation Measure 1. Electric compression could be installed to reduce emissions in the PAPA.

Air Quality Mitigation Measure 2. To ensure that this project will not contribute to an ozone violation, within 1 year of issuing the ROD, and as needed thereafter, BLM, WDEQ-AQD, and the Operators, with input from EPA, will refine the NO_x and VOC emissions inventory and conduct new modeling, which includes consideration of WDEQ 2004 and 2007 BACT requirements. BLM, WDEQ-AQD, and the Operators will evaluate the modeling results, and if needed, sequentially review and employ the most effective technologies available to reduce ozone. Such actions to reduce the likelihood of ozone exceedances would include reduction in numbers of holding tanks, greatly reduce numbers of truck trips, and switching from diesel to natural gas powered engines. Absent an effective technology to implement, reductions in the pace of development will be utilized to lower impacts to acceptable levels identified in this SEIS and applicable laws or regulations.

4.10 NOISE

4.10.1 Scoping Issues

The following concern related to noise was submitted during scoping: use noise mitigation in crucial winter range.

4.10.2 Impacts Considered in the PAPA DEIS

Two noise sources were analyzed in the PAPA DEIS (BLM, 1999a) for potential impacts in the PAPA, a drilling rig and a compressor station. A background noise level of 39 dBA was assumed in the PAPA in 1999. Based on sound attenuation from the two sources, noise impact would become significant (greater than 49 dBA) when:

- a drilling rig is located closer than about 800 feet to a receptor; and
- a compressor station is located closer than about 2,500 feet to a receptor.

With all of the potential compressor station sites farther than 2,500 feet from a residence, the PAPA DEIS (BLM, 1999a) concluded there would be no significant potential noise impacts to residences from compressor stations. There were potential well sites closer than 800 feet from a residence and significant noise impacts would be expected to occur at these locations. Noise from well flaring is loud and occurs during the initial testing of the well, also periodically during well operation.

The PAPA DEIS (BLM, 1999a) considered noise impacts to greater sage-grouse leks from well drilling and operation but concluded noise would not be significant because well locations would be at least 1,320 feet (0.25 mile) from greater sage-grouse leks. However, compressor facilities located closer than 2,500 feet to a greater sage-grouse lek could significantly affect greater sage-grouse lek use. From these considerations, the BLM determined that significant impacts by noise would result from project-related activities if noise levels are increased more than 10 dBA at any noise sensitive area (residences and greater sage-grouse leks). According to the significance criteria in the PAPA DEIS, significant impacts have most likely occurred.

4.10.3 Alternative Impacts

4.10.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development in the PAPA

Noise sensitive areas identified in the PAPA DEIS (BLM, 1999a) included greater sage-grouse leks, crucial big game habitat during crucial periods, residences within and adjacent to the PAPA, areas adjacent to the Lander Trail, ranches along both the New Fork and Green rivers, raptor nest sites when occupied, and recreation areas. The PAPA ROD (BLM, 2000b) set noise limits of new wellfield development so that distance to a dwelling or a greater sage-grouse lek would be sufficient to result in no noise level increase from operating facilities at the dwelling. It would not result in an increase greater than 10 dBA above background at the edge of a greater sage-grouse lek. In the PAPA DEIS, only wellfield traffic was considered as a potential noise source 0.25 mile away from greater sage-grouse leks because timing and geographic limitations on drilling were assumed to be enforced within 2 miles of greater sage-grouse leks from March 15 through July 15 (BLM, 2004c).

The PAPA DEIS (BLM, 1999a) established 800 feet as the distance at which noise between a sensitive receptor and a drilling rig attenuate to 49 dBA (~10 dBA above ambient levels); a distance closer than 800 feet would be classified as a significant impact. However, noise studies in the PAPA (Table 3.12-2 in Chapter 3) indicate that drilling noise may attenuate to 49 dBA up to 0.5 mile away from a drilling rig. Therefore, significant impact could occur over 3.5 times the distance used to define impact significance in the PAPA DEIS.

Under all Alternatives, noise would increase with increased development. Potential noise associated with development would be generated by traffic, construction equipment, drilling, and completions. Production-related noise would be generated from traffic, production equipment, maintenance activities, and compression. The BLM's Practices and Restrictions for the Pinedale Anticline Project Area as they relate to noise would apply under all Alternatives (Appendix 4).

Pipeline Corridors and Gas Sales Pipelines

Project-related vehicles and construction equipment would generate noise while in operation during construction of the gas sales pipelines. The noise would occur only during daylight hours, except for some highway vehicles which may be traveling over public roads in the minutes or hours preceding dawn and following dusk as workers return to work or lodging. The operation of the pipeline is not expected to generate noise, except for the regular small vehicle traffic associated with facility inspections.

4.10.3.2 Alternative A (No Action Alternative)

Under the No Action Alternative, impact from noise to sensitive resources would generally continue at current levels. There would be no development-related noise in seasonally restricted areas except as allowed by BLM's 2004 Decision Record (BLM, 2004a) in Questar's leases, unless exceptions are granted by the BLM AO. In these areas, there would still be production-related noise. As development begins to decline, and production increases, noise would also decline because noise generated from development is greater than that from production. Production-related noise would increase with additional production and then begin to taper off as production declines.

4.10.3.3 Alternative B

Under Alternative B, noise impacts would increase with increased development. Year-round development would be allowed in the Alternative B Core Area, increasing noise in these areas during otherwise seasonally restricted periods. There would be noise from development as well as from production; however, development-related noise could be concentrated in CDAs under Alternative B and if so, noise would potentially be less in other areas.

Under Alternative B, installation and use of the liquids gathering system and increased use of computer-assisted operations would reduce production-related noise generated by traffic in the development phase but especially in the production-only phase where daily traffic in the PAPA would be reduced by 3,820 vehicle trips per day.

4.10.3.4 Alternative C

Under Alternative C, year-round development would be allowed in the Alternative C Core Area except for DA-5. Year-round development would initially be allowed in some areas and would not be allowed in others. Under this scenario, Operators would most likely concentrate rigs both in winter and summer in the areas where year-round development is allowed. This may leave large areas free of development-related noise for some period; however, production-related noise would continue.

Similar to Alternative B, production-related noise would be reduced with installation and use of the liquids gathering system and computer-assisted operations.

4.10.3.5 Alternative D

Under Alternative D, year-round development would be allowed within the entire Alternative D Core Area. Concentrated development would occur under Alternative D leaving large areas open without development where at least development-related noise would be reduced; however, production-related noise would continue.

Similar to Alternatives B and C, noise would be reduced with installation and use of the liquids gathering system and computer-assisted operations.

Under Alternative D, there would be no development-related noise in federal suspended and term NSO lease areas, at least for the first 5 years. Existing production-related noise would continue in these areas.

4.10.3.6 Alternative E

Impact from noise to sensitive resources would generally continue at current levels under Alternative E. There would be no development-related noise in seasonally restricted areas except for as allowed by BLM’s 2004 Decision Record (BLM, 2004a) in Questar’s leases, unless exceptions are granted by the BLM AO; however, production-related noise would continue. Under this Alternative, concentrated development would be limited, requiring a greater number of well pads and greater fragmentation. Therefore, there could be noise impacts to a large number of noise sensitive area at one time, rather than being concentrated in one area. As development begins to decline, and production increases, noise would also decline because noise generated from development is greater than that from production. Production-related noise would increase with additional production and then begin to taper off as production declines.

4.10.4 Cumulative Impacts

The CIAA for noise extends outside the PAPA to some distance because active drilling rigs are sometimes audible for up to 20 miles (BLM, 2006c). This does not constitute a human health risk, but it would disturb wildlife to some extent, and does impact perceptions of the quality of the outdoor experience ("peace and quiet"). Traffic also contributes transient noise.

Existing noise sources in the PAPA are related to traffic, construction, development and production activities as well as noise related to agricultural activities. These noise sources are expected to continue under all Alternatives. No future sources of noise are known at this time that would contribute to a cumulative impact. Noise is not additive; therefore, no additional cumulative impact is anticipated.

4.10.5 Noise Additional Mitigation Opportunities

Noise Mitigation Measure 1. Operators could continue to reduce noise levels at noise sensitive locations, such as greater sage-grouse leks and residences.

4.11 GEOLOGY, MINERALS, AND GEOLOGIC HAZARDS

4.11.1 Scoping Issues

The following concern related to Geology and Geologic Hazards was submitted during scoping:

Companies should be required to get more gas out of their existing wells before drilling additional wells.

4.11.2 Impacts Considered in the PAPA DEIS

In the PAPA DEIS, impact considered to Geology and Geologic Hazards by development in the PAPA included:

- seismic hazards, including direct hazards such as ground shaking and surface faulting and indirect hazards such as ground failure and liquefaction of water-saturated deposits such as sandy soils, alluvium and artificial fill, that would result in substantial damage to operating equipment; and
- landslides and/or slope failures resulting from wellfield development because of 1) inherent weakness in the composition or structure of rock or soils; 2) variation in the weather, such as heavy rain and snowmelt; and 3) human activity.

The PAPA DEIS concluded that implementation of BLM's Mitigation Guidelines would avoid development on slopes greater than 25 percent, and landslides or slumps should not result from project activities.

4.11.3 Alternative Impacts

4.11.3.1 Summary of Impacts Common to All Alternatives

<u>Natural Gas Development in the PAPA</u>

The PAPA is not currently a pristine area and activities include active drilling, road, well pad and pipeline construction, and traffic. Potential impacts to geology (geomorphology) include erosion and destabilizing slopes. To date, the control of erosion and sediment transport has consisted of adherence to individual Stormwater Pollution Prevention Plans (SWPPPs), and berms and culverts where appropriate.

Tight gas sands such as the target formations in the PAPA require a high density of drilling to manage production, to not leave large blocks of the resource untapped and more difficult to access. In the last decade, drilling practices have developed so that a high density of drilling can be achieved from fewer well pads, optimizing production while minimizing surface disturbance.

Production of the gas resource does deplete a non-renewable resource. The BLM and the State of Wyoming management objectives associated with mineral resources are to enhance opportunities for their development, while protecting other resource values. There would be no interference with any other resource such as sand and gravel under any of the Alternatives. The BLM's Practices and Restrictions for the Pinedale Anticline Project Area as they relate to construction on steep slopes and other sensitive areas would apply to all Alternatives (Appendix 4).

Pipeline Corridors and Gas Sales Pipelines

Pipeline construction within the proposed pipeline corridors would result in disturbance of underlying bedrock beneath deep to shallow soils. The disturbance would occur by excavation of softer and/or fractured bedrock and by blasting followed by excavation of harder, consolidated bedrock. The rock would be excavated and removed from the trench and it would be returned to the trench after the pipeline is placed in the open trench and is padded with protective finer-grained sandy material. Construction activities should not cause slides due to the absence of active faults or slide surfaces in the immediate vicinity of the corridors. There would be only minor excavation into bedrock.

The terrain crossed by much of the proposed corridor system does not have steep slopes predisposed to mass movement. Areas with some susceptibility to mass movement of exposed soils and/or geologic substrate include the Blue Rim Area just south of the New Fork River. The RVII and PBC pipelines would cross the New Fork River at this location, but the potential for instability of geologic materials in such areas of steep slopes would be minimized by post-construction stabilizing measures and features, such as appropriately designed and constructed water bars and surface preparation.

Access to locatable or salable minerals would not be limited by corridor designation or pipeline construction due to the absence of such minerals and/or lack of proposed development of these resources near the proposed pipeline corridors. Access to preferred locations for natural gas development could be compromised by pipeline construction and operation; however, there is flexibility in both the proposed well locations and pipeline alignments to a limited extent.

4.11.3.2 Alternative A

Alternative A (not a full-field development Alternative), would allow for recovery of 6 to 9 trillion cubic feet of natural gas or about one-third of the total recoverable natural gas.

4.11.3.3 Alternatives B through E

Alternatives B through E are all full-field development Alternatives which would allow for recovery of 20 to 25 trillion cubic feet of natural gas in the PAPA.

4.11.4 Cumulative Impacts

The CIAA for geology and geologic hazards is the PAPA. Cumulative impacts would be the same as those described for the proposed project under any of the Alternatives.

4.11.5 Geological Resources Additional Mitigation Opportunities

No additional mitigation opportunities have been identified for geological resources.

4.12 PALEONTOLOGICAL RESOURCES

4.12.1 Scoping Issues

There were no project scoping comments related to Paleontological Resources.

4.12.2 Impacts Considered in the PAPA DEIS

In the PAPA DEIS (BLM, 1999a), BLM stated that a significant impact to paleontological resources would occur if important fossils, which could substantially add to scientific understanding of paleontological resources, are destroyed. BLM concluded that all of the Alternatives, except the *No Action Exploration/Development Scenario*, had the potential for uncovering or disturbing paleontological resources during construction and excavation of the project facilities. Further, improved access and increased visibility may cause fossils to be damaged or destroyed due to unauthorized collection and vandalism. It is not known if paleontological resources have been significantly impacted by existing development within the PAPA.

4.12.3 Alternative Impacts

4.12.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development in the PAPA

Since the PAPA DEIS (BLM, 1999a) was written, all significant paleontological discoveries in the PAPA have been made in the badlands and outcrops associated with Blue Rim and Ross Butte. Consequently, analyses of potential effects by each Alternative focus on surface disturbances in the Blue Rim Area of the Sensitive Soils SRMZ discussed below in Soil Resources, Section 4.15, and enumerated in Table 4.15-1 where future paleontological discoveries and potential for impact would probably occur. The potential for significant impact would increase as additional development is implemented under each of the Alternatives.

Development and surface disturbance would increase under all Alternatives which could lead to increased impact and/or discovery of paleontological resources especially in the Blue Rim Area. With the increase in development, greater access and increased visibility may cause fossils to be damaged, destroyed, or lost due to unauthorized collection and vandalism. Construction in frozen soils under any Alternative increases the risk of damage to paleontological resources. The BLM's Practices and Restrictions for the Pinedale Anticline Project Area as they relate to paleontological resources and construction in frozen soils would apply to all Alternatives (Appendix 4).

Pipeline Corridors and Gas Sales Pipelines

Construction of the gas sales pipelines would likely disturb unconsolidated and, to a lesser extent, consolidated bedrock by trenching in areas of moderately deep to shallow soils. Such disturbance of bedrock would have the potential to damage undiscovered, scientifically-significant fossils. Such disturbance could also result in the exposure and discovery of fossils that may add to the understanding of the area's paleontological resources.

Discovery of fossils during construction would result in the suspension of construction activities to prevent further disturbance and/or damage to the fossil resource. The discovery would result in the immediate reporting of the find to the BLM AO for a determination of significance and possible recommendation for recovery or avoidance

4.12.3.2 Alternative A (No Action Alternative)

Continued development in the PAPA under the No Action Alternative would disturb an additional 529.1 acres in the Blue Rim Area of sensitive soils (Table 4.15-1). Under Alternative A, there would more time to monitor impacts because disturbance would occur over a longer period.

4.12.3.3 Alternative B

Development under Alternative B would disturb 1,167.7 acres in the Blue Rim Area of sensitive soils.

4.12.3.4 Alternative C

Impacts under Alternative C would be the same as those under Alternative B.

4.12.3.5 Alternative D

Impacts under Alternative D would be the same as those under Alternatives B and C; however, there would no surface disturbance in federal suspended or term NSO leases in the Flanks for at least the first 5 years.

4.12.3.6 Alternative E

Continued development under Alternative E would disturb 1,390.0 acres in the Blue Rim Area of sensitive soils. Under Alternative E, there would more time to monitor impacts because disturbance would occur over a longer period.

4.12.4 Cumulative Impacts

The CIAA for paleontological resources is the PAPA. Cumulative impacts would be the same as those described for the Blue Rim Area of Sensitive Soils in Table 4.15-2, below. While there had been limited surface disturbances by non-wellfield disturbance in the Blue Rim Area, existing and projected surface disturbance under all Alternatives is likely to disturb between 1,000 and 2,000 acres and increase the likelihood of cumulative impact to paleontological resources.

4.12.5 Paleontological Resources Additional Mitigation Opportunities

Paleontological Resources Mitigation Measure 1. The Operators could instruct workers about the potential for encountering fossils in the PAPA and what to do should fossils be discovered during project-related activities. It should be explained to the workforce that it is illegal to remove vertebrate fossil materials from federal lands without a permit.

Paleontological Resources Recreation Mitigation Measure 2. The potential for fossils is generally unknown. A field survey should be conducted when appropriate to identify what other portions of the PAPA have high potential for paleontological resources. The results of this survey should be used to narrow the extent of site-specific paleontological field surveys for surface disturbing activities.

4.13 GROUNDWATER RESOURCES

4.13.1 Scoping Issues

The following comment addressing Groundwater Resources was received during scoping:

Concern about aquifer contamination by drilling and fracturing, BLM should provide methods to prevent, mitigate, and monitor impact to groundwater.

4.13.2 Impacts Considered in the PAPA DEIS

The PAPA DEIS (BLM, 1999a) considered various potential impacts to Groundwater Resources during future wellfield development in the PAPA including:

- the subsurface could be affected by groundwater withdrawals and wastewater injection;

- anticipated impacts consist of drawdown in aquifers from which water is extracted for drilling;
- there could also be loading of deeper receiving zones by wastewater injection;
- there is the potential for contamination of aquifers during drilling, completion, and production of the gas wells through drilling/fracturing fluids and/or produced water;
- there is the potential for shallow aquifers to be contaminated by leakage from the reserve pit and by onsite water wells with alkaline pH's; and
- drilling and completion techniques of water wells need to be changed to correct the alkalinity problem.

The PAPA DEIS (BLM, 1999a) addressed injection of produced water; however, there were at that time no injection wells in the PAPA. In 2006, there were five permitted Class II waste injection wells in the vicinity of the PAPA, which dispose of produced water in sands of the Fort Union Formation (Chapter 3, Table 3.16-3). In the PAPA DEIS, BLM considered potential impacts from an injection well to be insignificant because such wells must be permitted with the WOGCC. The agency's rules and regulations require that the Operator demonstrate that the proposed disposal operation would not endanger fresh water sources. The disposal well must be cased and cemented in such a manner that damage would not be caused to oil, gas, or fresh water sources. The Operator must also demonstrate mechanical integrity of the well at least every 5 years and, if tests fail, the well must be repaired, shut-in, or operated at a reduced injection pressure.

Similarly, BLM cited regulations in place were adequate to protect shallow aquifers from production wells:

- Significant impact to the aquifer from drilling and completion fluids and produced water are not likely because all production wells would be cased and cemented to protect subsurface mineral and freshwater zones according to WOGCC rules and regulations.
- Wells that are no longer productive would be plugged and abandoned according to procedures outlined in the WOGCC's rules and regulations.
- Contamination of shallow aquifers from reserve pits is unlikely because the reserve pits would be lined and would be constructed in cut areas or in compacted and stabilized fill in accordance with WOGCC rules.
- If the quality of groundwater becomes unacceptable for any purpose, other water supply sources would be investigated and permitted through the appropriate agency.

In the PAPA DEIS (BLM, 1999a), BLM considered that impacts to groundwater supplies or springs would be significant if:

- the natural flow of water to local springs is interrupted;
- new water supply wells that are first tested with a neutral pH (about 7.0) later become significantly alkaline (pH 8.0 to 10) after pumping;
- groundwater quality is degraded so that it can no longer be classified for its current use; or
- the water table is lowered, as a result of drilling water withdrawals, to a level that would require replacement or deepening of other groundwater wells in the project area.

Based on the significance criteria stated above, significant impacts to groundwater may or may not have occurred. WDEQ-WQD has requested sampling of all supply wells for VOCs (BTEX) and TPH. Depending on the results of this study, a determination of significant impacts could occur.

4.13.3 Alternative Impacts

4.13.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development in the PAPA

Potential impacts to groundwater quality include accidental spills of petroleum products or other pollutants and cross-aquifer mixing. Potential impacts to groundwater quantity are those resulting from withdrawals of groundwater from the Wasatch Formation aquifer and include:

- lowering water levels in aquifers used by domestic and stock wells;
- depletion of Wasatch Formation aquifer (drilling water supply source);
- depletion of groundwater discharge to surface waters; and
- cross contamination of aquifers which could either occur between aquifers or within the same aquifer.

As discussed in Chapter 3, Section 3.15.1.5, hydrocarbons were detected in water supply wells in 2006. As a result, WDEQ-WQD is requiring Operators to analyze samples from all water supply wells for BTEX and TPH and has since proposed that check valves (backflow preventers) should be installed on supply wellheads. Operators whose supply wells have shown exceedances of drinking water standards are submitting to voluntary remedial plans. Further proposed measures are:

- All water supply wells should be outfitted with locks to prevent unauthorized access,
- All well materials should be new or thoroughly cleaned (SEO water well requirements),
- New water supply well installation should be minimized, and
- Existing supply wells that are no longer necessary should be plugged and abandoned according to SEO procedures.

Depending on future monitoring results, the effectiveness of these measures, and of any other implemented measures deemed appropriate if necessary, this could be an ongoing impact under all Alternatives.

Groundwater quality could be impacted by leaky well seals allowing cross-aquifer contamination, by leaks and spills from trucks or other equipment on the well location, or as demonstrated in 2006-2007, by contamination of supply wells. Ensuring good well seals across aquifer boundaries would prevent cross-aquifer contamination. Potential for impact from leaks and spills and appropriate responses are addressed in each Operators' Spill Prevention Countermeasure and Control (SPCC) Plans. Detection of water quality impacts would require notification of WDEQ-WQD and appropriate remedial action.

Lowering of water levels and cross-contamination of shallow aquifers are preventable by sound well construction practices required by permits to drill, which state that isolation of aquifers will be maintained by ensuring good cement seals in gas production wells. All gas production wells have the annulus cemented to surface, and cement bond logs are run to confirm the cement integrity across formation contacts. The PAPA ROD (BLM, 2000a) required that open intervals of water wells be at least 200 feet deeper than any domestic or stock well within 0.5 mile. These provisions are meant to prevent impacts to domestic wells due to communication between shallow and Wasatch Formation aquifers. Temporary depletion of the Wasatch

Formation aquifer is a consequence of groundwater extractions for drilling water through water supply wells. The projected annual usage is a fraction of the annual recharge through infiltration, and less than 1 percent of the storage of the Wasatch Formation. Water level recovery in the Wasatch Formation should therefore be rapid when pumping ceases in any area. There are only a few domestic wells completed in the Wasatch Formation.

A model of possible impacts to the Wasatch Formation aquifer due to a dense cluster of drilling rigs and associated water supply wells is provided in Appendix 19. The model is based on typical Wasatch Formation hydraulic properties and a cluster of 17 wells active in six adjacent sections, resembling concentrations that may occur at some time. The model suggests that up to 11 feet drawdown may be expected up to 3 miles from such a concentration of activity. No more than 30 feet drawdown is expected anywhere in the Wasatch Formation except within 1.5 miles of a drilling rig.

This model assumes a very large aquifer with homogeneous (uniform) and isotropic (same in every direction) hydraulic properties. This is not an accurate representation of the Wasatch Formation with its variably interconnected, lenticular sandstones. It is not practical to represent the Wasatch Formation sandstones in a geological model with existing data except statistically, because the dimensions of the lenses, deposited in meandering stream channels, are typically smaller than drill hole spacing, so that they cannot be correlated between holes. It is impractical, given limited data with high variability, to construct a more detailed hydrologic model, when the simple model used here is adequate to predict order-of-magnitude drawdown patterns. Departures from these predictions could occur if a pumping well were completed in just one sand that either did or did not connect directly to an observation well; however, all Wasatch Formation wells are completed in multiple sands so that there is a hydraulic averaging of response, which on the whole will resemble the idealized model of a uniform aquifer.

Recovery of water levels in the Wasatch Formation after drilling and groundwater extraction cease should be rapid. Numerical modeling in the Jonah Field indicated full recovery in the case of the most aggressive development within 6 years. This estimation is particularly sensitive to recharge from above and within the Wasatch Formation. Groundwater use under any of the Alternatives is less than 1 percent of the water stored in the aquifers (Section 3.15 in Chapter 3).

As discussed in Chapter 3, Section 3.15.1.5, groundwater monitoring is conducted by SCCD on behalf of the Operators. The BLM initiated this program in 2005, and the number of sampled wells has grown to over 200 in 2007. The monitoring plan is now being reviewed with respect to guidelines in the recently developed *Regional Framework for Water Resources Monitoring Related to Energy Exploration and Development*. Additions to the PAPA monitoring plan will address concerns about groundwater drawdown and recent water quality issues. A cooperative effort by the BLM management and participating regulatory agencies will begin the Framework process immediately upon issuance of a ROD, and complete this revised monitoring plan within 6 months. SCCD will continue to monitor groundwater (and surface water) under the current sampling and analysis plan until a modified plan is adopted.

The Framework process will have three principal tasks, namely compilation of existing information, more detailed characterization of groundwater, and modification of the monitoring plan (delivered as a Sampling and Analysis Plan).

A monitoring report by SCCD, Pinedale Anticline Ground Water Data Summary, issued August 2007, gives results for 100 samples, 27 from fall of 2006 and 73 from spring of 2007. To date, SCCD has collected 608 samples from 237 wells within 1 mile of existing or proposed natural gas wells in the PAPA. Field data consisting of GPS coordinates, water level, pH, specific conductance and temperature are measured at each well, and lab samples are collected for analysis of constituents pertinent to drinking water, livestock, and agricultural standards.

Reported results in the 100 samples showed:

- Chloride - Values ranged from non-detect to 228 mg/L.
  - No water wells sampled exceeded the drinking water or livestock standards.
  - Five industrial wells exceeded the agricultural standard.

- Fluoride - Values ranged from non-detect to 14.2 mg/L.
  - All wells passed the agriculture and livestock standards.
  - 27 water wells exceeded the drinking water standard.
  - One domestic well sample exceeded the drinking water standard.

- Sulfate - Values ranged from non-detect to 1,540 mg/L.
  - There were 22 wells that exceeded the drinking water standards.
    - Six were stock wells and one was a domestic well.
  - No wells exceeded the livestock standard.
  - 24 wells exceeded the agricultural standard.

- TDS - Values ranged from 152 mg/L to 2,670 mg/L.
  - 24 wells exceeded the TDS drinking water standard.
    - Six of these were stock and one was a domestic well.
  - The livestock standard was not exceeded.
  - The agricultural standard was exceeded by three industrial wells.

- Sodium Adsorption Ratio (SAR) – Values ranged from 0.64 to 37.6 mg/L.
  - The agricultural standard was exceeded by 22 wells.
    - Five of these were stock and AD057 was the only domestic well. The remaining were miscellaneous industrial wells.

Field measurements confirmed that pH in Wasatch Formation groundwater is bi-modal, with some values as high as 10.4. TDS values ranged from 139 to 2,000 mg/L according to the field data. Water levels, measured in feet below ground surface, ranged from 8 to 80 feet for domestic wells, 2 to 370 for stock wells, and 0 to 480 for industrial wells.

WDEQ-WQD (2005b) voiced concern that the Groundwater Monitoring Program conducted by SCCD did not attempt to map or distinguish various aquifers within the Wasatch Formation, which rendered monitoring of an inconsistent target very uncertain. Much of the variability in the Wasatch Formation aquifer results from its being comprised of many stacked and discontinuous sands and deposits of meandering rivers so that water supply wells encounter and draw water from different units in different locations. Sands are so variable they can rarely be interpolated between drill holes on quarter-section spacing. This means that it is not practical to map individual water producing sand units, and it is practical only to monitor the Wasatch Formation as a heterogeneous aquifer, in whatever water-bearing sandstones are intersected by any monitored well.

As a result of these concerns, the BLM will develop a science-based water resources monitoring plan following their *Regional Framework for Water Resources Monitoring to Energy Exploration and Development*. This task will be completed in consultation with WDEQ-WQD to ensure that the information required for resource management and regulatory decisions is acquired. The Operators will be consulted for additional operational perspective in devising a feasible monitoring plan and funding its implementation.

The Wasatch Formation aquifer both recharges and discharges in the PAPA, that is, it receives some infiltration from precipitation and some of its groundwater enters surface water in the tributaries of the Green River. Depletion of the Wasatch Formation aquifer could decrease this local contribution to streamflow. This potential could be addressed by the installation of a number of alluvial monitoring wells in watercourses in the PAPA above the influence of the Green and New Fork rivers. Water levels would be measured on a monthly basis for 1 year to assess the seasonal and baseflow components of alluvial flow coming off the PAPA. Groundwater seepage typically supplies a minimum baseflow (surface water and or alluvial groundwater) throughout the year, and local flow generated by seasonal precipitation superimposes a local variable but cyclic component. When baseflow has been established, impacts due to depletion of the Wasatch Formation aquifer should be discernible in the monitoring wells. Mitigation of baseflow depletion would consist of augmenting the streamflow by pumping groundwater to infiltration basins in an affected watercourse. Alluvial wells would also monitor for any increase in salinity in discharge to surface water.

Various development and production scenarios are well specified under the Alternatives, but hydraulic characteristics of the aquifers are not, and so comparisons of impacts to groundwater resources cannot be precise. Impacts to the Wasatch Formation would be greater than the current scenario under all Alternatives, but these impacts should not affect stock and domestic wells if effective well seals are maintained. Operators are increasing the re-use of produced water and therefore, there is the potential for groundwater withdrawals to decrease under each of the Alternatives over time. Relative impacts to groundwater can be gauged by a comparison of total water usage by each Alternative as discussed below. The BLM's Practices and Restrictions as they relate to groundwater would apply to all Alternatives (Appendix 4). Based on the significance criteria in the PAPA DEIS, it is not expected that significant impacts to groundwater would occur under any of the Alternatives.

Pipeline Corridors and Gas Sales Pipelines

The establishment of the proposed corridors and subsequent construction and operation of pipelines is not expected to result in any impacts to groundwater resources. The depth to groundwater would preclude adverse effects from pipeline construction and operation. No toxic substances are proposed for use during pipeline construction. The pipelines would be hydrostatically tested for any leaks prior to entering service to ensure the absence of any leakage of natural gas. Any spills of fuel, lubricants, and solvents during pipeline/facility construction would be contained and cleaned up in accordance with SPCC Plan requirements.

4.13.3.2 Alternative A (No Action Alternative)

Under the No Action Alternative, it is estimated that an additional 1,139 wells would be drilled in the PAPA through 2011. This would require approximately 2,280 acre-feet of water for drilling and completions which would be obtained from groundwater supply wells in the PAPA.

4.13.3.3 Alternative B

Under Alternative B, it is estimated that an additional 4,399 wells would be drilled through 2025. This would require approximately 8,800 acre-feet of water for drilling and completions which would be obtained from groundwater supply wells in the PAPA.

4.13.3.4 Alternative C

Groundwater withdrawals for drilling and completion under Alternative C would be the same as those described for Alternative B.

4.13.3.5 Alternative D

Groundwater withdrawals for drilling and completion under Alternative D would be the same as those described for Alternatives B and C.

4.13.3.6 Alternative E

Groundwater withdrawals for drilling and completion would be the same as those described above in Alternatives B, C and D, but would be over a longer time. This would place less demand on the Wasatch Formation supply aquifer, and allow recharge to dampen drawdown impacts.

4.13.4 Cumulative Impacts

The CIAA for groundwater is the PAPA. Drawdown in the Wasatch Formation should be less than 1 foot at any time on the perimeter of the PAPA. Therefore, it is not likely that groundwater resources would be affected outside the PAPA as a result of the groundwater uses within the PAPA. Cumulative impacts to groundwater would be the same as those described for each of the Alternatives and could affect residential and livestock wells.

4.13.5 Groundwater Resources Additional Mitigation Opportunities

Groundwater Resources Mitigation Measure 1. Within 3 months of the ROD, the Operators, the WDEQ-WQD, and the BLM would develop a plan and funding strategy to characterize groundwater resources in the PAPA.

Groundwater Resources Mitigation Measure 2. As a result of a national initiative to establish a uniform approach for monitoring effects of energy development, the BLM is issuing guidance that provides a template to use in the development of monitoring plans for surface and groundwater resources in energy basins. This template will serve as the *Regional Framework for Water Resources Monitoring Related to Energy Exploration and Development* (Monitoring Framework) and will aid in the development of a credible, science-based, efficient monitoring plan for the PAPA. Concurrent with Mitigation Measure 1, a cooperative effort will be initiated which includes technical specialists from BLM and State Regulatory agencies to complete a science based Groundwater/Aquifer Pollution Prevention, Mitigation and Monitoring Plan within 6 months of completion of the groundwater characterization.

Development of a thorough monitoring plan following the criteria established in the Monitoring Framework will allow integration of pertinent existing monitoring into a comprehensive approach. This combined effort will provide the information needed for the BLM and WDEQ-WQD to understand existing surface and groundwater conditions. It will also allow for the development of a set of actions necessary to maintain water quality within established standards in the PAPA that could be used in an AM approach.

Surface and groundwater monitoring would continue under the agreements set up under the PAPA ROD until the process outlined by the monitoring framework is complete or changes are approved by the appropriate regulatory agencies.

Groundwater Resources Mitigation Measures for Water Supply Wells. The following measures could be implemented to protect groundwater quality:

- All water supply wells could be required to have backflow prevention devices.
- All new water supply wells could be constructed using sanitary water well construction methods. This means using non-toxic lubricants for casing threads, use of clean casing and drill pipe, and use of clean hydrocarbon-free drilling water.

- Water quality could be tested in all new water supply wells to ensure different classes of water are not being mixed.
- Water samples could be collected in new water supply wells and analyzed for major cations, anions, and hydrocarbons.
- Electric logs could be run to characterize the near surface geology.
- Water supply wells could be completed into deeper water-bearing zones instead of using Class I water for drilling and completion.
- All water supply wells could be outfitted with locks to prevent unauthorized access.

Failure to implement these mitigation measures may result in unnecessary or undue degradation and violation of State of Wyoming Water Quality Standards. The Operators are encouraged to consult with the WDEQ-WQD and the Wyoming SEO to insure that water supply well drilling, construction, and completion practices are adequate to protect groundwater. Further, the Operators are encouraged to implement the recommendations provided in the Geomatrix Report (2008).

4.14 SURFACE WATER RESOURCES

4.14.1 Scoping Issues

The public expressed the following concerns about surface water during scoping: evaluate potential for impacts to downstream water users including heavy metals in produced waters.

4.14.2 Impacts Considered in the PAPA DEIS

Because the New Fork and Green rivers flow through the PAPA, the PAPA DEIS (BLM, 1999a) recognized that potentially significant impacts could occur to water quality from increased erosion and sedimentation from construction related runoff (i.e., non-point source pollutants). The BLM also noted the potential impact (increased sedimentation) to water quality from discharge of hydrostatic test water during pipeline testing. Hydrostatic test water, though, was not expected to produce significant impacts because it would be short-term in nature and the Operators would be required to comply with WDEQ-WQD regulations. There could be water quality impacts from accidental spills. Depending on where such a spill occurred, the impacts could be significant.

Impacts from sedimentation would not be significant if the Operators strictly comply with BLM's Mitigation Guidelines, apply relevant stormwater BMPs, and implement appropriate mitigation measures described in the PAPA DEIS. If significant impacts to area waters from sedimentation are to be avoided, attention to control of non-point sources of sediment would be necessary. In the PAPA DEIS, impacts produced by the Alternatives would be considered significant should any of the following occur:

- Construction-related erosion and runoff into intermittent drainages and subsequently into perennial streams, altering the physical characteristics of streambeds;
- Construction-related erosion and leaching of exposed subsoils, releasing increased salts into perennial streams and degrading the quality of water;
- accidental spill of fuels or liquids associated with drilling, construction, or production activities affects the quality of surface water; or
- an increase in sediment loading causes any of the rivers or streams to be identified as a water which does not support its designated use.

Based on these significance criteria, it is not known if significant impact has occurred to surface water.

4.14.3 Alternative Impacts

4.14.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development in the PAPA

Surface Water Withdrawals. Table 4.14-1 shows the amount of required surface water withdrawal in the PAPA under each of the Alternatives for the LOP. Direct impacts to Colorado River endangered fish species could occur as a result of surface water withdrawal. A discussion of the Recovery and Implementation Program for Endangered Fish Species in the Upper Colorado River Basin is provided in Section 4.19.3.1. Surface water would be withdrawn from the New Fork River for hydrostatic testing of trunk pipelines, gas and liquids gathering pipelines, and for dust control during pipeline construction.

Table 4.14-1
Estimated Surface Water Withdrawals from the New Fork River for Life of Project in the PAPA by Alternative

Water Use	Surface Water Withdrawal (acre-feet)		
Surface Water Withdrawal Pipeline Hydrostatic Testing	**No Action Alternative**	**Alternatives B, C, D**	**Alternative E**
Gas gathering	2.37	2.38	3.95
Liquids gathering	0.11	4.98	0.33
30- to 42-inch Mesa Loops	22.53	22.53	22.53
8-inch water line	0.76	0.76	0.76
12-liquid lines	0.00	1.48	0.0
Liquids gathering trunk lines	0.00	0.19	0.0
Water redistribution lines	0.00	0.14	0.00
Pipeline interconnection	0.00	0.40	0.00
Dust Control During Pipeline Construction	11.86	50.28	18.55
Total	**37.63**	**83.14**	**46.12**

Surface Water Discharges. Produced water is managed in several ways in the PAPA. Mostly, produced water is piped or trucked to the Anticline Disposal Facility. Some is re-used in well completions (drill-out of the production zone, or fracturing). Produced water used for drilling is only used after isolation casing has been installed through the fresh water zone. After treatment, some produced water is re-used for dust control as authorized by WDEQ-WQD. These uses are increasing, and re-use of the water reduces the demand on the Wasatch Formation water supply. Some produced water and treatment plant reject is disposed of in permitted deep injection wells, some of which are in the PAPA. Currently, produced water is not discharged in the PAPA; however, Anticline Disposal has a permit to discharge (up to 1 cfs) water to the New Fork River that is treated to WDEQ-WQD standards. Discharge was planned to begin in 2007 but it is has not yet occurred.

Gray water is treated on-site by a third-party and is disposed of by sprinkler onto the land surface (WDEQ-WQD permit has been acquired for the discharge). Impacts to surface water could occur if the application does not conform to the requirements of the WDEQ-WQD permit. Placement of sprinklers, duration of discharge, and the amount of discharge at any one time are limited under the permit to prevent erosion.

Impacts Resulting from Disturbance. Potential direct impacts to surface water include increased salinity, turbidity, and sedimentation in surface waters. These impacts are a result of runoff and erosion, leaching of soil salts, or by increased salinity in groundwater discharging to streams. Increased salinity in surface water is a concern in regard to the Colorado River Basin Salinity Control Act (Section 3.16.1.1).

Implementation of each Alternative is expected to concentrate additional surface disturbance within New Fork River-Alkali Creek, Mack Reservoir, and Sand Draw-Alkali Creek sub-watersheds (Table 4.14-2).

Table 4.14-2
Initial Surface Disturbance in Relation to Sub-Watersheds by Alternative

Sub-Watershed and Hydrologic Unit Code	Alternative A (acres)		Alternatives B, C , and D (acres)		Alternative E (acres)	
	Federal	**Total**	**Federal**	**Total**	**Federal**	**Total**
Big Sandy River-Bull Draw 140401040106	16.9	16.9	49.0	49	31.2	31.2
Big Sandy River - Long Draw 140401040109	0.0	0.0	0.0	0.0	0.0	0.0
Big Sandy River-Waterhole Draw 140401040105	0.0	0.0	0.0	0.0	0.0	0.0
Mud Hole Draw 140401040107	251.3	251.3	209.0	209	464.6	464.6
East Fork River 140401020302	0.0	0.0	0.0	0.0	0.0	0.0
Hay Gulch 140401020105	0.0	0.0	0.0	0.0	0.0	0.0
Lower Muddy Creek-New Fork 140401020603	0.0	0.0	0.0	0.0	0.0	0.0
Lower Pine Creek 140401020203	0.0	0.0	0.0	0.0	0.0	0.0
Lower Pole Creek 140401020403	0.0	0.0	0.0	0.0	0.0	0.0
Mack Reservoir 140401020306	664.7	702.8	1,702.9	1,718.9	1,879.5	1,919.9
New Fork River-Alkali Creek 140401020303	1,925.6	2,067.9	5,907.0	6,320.3	4,893.3	5,118.4
New Fork River- Blue Ridge 140401020305	131.9	134.1	398.9	479.1	450.3	467.7
New Fork River-Duck Creek 140401020102	134.6	134.6	308.7	317	219.4	223.1
New Fork River-Stewart Point 140401020301	120.8	120.8	1,303.9	1,360.5	192.4	192.4
Sand Springs Draw 140401020304	127.3	127.3	532.2	533.7	502.3	504
South Muddy Creek 140401020602	0.0	0.0	0.0	0.0	0.0	0.0
Granite Wash 140401010704	0.0	0.0	0.0	0.0	0.0	0.0
Green River-The Mesa 140401010404	25.5	25.5	61.1	61.1	54.4	54.4
Green River-Tyler Draw 140401010403	57.9	57.9	161.8	161.8	77.4	77.4
North Alkali Draw 140401010705	68.4	79.8	394.7	399.7	289.5	301.9
Sand Draw-Alkali Creek 140401010701	335.8	404.2	1,146.6	1,275.5	1,001.9	1,072.1
Total	**3,860.7**	**4,123.1**	**12,175.8**	**12,885.6**	**10,056.2**	**10,427.1**

Modeling was conducted by HydroGeo, Inc. for sediment loss in the PAPA and transport (load) to the PAPA boundary for all sub-watersheds in the PAPA (HydroGeo, 2006) for the Draft SEIS (BLM, 2006a). Watersheds were modeled for individual storms of varying size, with the amount of erosion proportional to the size of the storm. The model did not consider incremental transport over time. For the Draft SEIS, modeled impacts for seven scenarios were assessed for new disturbance above and beyond that of the current conditions. Under all scenarios, disturbance was assumed to accumulate and not be reclaimed in the model. Because all Alternatives analyzed in this Final SEIS include some degree of reclamation, it was determined that the modeling for the Draft SEIS would be representative of all Alternatives. The model predicted potential sediment losses under all scenarios to be between 10 and 20 percent, without any reclamation.

The potential for impacts from erosion is greatest on the Anticline Crest under all Alternatives. Mack Reservoir, Sand Draw-Alkali Creek, and New Fork River-Alkali Creek sub-watersheds would have the largest potential for increase in annual erosion over the current conditions.

Rates of erosion and sediment transport in the PAPA are currently low, because relatively gentle slopes predominate, and runoff from much of the PAPA occurs only during large storm events. Measurable increases in sediment in the New Fork River are predicted only for 25-year or larger storms (a 25-year storm is of a magnitude that occurs on average every 25 years). Smaller storms mobilize significant sediment on disturbed land, but it tends to be redeposited in lower watercourses before leaving the PAPA. Increased disturbance translates to greater potential for higher sediment yield in all scenarios in large storms.

Reclamation would greatly reduce sediment yield. Instituting BMPs for erosion and sediment transport control would further diminish impacts as well as Operators' adherence to their individual SWPPPs. The BLM's Practices and Restrictions for the Pinedale Anticline Project Area as they apply to erosion and sediment control and use of BMPs would apply to all Alternatives (Appendix 4). Impacts to surface water could occur from accidental spills and leaks. This would be minimized if Operators follow their individual SPCC Plans.

According to the significance criteria in the PAPA DEIS, significant impact to surface water resources is not expected under any of the Alternatives.

<u>Pipeline Corridors and Gas Sales Pipelines</u>

Potential impacts to surface water resources from pipeline construction could include short-term increased turbidity, salinity, and sedimentation of surface waters. This would occur during seasonal flows or precipitation events due to increased runoff and accelerated erosion from disturbed upland areas, and depletion of Green River tributary waters for hydrostatic testing. Clearing and blading followed by construction vehicle travel across ephemeral stream channels could break down stream banks, cause or accelerate erosion, increase sediment loads, and destabilize the channels. However, vehicle access to the pipeline rights-of-way would be confined to existing access roads and to the construction rights-of-way (for the duration of construction activities). No new roads would be constructed. Vehicles would not operate when soils are saturated to avoid rutting and associated excessive soil compaction and enhanced conditions for accelerated erosion. Implementation of approved reclamation measures that extend to ephemeral stream banks and bottoms would also enhance bank stability and limit excessive channel erosion and sedimentation when streams flow again.

No toxic substances are proposed for use during pipeline construction. The pipelines would be hydrostatically tested for any leaks prior to being placed in service. Any spills of fuel, lubricants, and solvents during pipeline/facility construction in the corridors that could be entrained by surface soils materials and/or enter into surface waters or drainages would be contained and cleaned up in accordance with SPCC Plan requirements.

Direct impacts to perennial waterbodies would be minimized by using HDD construction methods. In HDD construction, disturbance is set back away from the river edges and typically above any flood plains that may be present. Increased contributions of sediment to the rivers from affected ephemeral tributaries would be mitigated by measures implemented at ephemeral stream crossings and in compliance with an approved reclamation plan.

Accidental leaks from the proposed natural gas pipelines would likely have negligible impact on surface water quality due to the minor amount of liquids present in the pipelines. The principal risks of pipeline operations that could lead to leaks/releases include excessive pressure, physical damage during flood events, and accelerated soil erosion and pipe corrosion. Pipeline failures due to excess pressure would be prevented by proper engineering design and incorporation of pressure relief valves. The pipeline would be monitored through periodic leakage surveys and patrols to anticipate and correct problems before failures occur.

Approximately 228.9 total acre-feet of water would be withdrawn from the New Fork, Green, and Blacks Fork rivers, combined, for hydrostatic testing and dust control for the proposed RVII, PBC, and Opal Loop III pipelines. Permits and/or license agreements for water withdrawal would be obtained from the Wyoming SEO. The terms of the permits/agreements would ensure that the quantity used for testing would not harm other uses. Discharge operations would be permitted by WDEQ-WQD, and permit requirements would ensure the discharged water would not damage soils or surface waters at the point of discharge. The test waters would be tested and treated, if necessary, to ensure compliance with federal and state water quality standards and permit conditions prior to release.

4.14.3.2 Alternative A (No Action Alternative)

Under Alternative A, Reclamation practices would be similar to that described in the PAPA ROD (Appendix 8A). Because year-round development would be limited to Questar's leases in the northern portion of the PAPA, concentrated development would be minimal under this Alternative. Well pads would likely be dispersed throughout the PAPA and would be left open during the seasonally restricted periods with no need for interim reclamation. Operators would return to these well pads once the seasonally restricted period ends. In addition to surface water withdrawals required for installation of the gas sales pipelines, surface water withdrawals from the New Fork River associated with installation of pipelines within the PAPA under Alternative A would be 37.63 acre-feet, probably within the first 2 years of the ROD.

4.14.3.3 Alternative B

Reclamation under Alternative B has provisions for interim reclamation (Appendix 8B). Interim reclamation would be conducted on well pads if there is no development within 2 years reducing the potential for erosion and sediment loss. Under this Alternative, year-round development would be allowed within CDAs in the Alternative B Core Area and would be concentrated. Concentrated development increases the potential impact from erosion more than if the surface disturbance were dispersed. In addition to the surface water withdrawals required for installation of the gas sales pipelines, surface water withdrawals from the New Fork River for installation of pipelines within the PAPA under Alternative B would be 83.14 acre-feet, probably within the first 2 years of a ROD.

4.14.3.4 Alternative C

Impacts to surface water under Alternative C would be similar to that described for Alternative B. The Reclamation Plan for Alternative C is provided in Appendix 8C.

4.14.3.5 Alternative D

Impacts to surface water under Alternative D would be similar to that described for Alternatives B and C. The Reclamation Plan for Alternative D is provided in Appendix 8D. Under Alternative D, there would be no surface disturbance and therefore no potential for erosion or sediment loss within the federal suspended and term NSO leases in the Flanks, at least for the first 5 years.

4.14.3.6 Alternative E

Under Alternative E, year-round development would be limited to Questar's leases in the northern portion of the PAPA. Alternative E includes development on 415 new pads causing surface disturbance to be more fragmented and dispersed similar to Alternative A. Alternative E includes provision for interim reclamation so even though wells pads would be left open during seasonally restricted periods, Operators would be required to conduct interim reclamation on well pads if there is no development within 2 years (Appendix 8D). In addition to surface water withdrawals for the gas sales pipelines, surface water withdrawals from the New Fork River under Alternative E for installation of pipelines within the PAPA would be 46.12 acre-feet, probably within the first 2 years of the ROD.

4.14.4 Cumulative Impacts

The CIAA for surface water resources is the PAPA which is the same CIAA for soils and vegetation. Watersheds that drain the PAPA are not expected to be directly impacted outside of the PAPA except for those associated with construction of the gas sales pipelines. The extent of indirect impacts would depend primarily on the effectiveness of erosion control and reclamation in the PAPA. Table 4.14-3 shows the cumulative disturbance impacts for each of the Alternatives. The cumulative disturbance for all Alternatives includes disturbance associated with non-wellfield disturbance in the PAPA, existing wellfield disturbance in the PAPA and that portion of disturbance associated with the gas sales pipelines that is within the PAPA. Under each of the Alternatives, the New Fork River-Alkali Creek sub-watershed would have the most disturbance with nearly 10,000 acres under the Alternative B and Alternative C in 2023. Total cumulative disturbance in the PAPA is more than 25,000 acres under each of the action Alternatives in 2023, which represents almost 13 percent of the PAPA.

Table 4.14-3
Cumulative Surface Disturbance in Relation to Sub-Watersheds by Alternative

Sub-Watershed and Hydrologic Unit Code	Existing Non Wellfield Disturbance (acres)	Existing Wellfield Disturbance (acres)	Proposed Gas Sales Pipeline Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative		
				Alternative A	Alternatives B, C, and D	Alternative E
Big Sandy River-Bull Draw 140401040106	22.0	73.3	0.0	112.2	144.3	126.5
Big Sandy River - Long Draw 140401040109	0.0	0.0	0.0	0.0	0.0	0.0
Big Sandy River-Waterhole Draw 140401040105	1.9	0.0	0.0	1.9	1.9	1.9
Mud Hole Draw 140401040107	48.4	348.1	0.0	647.8	605.5	861.1
East Fork River 140401020302	62.7	4.2	0.0	66.9	66.9	66.9
Hay Gulch 140401020105	23.3	0.0	0.0	23.3	23.3	23.3

Sub-Watershed and Hydrologic Unit Code	Existing Non Wellfield Disturbance (acres)	Existing Wellfield Disturbance (acres)	Proposed Gas Sales Pipeline Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative		
				Alternative A	Alternatives B, C, and D	Alternative E
Lower Muddy Creek-New Fork 140401020603	0.0	0.0	0.0	0.0	0.0	0.0
Lower Pine Creek 140401020203	805.8	0.0	0.0	805.8	805.8	805.8
Lower Pole Creek 140401020403	1,740.4	0.0	0.0	1,740.4	1,740.4	1,740.4
Mack Reservoir 140401020306	34.3	816.0	146.4	1,699.5	2,715.6	2,916.6
New Fork River-Alkali Creek 140401020303	1,194.4	2,290.9	133.6	5,686.8	9,939.2	8,737.3
New Fork River- Blue Ridge 140401020305	175.2	209.1	21.9	540.3	885.3	873.9
New Fork River-Duck Creek 140401020102	599.2	36.3	0.0	770.1	952.5	858.6
New Fork River-Stewart Point 140401020301	2,748.4	370.8	0.0	3,240.0	4,479.7	3,311.6
Sand Springs Draw 140401020304	70.1	48.3	0.0	245.7	652.1	622.4
South Muddy Creek 140401020602	20.6	0.0	0.0	20.6	20.6	20.6
Granite Wash 140401010704	0.8	0.0	7.31	8.1	8.1	8.1
Green River-The Mesa 140401010404	23.5	4.2	0.0	53.2	88.8	82.1
Green River-Tyler Draw 140401010403	50.0	18.3	0.0	126.2	230.1	145.7
North Alkali Draw 140401010705	13.0	134.5	97.3	324.6	644.5	546.7
Sand Draw-Alkali Creek 140401010701	5.0	480.6	19.9	909.7	1,781.0	1,577.6
Total	**7,639.0**	**4,834.6**	**426.3**	**17,023.0**	**25,785.5**	**23,327.0**

4.14.5 Surface Water Resources Additional Mitigation Opportunities

Surface Water Resources Mitigation Measure 1. Operators and land management agencies could cooperate to monitor Fremont Lake, the municipal water supply for the Town of Pinedale.

4.15 SOIL RESOURCES

4.15.1 Scoping Issues

There were no project scoping comments related to soil resources.

4.15.2 Impacts Considered in the PAPA DEIS

The PAPA DEIS described potential impacts to soils that include:

- increased wind and water erosion,
- loss of topsoil,
- decreased soil and vegetation productivity, and

- introduction and invasion of noxious weeds.

Removal of vegetation and the exposure of soils during construction of well pads, roads, and pipelines, along with the alteration and compaction of soils during construction, can increase runoff and wind and water erosion. Topsoil, in particular, is a valuable resource in semi-arid areas such as the PAPA, particularly during reclamation as well as for the following considerations:

- topsoil development is slow,
- it provides a crucial plant-growth medium that is essential to establish successful revegetation,
- it is higher in organic matter, fertility and biologic activity than subsoil materials,
- loss or dilution of the topsoil during construction by burial or mixing with subsoil horizons would reduce soil productivity and could hinder successful revegetation, and
- topsoil is generally much darker than subsoil materials and its reapplication during reclamation would help to minimize visual impacts by reducing contrasts on reclaimed sites.

Impacts from erosion would be greatest after initial soil disturbance and would decrease naturally in the short-term due to natural stabilization through particle aggregation and armoring (i.e., formation of soil crusts and pavements). In general, most sediment in the PAPA is from exposed areas (i.e., stream channels and banks, badlands and bare escarpment slopes). The primary factors affecting sediment delivery or movement includes slope gradient, soil particle size, roughness of soil, and vegetation cover.

The BLM considered implementation of Alternatives in the PAPA DEIS would cause significant impacts to soils if:

- disturbed areas are not adequately stabilized to reduce soil erosion and potential impacts to water quality, or
- there is increased erosion or reduced soil productivity to a level which prevents reestablishment of vegetative cover within 5 years.

Based on these criteria, significant impacts to soils has not been documented. However, as pointed out in Chapter 3 and the sections below, there is surface disturbance in soils that are considered sensitive.

4.15.3 Alternative Impacts

4.15.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development in the PAPA

One of the primary concerns related to soil resources is the potential for sedimentation to cause significant adverse impacts to area waters as discussed in Section 4.14. Alteration of soil physical and chemical characteristics (e.g., compaction), dilution of topsoil (i.e., mixing of soil horizons) or the addition of contaminants from spilled materials decrease soil productivity. Sensitive soils (e.g., steep slopes, soils with high erosion potential, saline and/or sodic soils, shallow soils, soils with low reclamation potential, or with high water tables) are more susceptible to impacts due to their limiting characteristics. For example, construction activities on steep slopes (greater than 15 percent) would require larger disturbed areas. They would also require longer and steeper cut and fill slopes which are difficult to successfully revegetate and stabilize, and in turn, have a greater erosion potential. These slopes can be difficult to return to their original contour during final reclamation. The BLM's Practices and Restrictions for the Pinedale Anticline Project Area as they apply to soil resources would apply to all Alternatives (Appendix 4).

By the end of 2006, 595.2 acres were disturbed in the Sensitive Soils SRMZ by wellfield development in the PAPA. Of this, 565.0 were in Blue Rim Sensitive Soils and 57.6 acres were in soils on slopes greater than or equal to 15 percent, increasing the likelihood of erosion (Table 3.17-1 in Chapter 3). Implementation of any of the Alternatives would result in increased disturbance to sensitive soils and the sensitive soils SRMZ (Table 4.15-1).

Table 4.15-1
Initial Surface Disturbance in Relation to Sensitive Soils SMRZ by Alternative

Sensitive Soils Category	Alternative A (acres)		Alternatives B, C , and D (acres)		Alternative E (acres)	
	Federal	Total	Federal	Total	Federal	Total
Blue Rim Area Sensitive Soils	479.8	529.1	1,147.2	1,167.7	1,337.6	1,390.0
Soils on slopes ≥ 15%	193.8	203.1	929.7	974.3	453.7	478.5
Sensitive Soils SRMZ[1]	605.0	661.9	1,919.8	1,984.2	1,599.9	1,675.1

[1] Areas within Sensitive Soils SRMZ are not the combined total of the Blue Rim Area soils and soils on slopes greater than 15 percent because some soils are in both categories – see Map 3.17-1.

Pipeline Corridors and Gas Sales Pipelines

Construction of the proposed pipelines would disturb approximately 2,900 acres. Soil impacts are expected to be temporary (less than 1 year) to short-term (1 to 3 years) in duration. During a period of stabilization and reestablishment of protective vegetative cover, there would be some accelerated erosion and loss of soil material from disturbed areas due to exposure and physical degradation of soil materials during construction activities. Potential for accelerated erosion and soil loss would be greatest in areas with steeper and longer slopes. The largest extent of these steeper and longer slopes is in the Blue Rim Area south of the New Fork River crossing and northwest of the Jonah Field.

Potential for accelerated erosion would be increased during pipeline construction after protective vegetative cover is cleared and topsoil materials are bladed into windrowed stockpiles within the construction rights-of-way. Windrowed topsoil and exposed subsoil would be exposed to accelerated water and wind erosion due to the loss of protective vegetative cover, loss of aggregation, lower infiltration rates, higher runoff rates, and more direct exposure to wind. The exposed subsoils that form the working surface in the construction right-of-way would also receive rubber-tired and track vehicle traffic which would result in soil compaction. Such compaction could result in reduced soil productivity due to loss of soil structure, increased erodibility, and decreased infiltration and waste storage capacity. Accelerated soil erosion could potentially increase delivery of sediment and salinity to drainages.

Site stabilization and reclamation measures would limit potential impacts to soils in duration, extent, and magnitude. Trench spoil would be backfilled into the trench above the installed pipe and subsoil and topsoil would be redistributed over the construction right-of-way. Erosion control features would be installed as necessary. Approved seed mix(es) would be applied. All equipment and vehicular access would be confined to existing roads and the established rights-of-way thereby avoiding soil compaction on undisturbed areas. Vehicle travel during saturated soil conditions would be avoided to prevent rutting, to minimize soil compaction, and to reduce potentials for accelerated soil erosion.

4.15.3.2 Alternative A (No Action Alternative)

Initial surface disturbance in the Sensitive Soils SRMZ is 661.9 acres under the No Action Alternative. This includes 529.1 acres in the Blue Rim Area and 203.1 acres on soils with slopes greater than or equal to 15 percent (Table 4.15-1).

4.15.3.3 Alternative B

Under Alternative B, initial surface disturbance in the Sensitive Soils SRMZ would be 1,984.2 acres. This disturbance would occur on sensitive soils in the Blue Rim Area (1,167.7 acres) on soils with slopes greater than or equal to 15 percent (974.3 acres) (Table 4.15-1).

4.15.3.4 Alternative C

Initial surface disturbance in the Sensitive Soils SRMZ and to sensitive soils would be the same under Alternative C as under Alternative B.

4.15.3.5 Alternative D

Initial surface disturbance in the Sensitive Soils SRMZ and to sensitive soils would be the same under Alternative D as under Alternatives B and C.

4.15.3.6 Alternative E

Initial surface disturbance in the Sensitive Soils SRMZ is 1,675.1 acres under Alternative E. This includes 1,390.0 acres in the Blue Rim Area and 478.5 acres on soils with slopes greater than or equal to 15 percent (Table 4.15-1).

Safety requirements dictate that a drill rig can set up closer to a non-producing well than it can a producing well. This means that for these pads where a well is drilled and then put into production, the pad must be made larger; this would result in more surface disturbance. Well pads are left unreclaimed longer, up to 10 years, because of the rig on and off cycles until the pad is completely drilled out, resulting in additional wind and in some cases, water, erosion.

4.15.4 Cumulative Impacts

Cumulative impact analysis to soil resources in the PAPA is based on past, present, and future levels of surface disturbance in Table 4.15-2. There has been only minor disturbance to the Blue Rim sensitive soils and soils on slopes of 15 percent by existing non-wellfield development. Most of the existing sources were livestock watering facilities and roads. Existing wellfield development in the PAPA has affected sensitive soils by the amounts shown in Table 4.15-2. There would be cumulative impact to sensitive soils by each Alternative as well, at least until reclamation has been successfully implemented.

Table 4.15-2
Cumulative Surface Disturbance in Relation to Sensitive Soils SMRZ by Alternative

Sensitive Soils Category	Existing Non Wellfield Disturbance (acres)	Existing Wellfield Disturbance (acres)	Proposed Gas Sales Pipeline Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative		
				Alternative A	Alternatives B, C, and D	Alternative E
Blue Rim Area Sensitive Soils	32.8	565.0	86.8	1,213.7	1,852.3	2,074.6
Soils on slopes ≥ 15%	28.7	57.6	10.5	299.9	1,071.1	575.3
Sensitive Soils SRMZ[1]	57.2	595.2	0.0	1,314.3	2,636.6	2,327.5

[1] Areas within Sensitive Soils SRMZ are not the combined total of the Blue Rim Area soils and soils on slopes greater than 15 percent because some soils are in both categories – see Map 3.17-1.

4.15.5 Soil Resources Additional Mitigation Opportunities

Soil Resources Mitigation Measure 1. To determine site potential and facilitate reclamation as well as identify sensitive soils, a Level III soil survey could be conducted.

4.16 VEGETATION RESOURCES

4.16.1 Scoping Issues

1. Multiple wells drilled from one well pad should be standard practice to minimize surface disturbance.
2. Operators should coordinate activities with livestock producers who utilize the Mesa.
3. BLM should ensure reclamation is timely, successful, and appropriate to benefit wildlife.

4.16.2 Impacts Considered in the PAPA DEIS

Potential impacts to vegetation from all project Alternatives considered in the PAPA DEIS include:

- removal of native vegetation during construction of well pads, roads, and pipelines;
- sagebrush, the predominant shrub within the PAPA, may take 10 to 20 years to become reestablished;
- surface disturbance to sagebrush steppe vegetation may adversely affect wildlife species that depend on sagebrush for some life history function;
- undisturbed ground is covered by microphytic crusts (growths of lichens, algae, mosses, fungi, or bacteria on the soil surfaces) which are readily destroyed by vehicles and trampling, thereby increasing erosion potential and suitability for invasions by nonnative species;
- cheatgrass and halogeton are exotic species that have invaded, halogeton is poisonous to livestock; and
- introduction of other noxious weeds following removal of native vegetation is a potential impact that would further limit reestablishment of native species.

The BLM considered that impacts to vegetation produced by the Alternatives in the PAPA DEIS would be significant if:

- within 5 years, reclaimed areas do not attain adequate vegetation cover and species composition to stabilize the site and to support predisturbance land uses including livestock forage, wildlife habitat, and big game population objectives; or
- there is invasion and establishment of noxious nonnative weeds that contribute to unsuccessful revegetation.

Based on the significance criteria above, it is not known that vegetation resources have been significantly impacted by existing development in the PAPA.

4.16.3 Alternative Impacts

4.16.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development in the PAPA

In general, the extent of impacts by removal of vegetation would be influenced by precipitation and soil characteristics. Areas with shallow or exposed subsoils and areas where soils are highly alkaline would be difficult to revegetate. In 1999, mean annual precipitation in the PAPA was approximately 10 inches. Beginning in 2000 and continuing through 2003, precipitation in the PAPA was consistently below the 30-year average. This is in part because snowfall (October through April) was below the 30-year average of 58 inches since 1987, except during winter 2003-2004 (Table 3.3-1). With the possibility that drought could continue, the future of successful revegetation in the PAPA could be at risk.

Wellfield development directly impacts vegetation, primarily by removal. Indirect impact to vegetation may occur if wellfield development displaces native and domestic herbivores, causing excessive browsing and/or grazing on vegetation resources that would otherwise not occur. Indirect impact to native vegetation can also occur if invasive non-native species become established and limit or prohibit growth of native species.

In addition to black henbane and scentless chamomile being declared as noxious weeds by Sublette County, large areas of the county have also been invaded by Canada thistle and perennial pepperweed and to lesser extents by hoary cress and Russian knapweed which are state-listed noxious species (Table 3.18-2 in Chapter 3). Because noxious weeds are often able to establish in areas following surface disturbance, primarily along roads, areas of oil and gas development, and in heavily grazed areas (BLM, 2005e), the potential for increased infestation and profusion of weeds is very likely under all Alternatives.

The BLM's Practices and Restrictions for the Pinedale Anticline Project Area as they relate to vegetation resources and reclamation would apply to all Alternatives (Appendix 4). Individual Reclamation Plans are also specified under each Alternative.

Sagebrush-dominated vegetation is the most extensive of all vegetation categories in the PAPA. By the end of 2006, most surface disturbance occurred in the sagebrush steppe vegetation type (3,932.5 acres). Continued direct impact to sagebrush and other native vegetation types is expected under each Alternative due to removal of vegetative cover and the long re-growth timeframe of shrubs (Table 4.16-1). The potential for significant impact would increase as additional development is implemented under any of the Alternatives.

Table 4.16-1
Initial Surface Disturbance in Relation to Vegetation Types by Alternative

	Alternative A (acres)		Alternatives B, C , and D (acres)		Alternative E (acres)	
Vegetation Category	**Federal**	**Total**	**Federal**	**Total**	**Federal**	**Total**
Sagebrush Steppe	3,029.4	3,172.0	9,766.4	10,117.2	7,785.1	7,988.0
Mixed Grass Prairie	310.2	313.3	964.8	990.8	795.6	806.7
Greasewood Flats	69.2	69.2	218.8	218.8	213.6	213.6
Desert Shrub	248.2	251.3	627.8	629.6	705.6	709.5
Riparian Forest and Shrub	32.3	68.9	91.1	183.9	71.1	122.1
Other limited types	1.2	1.2	22.3	22.3	1.6	1.6
Barren Ground	34.3	39.0	81.4	83.4	92.4	97.4
Irrigated Cropland	129.9	202.2	380.7	614.5	380.2	475.5
Human Settlement	6.0	6.0	22.5	25.1	11.0	12.6
Total	**3,860.7**	**4,123.1**	**12,175.8**	**12,885.6**	**10,056.2**	**10,427.0**

Pipeline Corridors and Gas Sales Pipelines

Construction of pipelines within the proposed corridors would directly impact and possibly indirectly impact vegetation by the mechanisms discussed, above. The extent of active disturbance to the vegetative cover is expected to be limited to the construction right-of-way approved for each pipeline. Incremental disturbance and subsequent reclamation of the corridors is anticipated with each pipeline installation.

Construction of the proposed RVII and the PBC and Opal Loop III pipelines would disturb approximately 2,813 acres of mostly native shrubs and grasses. Construction activities would result in either the direct removal of vegetation by blading, excavation/trenching, or damage from vehicular traffic and placement of equipment and materials where some vegetation may be left in place within the right-of-way. Removed vegetative debris would be windrowed to one side of the construction right-of-way, usually in combination with salvaged topsoil materials, for later redistribution across the disturbed right-of-way as part of reclamation.

Invasive, noxious weed species could establish in cleared, disturbed areas resulting in infestations that may limit success of native and/or desirable species. Weed seeds or cuttings of some species could be transported naturally (wind and water) or accidentally (vehicles or other equipment) to the disturbed areas. Weed seeds may be present in the native soil materials and the removal of vegetative cover and soil disturbance may promote weed establishment at the expense of desirable species.

In order to replace protective vegetative cover, limit weed infestation, and restore vegetative productivity of desirable species, all areas disturbed for pipeline construction would be reclaimed and revegetated after construction is complete. Revegetation would be conducted with landowner-approved seed mixtures to promote establishment of grasses in the short-term while the shrubs would become established over a longer period of time. On federal lands, different seed mixtures may be applied to different areas at the direction of the BLM/U.S. Bureau of Reclamation. Grasses could require 3 to 5 years for successful re-establishment in arid environments. Shrub components may require more than 20 years for recovery to predisturbance levels after reseeding and reclamation. Although some weed infestation may be anticipated on the pipeline construction right-of-way, the application of weed control measures would minimize impacts from weed species. Overall, long-term impacts to vegetative resources should be minimal.

4.16.3.2 Alternative A (No Action Alternative)

Under the No Action Alternative, initial surface disturbance of 4,123.1 acres would result from construction of 249 well pads and associated roads, pipelines, and ancillary facilities. LOP surface disturbance would be 1,622.5 acres. Reclamation would be similar to current management practices under the PAPA ROD (Appendix 8A). Year-round development under this Alternative would be limited to Questar's leasehold in the northern portion of the PAPA as defined by BLM's 2004 Decision Record (BLM, 2004a) although development could occur outside of the seasonally restricted areas. All disturbance outside of this leasehold must take place while adhering to seasonal restrictions for wildlife unless exceptions are granted.

Opportunity for interim reclamation under this Alternative is minimal because while drilling within seasonal restrictions for wildlife, Operators would be required to leave well pads open during the seasonally restricted periods returning to them after the seasonally restricted period.

Initial disturbance would be greatest in the Sagebrush Steppe (3,172.0 acres) vegetation type. Other types of vegetation that would be disturbed under this Alternative are shown in Table 4.16-1.

4.16.3.3 Alternative B

Under Alternative B, year-round development would occur in CDAs within the Alternative B Core Area (Map 2.4-3 in Chapter 2). Development outside of the Alternative B Core Area would occur with seasonal wildlife restrictions, unless exceptions are granted.

Alternative B would require construction of 250 new well pads, 100 miles of new road and associated ancillary facilities. In the Alternative B Core Area, development would include concentrated development which allows for utilization of larger multiple-well pads occurring year-round. This allows for operations on individual well pads to be completed sooner ultimately allowing for reclamation of wells up to a decade earlier than under development within seasonally restricted periods. Under Alternative B, reclamation would occur according to the Reclamation Plan provided by the Proponents (Appendix 8B).

Initial disturbance would be greatest in the Sagebrush Steppe (10,117.2 acres) vegetation type. Other types of vegetation that would be disturbed under this Alternative are shown in Table 4.16-1.

4.16.3.4 Alternative C

Implementation of Alternative C would result in the same initial and LOP surface disturbance as Alternative B (Table 4.16-1) and it is reasonable that the disturbance would occur in the same location and would affect the same vegetation types.

Year-round development would be allowed in the Alternative C Core Area (with the exception of DA-5) and development outside of the Alternative C Core Area would be conducted under seasonal wildlife restrictions. Rates of wellfield development within different portions of the PAPA (CDAs in Alternative B versus DAs in Alternative C) would be different at different times during the common period of development from 2007 through 2025. Under Alternative C, there is opportunity for full-field development in DAs to be completed prior to development in other DAs with the potential reclamation and revegetation to be finalized in those DAs sooner than may be possible for other Alternatives.

Under Alternative C, because development would be complete in the southern area of DA-1 before moving north and development in DA-2 would be complete before moving to DA-3, the potential exists for focal points of final reclamation rather than just interim reclamation. Reclamation would be conducted as outlined in Appendix 8C. Under Alternative C, final reclamation must begin, once an area is fully developed. Depending on how successful future revegetation efforts would be during wellfield development, there may be some reestablishment of native vegetation within the PAPA, though not to pre-disturbance levels. Disturbed areas within sagebrush steppe would most likely be converted to some other vegetation type.

4.16.3.5 Alternative D

Implementation of Alternative D would result in the same potential initial and LOP surface disturbance as Alternatives B and C (Table 4.16-1) and it is reasonable that the disturbance would occur in the same location and would affect the same vegetation types.

Under Alternative D, year-round development would be allowed within the Alternative D Core Area but would also include the PDA where year-round development could occur if approved by the BLM AO. Alternative D includes specific progression for delineation drilling not included in Alternative C (Chapter 2, Section 2.4.3). If year-round development is approved within either all or portions of the PDA, the spatial extent of high intensity development within the PDA would occur earlier than under Alternative C, and may resemble Alternative B which includes a larger core area. However, the Alternative D Reclamation Plan (Appendix 8D) would ensure faster and more results-oriented return of vegetation and functional habitat than the other Alternatives, for both interim and final reclamation.

During the first 5 years after issuance of a ROD, under Alternative D, there would be no new wellfield development in the Flanks (outside the boundary of the PDA) in federal suspended and term NSO leases (Map 2.4-9 in Chapter 2). After 5 years, development could occur in the Flanks if approved by the BLM AO.

4.16.3.6 Alternative E

Year-round development under Alternative E would only be allowed in Questar's leases in the northern portion of the PAPA as stated in BLM's 2004 Decision Record (BLM, 2004a). Year-round development would not be allowed in seasonally restricted areas unless exceptions are granted by the BLM. Therefore, the development period for Alternative E (a full-field development Alternative) would be extended over a longer time, through 2033.

Opportunity for interim reclamation under this Alternative is minimal because while drilling within seasonal restrictions for wildlife, Operators would be required to leave well pads open during the seasonally restricted periods returning to them after the seasonally restricted period, resulting in pads being open longer. Reclamation requirements under Alternative E, including revegetation, would be similar to that under Alternative D (Appendix 8D).

4.16.4 Cumulative Impacts

The CIAA for vegetation is the PAPA. Cumulative impact analysis to vegetation resources in the PAPA is based on past, present, and future levels of surface disturbances in Table 4.16-2 for which the vast majority of impact by any Alternative would be within sagebrush steppe. There would be cumulative impact to irrigated cropland by each Alternative as well. As shown in Table 4.16-2, 5,777.4 acres of irrigated cropland is due to agricultural use. Even so, there is existing wellfield development (198.1 acres) and future development that would convert cropland to a non-vegetated status, at least until reclamation has been successfully implemented. Likewise, the human settlement category in Table 4.16-2 is comprised of residences, roads, and urban infrastructure in the PAPA.

Table 4.16-2
Cumulative Surface Disturbance to Vegetation Types by Alternative

Vegetation Category	Existing Non Wellfield Disturbance (acres)	Existing Wellfield Disturbance (acres)	Proposed Gas Sales Pipeline Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative		
				Alternative A	Alternatives B, C, and D	Alternative E
Sagebrush Steppe	1,006.1	3,932.5	294.2	8,404.8	15,350.0	13,220.8
Mixed Grass Prairie	37.0	340.8	34.4	725.5	1,403.0	1,218.9
Greasewood Flats	18.2	39.0	0.0	126.4	276.0	270.8
Desert Shrub	27.4	294.0	64.3	637.0	1,015.3	1,095.2
Riparian Forest and Shrub	38.5	10.7	7.3	125.4	240.4	178.6
Other limited types	0.6	1.7	0.0	3.5	24.6	3.9
Barren Ground	3.6	16.5	0.2	59.3	103.7	117.7
Irrigated Cropland	5,777.4	198.1	26.0	6,203.7	6,616.0	6,477.0
Human Settlement	730.2	1.3	0.0	737.5	756.6	744.1
Total	**7639.0**	**4,834.6**	**426.3**	**17,023.0**	**25,785.5**	**23,326.9**

While existing, non-wellfield disturbance has generated a minor amount of disturbance compared to existing and future wellfield disturbance, the majority of existing wellfield disturbance has been concentrated in sagebrush steppe and future disturbance by any Alternative are expected in sagebrush steppe as well.

4.16.5 Vegetation Resources Additional Mitigation Opportunities

Vegetation Resources Mitigation Measure 1. A disturbance cap could be imposed in the PAPA. Once a certain amount of surface disturbance occurs, additional surface disturbance would not be allowed until disturbed areas are reclaimed to an acceptable level. This would provide certainty in how much land could be disturbed at one time. A phased process could be applied to aid in meeting acceptable reclamation levels. Some obstacles are likely to occur in allocating surface disturbance amongst the various leaseholders.

Vegetation Resources Mitigation Measure 2. Vegetation treatments could be applied to the west side of the Mesa Allotment and within other impacted allotments to improve/maintain rangeland health and provide for improved forage and habitat.

4.17 GRAZING RESOURCES

4.17.1 Scoping Issues

The following concerns related to livestock and grazing resources were raised during the scoping process:

1. BLM could evaluate how effects to wintering mule deer on the Mesa would affect private lands and consider off-site mitigation for affected landowners.
2. BLM could evaluate how off-site mitigation benefiting wildlife would reduce livestock AUMs on and off the Mesa.
3. Operators could coordinate activities with livestock producers who utilize the Mesa.

4.17.2 Impacts Considered in the PAPA DEIS

BLM analyzed potential impacts to grazing resources from wellfield development in the PAPA DEIS (BLM, 1999a). The BLM considered the primary impact to grazing resources would be the loss of forage associated with construction and production-related disturbance. Loss of forage associated with construction was anticipated to be temporary (short-term), lasting until areas became revegetated, approximately 3 to 5 years after reclamation. However, production-related disturbance, such as portions of well pads and road surfaces, would convert rangeland to an industrial use for the life of the project. Other impacts to grazing considered in the PAPA DEIS include:

- displacement of livestock from preferred grazing areas and stock watering facilities or ponds;
- disruption of livestock trailing by surface pipelines (typically greater than 6 inches in diameter), and new roads that run perpendicular to cattle drive trails, or large surface pipelines laid across two-track roads which impede vehicles and cause annoying and sometimes long detours;
- damage to range improvements including fences, cattleguards, water wells, and water impoundments;
- the spread of noxious weeds; and
- increased injury or loss of livestock from vehicle-livestock collisions or other incidents associated with oil and gas operations.

Section 4.13 describes the potential impacts of water supply wells in the PAPA could have on the existing stock water wells. The BLM considered impacts produced by the project Alternatives would be significant if:

- animal unit months in any single grazing allotment declined by 5 percent or more through clearing or disturbance of vegetation; or
- project activities result in long-term disruption of grazing management, such as changes in livestock use patterns, which result in increased resource conflicts or changes in ranching operations, livestock trailing, watering, fencing, and feeding.

More than 5 percent of some grazing allotments in the PAPA have been subject to surface disturbance as of November 2006. Assuming that grazing capacities (AUMs) in any allotment are directly related to the amount of vegetation present, those allotments have been significantly impacted by current wellfield developments, under the significance criteria in the PAPA DEIS (BLM, 1999a).

4.17.3 Alternative Impacts

4.17.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development in the PAPA

Wellfield development directly impacts grazing resources, primarily by removal of vegetation. Other direct impact includes livestock deaths due to wellfield actions. BLM has reported inadequate fencing around pits and tanks. Livestock, similar to wildlife, can suffer from toxic effects of ingesting fluids from reserve pits, particularly if pit fluids are contaminated with petroleum-based drilling fluids (Ramirez, 2000) and other compounds such as benzene and other organic compounds, or chromium, lead and other metals (EPA, 2000).

Wellfield activities impact grazing management within each of the affected 16 allotments. Well pads, roads, and other associated facilities would disrupt seasonal movement of livestock, including that along the Green River Stock Drift, damage cattle guards and fences, and allow for movement of livestock into non-permitted areas leading to potential resource conflicts.

Increased vehicular traffic has caused several livestock deaths in the PAPA since the PAPA ROD (BLM, 2000b) was issued. Increases in wellfield development have contributed to high levels of dust on some areas of forage plants (Schultz, 2006). Dust suppressants (magnesium chloride) applied to dirt road surfaces may accelerate deterioration of metals, such as cattle guards (Turner, 2007).

Indirect impact to grazing resources may occur if wellfield development displaces native herbivores and livestock, causing them to graze unaffected areas. Displacement and concentration of animals could cause excessive grazing pressure on vegetation that would otherwise not occur.

Drought on the PAPA has probably exacerbated wellfield impact. In 2003 and 2004, the BLM proposed a 25 percent reduction in PAPA allotment use because of drought. The number of livestock grazing on the BLM allotments was moderately reduced during that time (Schultz, 2006).

Indirect impact to native vegetation, and consequently grazing, can also occur if invasive nonnative species become established and limit or prohibit growth of native vegetation. Nonnative invasive species may be less palatable than native vegetation and some may be toxic to livestock. Black henbane and scentless chamomile are declared weeds in Sublette County. Relatively large areas of the county have been infiltrated by Canada thistle and perennial pepperweed and to lesser extents by hoary cress and Russian knapweed, all of which are listed as noxious species by the State of Wyoming. Noxious weeds are often able to establish in areas following surface disturbance, primarily along roads, areas of oil and gas development, and in heavily grazed areas (BLM, 2005e), and therefore, the potential for increased infestation and profusion of weeds is very likely under any of the Alternatives. Canada thistle and perennial pepper weed are especially aggressive and difficult to control once established. Hoary cress can be controlled with herbicides but is very competitive with other plants if established and Russian knapweed readily colonizes pastures, roadsides, and other disturbed sites. Introduction of additional noxious and invasive weed species may occur due to increased wellfield activities that require equipment and supplies from outside of the county and region. This would lead to an increased need for measures associated with weed management and control.

Of the 16 grazing allotments in the PAPA, the ones most affected by wellfield development and those that would continue to be affected are on the Anticline Crest. The amount of surface disturbance that has been reclaimed in allotments is unknown and there is no evaluation of successful revegetation that could offset the impact to AUMs by surface disturbance. Though no estimate has been made of changes in AUMs within either allotment, the amount of surface disturbance suggests that significant impacts to grazing resources (more than 5 percent of the total allotment areas) in two allotments have already occurred according to the impact significance criteria established in the PAPA DEIS (BLM, 1999a).

The amount of forage lost to livestock grazing within any single allotment during future development by any of the Alternatives cannot be predicted because revegetation of disturbed surfaces would compensate for forage lost through development. However, forage lost due to very dense wellfield development could be considerable and successful reclamation could take a decade to reestablish grazing. Future wellfield development under any Alternative is expected to generate significant impact according to the significance criteria in the PAPA DEIS. In particular, more than 5 percent of the New Fork Individual and Stud Horse Common allotments have already been impacted by wellfield surface disturbance (Table 3.19-1 in Chapter 3) and projected new surface disturbance by each Alternative will further reduce grazing capacities in these and other allotments in the PAPA (Table 4.17-1). Due to wellfield activities, wildlife may move off the PAPA and use other areas including private lands used for other activities such as livestock grazing.

Future wellfield development under any Alternative is expected to generate significant impact according to the significance criteria in the PAPA DEIS (Table 4.17-1). Such impacts are expected to be reduced to levels below impact significance once surface disturbance has been fully reclaimed. Depending on how successful future revegetation efforts would be during wellfield development, grazing capacity may or may not become reestablished to levels above 95 percent in allotments where substantial areas have been disturbed.

The BLM's Practices and Restrictions for the Pinedale Anticline Project Area as they relate to grazing resources would apply under all Alternatives (Appendix 4). Reclamation Plans are provided for each Alternative (Appendix 8).

Table 4.17-1
Initial Surface Disturbance in Relation to Grazing Allotments by Alternative

	Alternative A (acres)		Alternatives B, C , and D (acres)		Alternative E (acres)	
Allotment and Number	**Federal**	**Total**	**Federal**	**Total**	**Federal**	**Total**
Blue Rim Individual (2173)	1,214.6	1,264.4	4,141.7	4,163.0	3,890.2	3,943.1
Circle 9 Individual (2124)	0.0	0.0	0.0	0.0	0.0	0.0
Clark-Bloom Common (2053)	116.4	116.4	256.9	256.9	196.2	196.2
Blue Rim Desert (2029)	0.0	0.0	0.0	0.0	0.0	0.0
Fremont Butte Common (2009)	106.4	107.0	388.0	392.0	409.0	411.4
Luman Individual (2124)	4.1	4.1	12.5	12.5	27.4	27.4

	Alternative A (acres)		Alternatives B, C , and D (acres)		Alternative E (acres)	
Marincic Mesa Individual (2132)	0.0	0.0	0.0	0.0	0.0	0.0
Mesa Common (2031)	1,153.6	1,183.3	3,150.3	3,288.5	2,629.8	2,716.4
Mount Airy Common (2049)	270.7	270.7	1,932.6	1,933.3	421.2	421.2
New Fork Individual (2113)	205.1	210.6	594.5	603.2	606.1	611.8
Burch Individual (2050)	9.2	11.2	28.1	79.7	21.5	38.1
Northwest Square Top Individual (2123)	139.2	139.2	708.4	708.4	532.8	532.8
Square Top Common (2051)	14.3	14.3	18.5	18.5	37.2	37.2
Stud Horse Common (2008)	392.8	461.0	331.3	459.8	693.0	762.9
Sand Draw (2156)	0.4	0.4	0.8	0.8	0.6	0.6
Boundary/Poston (13005)	0.1	0.1	1.4	1.4	1.4	1.4
Total	**3,626.9**	**3,782.7**	**11,565.0**	**11,918.0**	**9,466.4**	**9,700.5**

Pipeline Corridors and Gas Sales Pipelines

Establishment of the three proposed pipeline corridors would have no immediate impact on lands within those portions of the corridors used for livestock grazing. However, pipeline construction/trenching within the proposed corridors would result in short-term loss of available forage and potential temporary impacts on animal movement and well-being.

Based on an average stocking ratio of 11.5 acres per AUM for the area (BLM, 2006c), the construction of the proposed pipelines would affect 252 AUMs (2,900 acres/11.5 acres per AUM). The estimate includes federal, state, and private lands and assumes all lands within the corridors are open to grazing. These affected AUMs would be restored in the short-term as re-seeded vegetation reestablishes and restores vegetative productivity in the construction rights-of-ways over a 3 to 5 year period.

To minimize impacts to animal movement and overall well being, soft plugs would be constructed and left in the open trenchline every 0.25 mile to allow for livestock and wildlife crossings and if necessary escape from the trench should an animal fall into the open trench.

Long-term loss of forage would be negligible because of the minimal amount of LOP disturbance (less than 1 acre for each pipeline) required for ancillary surface facilities.

4.17.3.2 Alternative A (No Action Alternative)

Under Alternative A, approximately 2.2 percent of the federal grazing capacity (3,626.9 acres out of 158,248 acres) would be disturbed, assuming a direct relationship between surface disturbance to vegetation and assuming no reclamation.

Reclamation under Alternative A would be similar to reclamation currently ongoing in the PAPA (Appendix 8A). Year-round development would only be allowed in Questar's leases in the northern portion of the PAPA as stated in BLM's 2004 Decision Record (BLM, 2004a), unless exceptions are granted by the BLM AO. In seasonally restricted areas, Operators would be required to leave pads open during the seasonally restricted period, moving drilling rigs to other locations outside of the seasonally restricted areas, and return to those pads when development is no longer seasonally restricted. Opportunities for concentrated development are minimal under Alternative A, causing additional fragmentation, which could increase impacts to grazing.

4.17.3.3 Alternative B

Over 7 percent the federal grazing capacity (11,565.0 acres out of 158,248 acres) and over 7 percent of grazing capacity on all lands (11,918.0 acres out of 165,712.0 acres) would be disturbed under Alternative B, assuming a direct relationship between surface disturbance to vegetation and assuming no reclamation.

The Proponents have provided a Reclamation Plan which would apply to Alternative B (Appendix 8B). Under Alternative B, year-round development would be allowed in the entire Alternative B Core Area, 19 square miles at a time. This provides an opportunity for concentrated development with larger multi-well pads where development and final reclamation could be completed in sequence without leaving the pad open. Under Alternative B, Operators would conduct interim reclamation on pads that have no development for 2 years.

4.17.3.4 Alternative C

Implementation of Alternative C would result in the same initial surface disturbance as Alternative B (Table 4.17-1) and it is reasonable that the disturbance would occur in the same location and would affect the same grazing allotments.

Reclamation under Alternative C is described in Appendix 8C. Under Alternative C, year-round development would occur within the Alternative C Core Area except for DA-5. Alternative C allows for development to be completed in specific areas before new areas are developed (activities completed in DA-2 before initiated in DA-3). This provides the opportunity for final reclamation due to concentrated development in large areas (within all of DA-2) which could lessen the impacts to grazing. Under Alternative C, Operators would be required to conduct interim reclamation on pads that have no development for 2 years or more.

4.17.3.5 Alternative D

Implementation of Alternative D would result in the same initial surface disturbance as Alternatives B and C (Table 4.17-1) and it is reasonable that the disturbance would occur in the same location and would affect the same grazing allotments.

Unlike Alternative C, year-round development would occur in all DAs of the Alternative D Core Area, simultaneously. Operators could return to the same vicinity multiple times during the development period which could potentially prolong the effects to grazing. Reclamation under Alternative D would be conducted in accordance with the Reclamation Plan provided in Appendix 8D which requires interim reclamation on pads with no development for 2 years.

No development would occur in the federal suspended and term NSO leases in the Flanks (outside of the Alternative D PDA) for at least the first 5 years. This would leave large areas open for grazing in the Flanks during that time.

4.17.3.6 Alternative E

Under Alternative E, almost 6 percent of the federal grazing capacity (9,466.4 acres out of 158,248 acres) would be disturbed. Approximately 5.8 percent of grazing capacity on all lands (9,700.5 acres out of 165,712 acres) would be disturbed under this Alternative, assuming a direct relationship between surface disturbance to vegetation and assuming no reclamation.

Reclamation under Alternative E, including revegetation, would be similar to that under Alternative D (Appendix 8D). Similar to Alternative A, year-round development would only be allowed in Questar’s leases in the northern portion of the PAPA as stated in BLM’s 2004 Decision Record (BLM, 2004a), unless exceptions are granted by the BLM AO. In seasonally restricted areas, Operators would be required to leave pads open during the seasonally restricted period, moving drilling rigs to other locations outside of the seasonally restricted areas, and return to those pads when development is no longer seasonally restricted. Opportunities for concentrated development are minimal under Alternative E, causing additional fragmentation, which could increase impacts to grazing. Even though Alternative E requires interim reclamation for well pads that are not developed within 2 years, well pads would be left open during seasonally restricted periods and returned to when the seasonal restrictions end, thereby, prolonging the need for reclamation actions.

4.17.4 Cumulative Impacts

The CIAA for grazing resources is the PAPA. Even though employment in agriculture within Sublette County decreased from 2001 to 2004 (Section 3.5 in Chapter 3), livestock grazing in the PAPA remains an important use of lands for livestock producers within the BLM grazing allotments (see scoping comments in Section 4.17-1, above). Cumulative impact analysis to grazing resources in the PAPA is based on past, present, and future levels of surface disturbance in Table 4.17-2.

Table 4.17-2
Cumulative Surface Disturbance in Relation to Grazing Allotments by Alternative

Allotment and Number	Existing Non Wellfield Disturbance (acres)	Existing Wellfield Disturbance (acres)	Proposed Gas Sales Pipeline Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative		
				Alternative A	Alternatives B, C, and D	Alternative E
Blue Rim Individual (2173)	25.2	1,374.3	318.9	2,982.8	5,881.4	5,661.5
Circle 9 Individual (2124)	0.0	0.0	0.0	0.0	0.0	0.0
Clark-Bloom Common (2053)	125.8	429.0	0.0	671.2	811.7	751.0
Blue Rim Desert (2029)	43.4	0.8	0.0	44.2	44.2	44.2
Fremont Butte Common (2009)	8.5	31.1	0.0	146.6	431.6	451.0
Luman Individual (2124)	18.5	15.5	0.0	38.1	46.5	61.4
Marincic Mesa Individual (2132)	0.0	0.0	0.0	0.0	0.0	0.0
Mesa Common (2031)	126.2	1,370.4	9.6	2,689.5	4,794.7	4,222.6
Mount Airy Common (2049)	17.2	518.1	0.0	806.0	2,468.6	956.5
New Fork Individual (2113)	0.9	76.8	48.9	337.2	729.8	738.4
Burch Individual (2050)	9.9	28.7	0.0	49.8	118.3	76.7
Northwest Square Top Individual (2123)	0.3	339.6	0.0	479.1	1,048.3	872.7
Square Top Common (2051)	23.2	100.7	0.0	138.2	142.4	161.1
Stud Horse Common (2008)	18.2	7.9	0.0	487.1	485.9	789.0
Sand Draw (2156)	0.0	63.6	0.0	64.0	64.4	64.2
Boundary/Poston (13005)	20.5	0.0	0.0	20.6	21.9	21.9
Total	**437.8**	**4,356.5**	**377.5**	**8,954.5**	**17,089.8**	**14,872.3**

Non-wellfield activities have generated a minor amount of disturbance in grazing allotments in the PAPA. Since 2000, wellfield disturbance is about 10 times the area (4,356.5 acres) than had been disturbed by non-wellfield actions (437.8 acres) (Table 4.17-2). Cumulative disturbance under Alternatives B, C, and D would be approximately 10 percent of all grazing lands in the PAPA. Cumulative disturbance under Alternative A would be approximately 5 percent and that generated by Alternative E would be nearly 9 percent of all grazing lands in the PAPA. These cumulative effects would not be distributed among all allotments. Focal areas of cumulative disturbance by all Alternatives would be in the Blue Rim Individual, Burch Individual, Clark-Bloom Common, Mesa Common, Mount Airy Common, New Fork Individual, Northwest

Square Top, and Sand Draw allotments. Effects to grazing could be minimized depending on the success of reclamation under any Alternative.

4.17.5 Grazing Resources Additional Mitigation Opportunities

Grazing Resources Mitigation Measure 1. A 100-foot buffer of no surface disturbance on either side of the stock drift as shown in Map 4.17-1 could be imposed to ensure adequate areas for unimpaired movement of stock.

Grazing Resources Mitigation Measure 2. On-site and off-site stock water facilities could be developed throughout the 16 affected grazing allotments to aid in directing stock use to appropriate areas, especially along the west side of the Mesa.

Grazing Resources Mitigation Measure 3. Wildlife friendly cross-fencing could be established, on either a short- or long-term basis in allotments identified as focal areas in the cumulative disturbance section to protect livestock.

Grazing Resources Mitigation Measure 4. Operators could voluntarily agree to compensation for stock death loss directly associated with wellfield activities.

Grazing Resources Mitigation Measure 5. Operators could provide forage mitigation in the form of alternative pasturing, supplemental feeding, and other approved methods especially if the option for a livestock permittee to take non-use within an allotment would be beneficial.

4.18 WETLANDS, RIPARIAN RESOURCES AND FLOOD PLAINS

4.18.1 Scoping

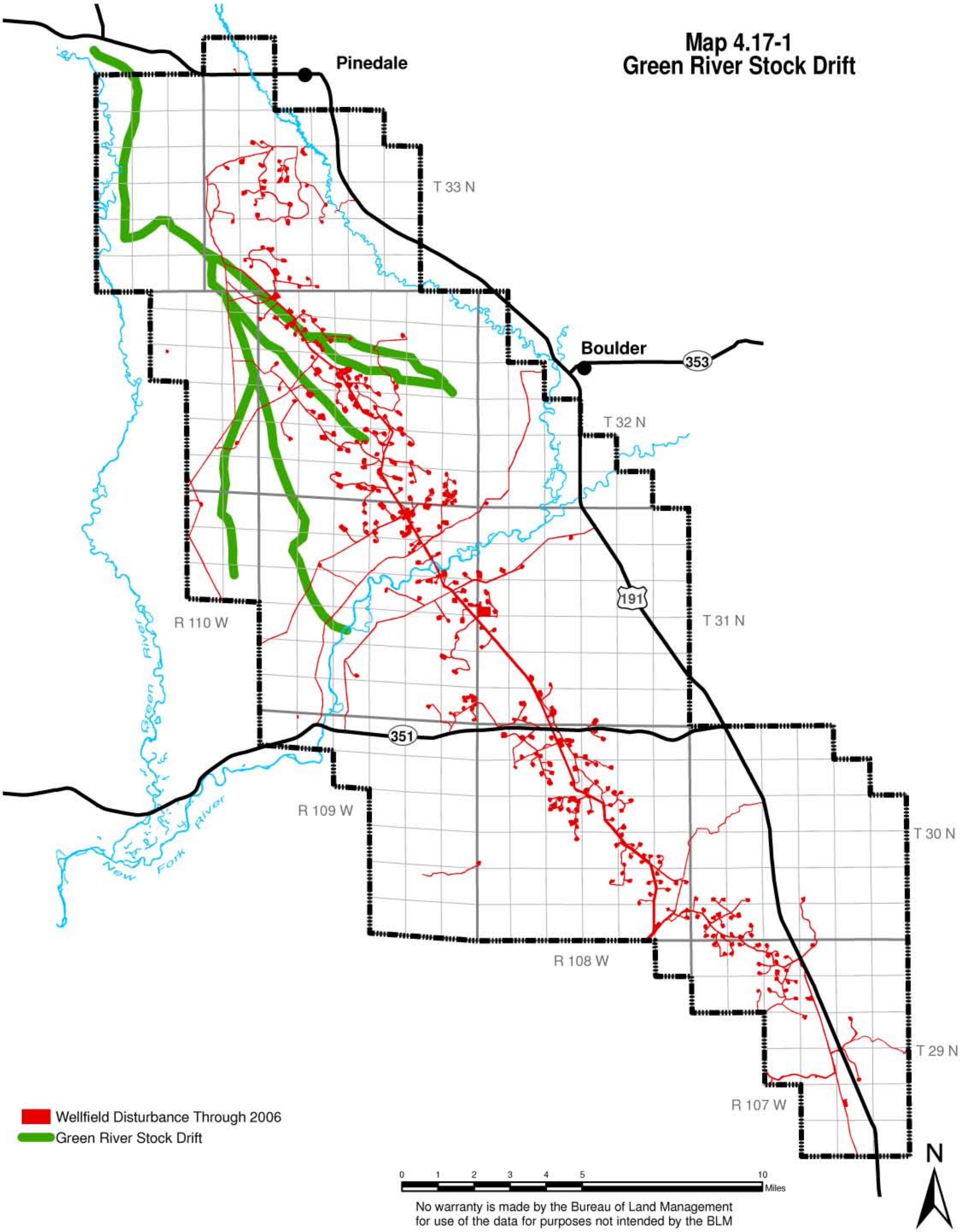
There were no comments related to wetlands, riparian resources or flood plains from project scoping.

4.18.2 Impacts Considered in the PAPA DEIS

Jurisdictional wetlands considered in the PAPA DEIS (BLM, 1999a) were primarily associated with the Green River and New Fork River flood plains that support wet meadow, aquatic bed, riparian scrub shrub, and riverine wetland types. Stock ponds fall within another wetland category. To minimize impact to wetlands, the BLM considered the following actions:

- locations of new well pads would be avoided within 500 feet of perennial streams, riparian areas, or wetlands on federal lands and minerals (96 percent of all wetlands in the PAPA are located on private and state lands and minerals);
- avoid placement of well pads within 100-year flood plains; and
- some impacts to intermittent streams by road and pipeline crossings would be unavoidable.

By adhering to conditions in permits issued by the COE for pipeline and road construction, no significant impacts to those “waters of the U.S” were expected. Section 404 of the Clean Water Act requires that a permit be issued to ensure that no discharge of dredged material or fill material is allowed to enter waters of the U.S. if a practicable alternative exists that is less damaging to the aquatic environment or if the nation's waters would be significantly degraded. To obtain a Section 404 permit from the COE, the applicant must demonstrate that three steps have been accomplished: wetland impacts have been avoided, where practicable; potential impacts to wetlands have been minimized; and, compensation has been provided for any remaining unavoidable impacts through activities to restore or create wetlands.


Map 4.17-1
Green River Stock Drift
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
Green River Stock Drift
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

In the PAPA DEIS, BLM determined that impacts by the project Alternatives would be significant if:

- there is a loss of wetlands or wetland function in the project area; or
- there is any violation of the requirements for Section 404 permits.

BLM concluded that significant impacts to wetlands would likely occur from implementation of the Alternatives considered in the PAPA DEIS (BLM, 1999a) by the following:

- loss of wetlands or wetland function could occur from authorization under general permits without mitigation as a requirement; and
- although the COE usually requires restoration or creation of similar wetland types as mitigation for projects that impact more than 0.33 acre of wetland, it takes several years for a wetland created as mitigation to develop functions that are typical of natural wetlands, especially scrub-shrub and forested wetlands.

Therefore, the loss of wetlands without mitigation would be significant long-term impacts and when mitigation is required, there would be significant short-term impacts due to the temporary loss of important wetland functions. The BLM's Practices and Restrictions for the Pinedale Anticline Project Area as they apply to wetlands, riparian areas, and flood plains would apply to all Alternatives (Appendix 4). Wetlands have not been significantly impacted (based on the significance criteria, above) by wellfield development in the PAPA (Gamper, 2007).

4.18.3 Alternative Impacts

4.18.3.1 Summary of Impacts Common to All Alternatives

<u>Natural Gas Development in the PAPA</u>

Wellfield disturbance has occurred in wetlands, in the Wetland SRMZ, and in the 100-year flood plain of the New Fork River; however, surface disturbance in wetlands is minimal and is mostly a result of construction of linear facilities. Operators have obtained wetland surveys, where appropriate, and have avoided construction in wetlands for well pads. For linear facilities where disturbance in wetlands cannot be avoided, appropriate COE Section 404 permits have been obtained. Continued development in the PAPA by any of the Alternatives would disturb additional acreages within wetlands, riparian zones, and 100-year flood plain. Most, if not all, disturbance to wetlands, the riparian zone of the New Fork River, and the 100-year flood plain has been and would continue to be on non-federal lands and minerals.

Future disturbance within wetlands and the 100-year flood plain would be mostly associated with linear facilities where disturbance cannot be avoided and would be subject to COE Section 404 permit conditions. The potential for impact to wetlands would increase as additional development is implemented under any of the Alternatives, according to the significance criteria in the PAPA DEIS (BLM, 1999a). BLM has no jurisdiction on non-federal lands and minerals in the PAPA and wetlands and the 100-year flood plain coinciding with these lands could be more vulnerable to development.

<u>Pipeline Corridors and Gas Sales Pipelines</u>

Potential impacts to wetlands may occur as a result of pipeline construction within the proposed pipeline corridor system. These impacts would likely occur as a result of ground disturbance within the proposed BCC pipeline corridors and at the crossings of the New Fork River flood plain by the RVII and PBC pipelines. Impacts to the river, wetlands within the flood plain, and riparian habitats would be minimized by the use of HDD construction techniques at river crossings. However, due to spatial requirements of HDD temporary use areas, minor short-term impacts to wetlands within the flood plain may occur. Construction techniques within wetlands would include segregation of hydric topsoil from spoil during construction. Reclamation is expected to be successful due to replacement of hydric soils, the existing moisture regime, and the anaerobic conditions that are favorable to hydrophytic vegetation. Seed sources for wetland species are likely present within and adjacent to the proposed rights-of-way and existing plant material and seeds in the soil would likely contribute to successful revegetation of disturbed areas within 1 to 3 years.

Wetland vegetation is only present along the riverbanks, immediately adjacent to the Green and Blacks Fork rivers. These areas consist of small strips of hydrophytic vegetation present only at the waters edge. Due to the use of HDD crossing techniques, these limited wetland areas would not be disturbed by pipeline construction. No other wetlands are present within the proposed pipeline corridors.

4.18.3.2 Alternative A (No Action Alternative)

Surface disturbance in wetlands and the 100-year flood plain would mostly occur from construction of linear facilities (roads and pipelines) and would most occur on non-federal lands and minerals.

4.18.3.3 Alternative B

Under Alternative B, impacts would be similar to Alternative A but there is the potential for increased disturbance to wetlands and the 100-year flood plain.

4.18.3.4 Alternative C

Impacts from surface disturbance under Alternative C would be similar to those under Alternative B.

4.18.3.5 Alternative D

Impacts from surface disturbance under Alternative D would be the similar to those under Alternatives B and C; however, there would be no surface disturbance in the federal suspended and term NSO leases in the Flanks at least for the first 5 years.

4.18.3.6 Alternative E

Impacts under Alternative E would be similar to those under the other Alternatives but may be increased due to a larger number of pads, roads, and pipelines.

4.18.4 Cumulative Impacts

Cumulative impact analysis to wetlands, the Wetland SRMZ, and Flood Plain SRMZ in the PAPA (the CIAA) is based on past, present, and future levels of surface disturbances. Existing non-wellfield disturbance in wetlands and the Wetland SRMZ appears substantial but is mainly due to irrigated and non-irrigated croplands in those areas of the PAPA while only minor non-wellfield disturbance has occurred in the 100-year flood plain, primarily from roads and residences. By 2006, disturbances to each of the three areas by existing wellfield development are relatively minor. Implementation of any of the Alternatives would generate additional cumulative disturbance to the 100-Year Flood Plain and Flood Plain SRMZ.

4.18.5 Wetland, Riparian Resources, and Flood Plains Additional Mitigation Opportunities

No additional mitigation for wetland, riparian resources, and flood plains has been identified.

4.19 THREATENED AND ENDANGERED SPECIES AND SPECIAL STATUS SPECIES

4.19.1 Scoping

There were no comments received during project scoping related to threatened and endangered species or special status species.

4.19.2 Impacts Considered in the PAPA DEIS

Section 7(a) of the ESA requires BLM to ensure that actions which they authorize or permit are not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat for such species. Such action could result in "take" of a listed species. As defined in the ESA, "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (16 USC § 1532(19)). This broad definition includes "harm," a term subject to debate. The USFWS defined "harm" as an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 C.F.R. § 17.3 (1994)), an interpretation that has been upheld by the U.S. Supreme Court. Even though an action may "harm" a listed species, the ESA, as amended, recognizes that incidental take (50 CFR. § 402.02) can occur in "carrying out an otherwise lawful activity conducted by the federal agency or applicant."

Following the definitions of "take" and "harm," the PAPA DEIS (BLM, 1999a) examined impacts to federally-listed endangered or threatened species by potential development in the PAPA. Impacts were considered and evaluated if a species potentially occurred near the PAPA or if any of the criteria listed below were met:

- direct mortality of individuals (fish, wildlife, or plants);
- long-term or permanent loss or alteration of existing or potential fish or wildlife habitat supporting significant life history functions (e.g., breeding, wintering, or migration); or
- temporary alteration or disturbance of habitat that may result in avoidance by listed fish or wildlife species, and increased mortality or lowered reproductive success.

The BLM (2002) updated their *Sensitive Species Policy and List* in Wyoming in 2002 with the following stated goals:

- maintain vulnerable species and habitat components in functional BLM ecosystems;
- ensure sensitive species are considered in land management decisions;
- prevent a need for species listing under the ESA; and
- prioritize needed conservation work with an emphasis on habitat.

In the PAPA DEIS (BLM, 1999a), the BLM declared that impacts to federally-listed threatened and endangered species, species proposed for listing, candidate species, and species with special status recognized by the USFWS, the BLM, and the WGFD would be considered significant if any of the following occurs:

- the death of any individuals due to project-related activities, which would jeopardize the continued existence of a species;
- reduced recruitment and/or survival of individuals that would impede species' recovery;
- loss of federally-designated critical habitats; or

- contributing causes to warrant an unlisted species to be proposed for listing as threatened or endangered under the ESA.

The PAPA DEIS (BLM, 1999a) determined that implementation of any of the Alternative development scenarios would not be likely to adversely affect species listed under the ESA. The USFWS concurred with that determination in their Biological Opinion (see Appendix F in the PAPA ROD).

4.19.3 Alternative Impacts

4.19.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development in the PAPA

Federally-Listed Species. Four endangered fish species (Colorado pikeminnow, humpback chub, bonytail, and razorback sucker) inhabit the Colorado River System downstream from the PAPA in the Green River, below Flaming Gorge Dam. The USFWS has determined that any withdrawal of water from the Colorado River System would impact these species. Therefore, withdrawal of water from the Colorado River System could adversely affect these four endangered fish species and effects to them and designated critical habitat are included.

Other species listed under the ESA which are known or potentially occur in western Wyoming considered in this Final SEIS include the black-footed ferret (endangered), Kendall Warm Springs dace (endangered), Canada lynx (threatened), and Ute ladies'-tresses orchid (threatened). None of these species is likely to be adversely affected by implementation of any of the Alternatives. Because none of these listed species is likely to occur or otherwise be adversely affected by any Alternative, incidental take is not expected for any of these federally-listed species. The BLM's Practices and Restrictions as they relate to federally-listed species would apply to all Alternatives (Appendix 4).

Until recently, bald eagles had been the only species listed under the ESA documented in the PAPA. Since publication of the Draft SEIS (BLM, 2006a), bald eagles have been removed from the list of threatened and endangered species under the ESA (USFWS, 2007b) and are now included below as Delisted Species. Other species that have recently been removed from the ESA list include the grizzly bear and gray wolf.

Black-footed Ferret. The USFWS (2004a) determined that approximately 64 square miles of the PAPA (all or portions of T. 29 N. through 31 N., and R. 109 W. through 111 W.) are within the Big Piney Prairie Dog Complex in which surveys for black-footed ferrets are recommended. The remainder of the PAPA has been cleared for any further need to conduct surveys for black-footed ferrets (USFWS, 2004a). Should a black-footed ferret be observed within the PAPA, the USFWS would be contacted.

The USFWS concurred with the BLM's determination for the PAPA DEIS (BLM, 1999a) that project activities were not likely to adversely affect black-footed ferrets. That concurrence was based on mitigating measures provided in the PAPA ROD (BLM, 2000b) including:

- examining construction sites prior to surface disturbance for presence of prairie dog colonies;
- avoiding disturbance to prairie dog colonies that meet criteria as suitable habitat for black-footed ferrets;
- if colonies cannot be avoided, conducting surveys for black-footed ferrets; and

- if black-footed ferrets or signs are detected during surveys, immediately stopping all actions that may affect black-footed ferrets and reinitiating Section 7 review with the USFWS.

Vehicles have killed black-footed ferrets in another area of the state (records in Kinter and Martin, 1992). The North Anticline Road is within 0.5 mile of white-tailed prairie dog colonies that have not been exempted by the USFWS (T. 31 N., R. 109 W.) from recommended surveys for black-footed ferrets (USFWS, 2004a). Until surveys have been conducted, the colonies remain as potential habitat for black-footed ferrets. There is recent evidence (a skull) to suggest black-footed ferrets have been present in the prairie dog colonies at some time in the past. If black-footed ferrets are present in the PAPA, there would be some risk of vehicle-related mortality associated with all Alternatives due to increased traffic above current levels. However, the risk of vehicle mortality or other sources to harm black-footed ferrets by any Alternative is extremely minute and probably non-existent because no extant populations are known to occur in the PAPA or vicinity.

Kendall Warm Springs Dace. This species is limited to habitat in the BTNF, approximately 30 miles north of Pinedale, and would not be affected by any of the Alternatives.

Canada Lynx. Absence of montane, forested habitat precludes Canada lynx from occurring within the PAPA. Canada lynx would not be adversely affected by any of the Alternatives.

Ute Ladies'-tresses Orchid. This species has not been detected in the PAPA and available information indicates it is not present (Fertig, 2000). Further, there are no records of this species' presence in southwest Wyoming. The species would not be adversely affected by any of the Alternatives.

Colorado River Fish. Primary threats to the Colorado pikeminnow, humpback chub, bonytail, and razorback sucker are stream flow regulation and habitat modification, including coldwater dam releases, habitat loss, and blocked migration corridors, as well as competition from nonnative fish species, pesticides, and pollution (USFWS, 2002a, 2002b, and 2002c). Flow recommendations have been developed for some waters in the Upper Colorado River Basin. The recommendations were designed to enhance habitat complexity (i.e., suitable spawning areas and inundation of flood plain areas), and to restore and maintain ecological processes (i.e., sediment transport and food production) that are believed to be important for the life history and subsequent recovery of the endangered Colorado pikeminnow (USFWS, 2002a, 2002b, and 2002c).

The Recovery and Implementation Program (RIP) for Endangered Fish Species in the Upper Colorado River Basin was established in 1988 to mitigate for water depletion impacts. Under the RIP, water depletions from tributary waters within the Colorado River Basin are considered to jeopardize the continued existence of these fish species. The provisions for the RIP were based upon appropriate legal protection of the in-stream flow needs of the Endangered Colorado River Fishes. To ensure the survival and recovery of listed fish species, any single incremental withdrawal of 100 acre-feet (annual average) or more would require the water user to make a payment to the RIP. The current depletion fee (for FY 2007) is $17.24/acre-foot. The fee would be applied to the average annual depletion from the Colorado River System, averaged over the life of the action. Water use and depletion includes evaporative loss and consumption of surface and groundwater within the Green River Basin.

For development within the PAPA, water would be withdrawn from the New Fork River for hydrostatic testing of trunk pipelines, gas and liquids gathering systems, and for dust control during pipeline construction. Groundwater supply wells provide drilling water on certain well locations; however, groundwater use in the PAPA is declining due to water re-use. The total water withdrawal and average annual depletion for each Alternative is provided in Table 4.19-1. This water would be subject to the RIP for Endangered Colorado River Fish and depletion fees may apply. Produced water from the PAPA, if surface discharged, would be returned to the Colorado River Basin. However, produced water may also be subject to depletion fees. The determination of effect to the Endangered Colorado River Fish species will be addressed in the BLM's Biological Assessment for the project and by the resulting Biological Opinion which will be prepared at the conclusion of consultation with the BLM. It will be determined at that time if the project would be subject to a depletion fee.

Table 4.19-1
Estimated Surface and Groundwater Withdrawals in the PAPA Subject to the Recovery and Implementation Program for Endangered Fish Species by Alternative

Water Use	Surface and Groundwater Withdrawal (acre-feet)		
	No Action Alternative	Alternatives B, C, D	Alternative E
Surface Water Withdrawals for Construction of Pipelines within the PAPA	37.63	83.14	46.12
Surface Water Withdrawals for Construction of Gas Sales Pipelines	228.9	228.9	228.9
Groundwater Withdrawal[2]	2,280	8,800	8,800
Total Depletion	2,546.53	9,112.04	9,075.02
Average Annual Depletion[1]	509.31	479.58	336.11

[1] Average annual depletion based on 5-year development period for No Action Alternative, 19-year development period for Alternatives B, C, and D, and 27-year development period for Alternative E.
[2] Does not account for water re-use.

Delisted Species. Three species have been removed from the ESA list of threatened and endangered species since the initial Draft SEIS was completed. They include bald eagle, grizzly bear, and gray wolf and are included here and in Chapter 3 as Delisted Species.

Bald Eagle. The bald eagle was recently removed from being listed under the ESA (USFWS, 2007b). Bald eagles remain protected under the BGEPA (16 U.S.C. § 668-668d) and the MBTA (16 U.S.C. § 703-712). The BGEPA prohibits "take" of bald and golden eagles, which includes take due to human-related disturbances. The USFWS defines "disturb" as "to agitate or bother a bald or golden eagle to the degree that it interferes with or interrupts normal breeding, feeding, or sheltering habits, causing injury, death, or nest abandonment" (USFWS, 2006b). The BLM in Wyoming will follow state guidance (IM No. WY-2007-037 – BLM, 2007d) during the interim period until the USFWS develops a process to allow for "take" of bald eagles under the BGEPA. The guidance states, "Wyoming BLM will continue to apply protective measures (terms and conditions) found in the Statewide Bald Eagle Programmatic Biological Opinion or other valid Biological Opinions to safeguard bald eagles and their nesting and roosting habitats when authorizing various actions. The BLM PFO will follow the New Fork and Green Rivers within the Pinedale Anticline Oil and Gas Exploration and Development Project Area BO (New Fork and Green Rivers BO - USFWS, 2007c).

Bald eagles nest in the PAPA and feed on fish, waterfowl, and big game carrion. They inhabit forest-dominated riparian zones along the Green River and New Fork River for perching during the breeding season and during winter. Most of the existing surface disturbance, in forested-dominated riparian vegetation, is on private land. Bald eagle nests in the PAPA are also on private land.

To address potential conflicts between wellfield development on private lands and bald eagles, Ultra, Shell, Questar, and JGGC consulted with the USFWS for conservation approaches to minimize impact to bald eagle habitats along the New Fork River. The USFWS recommended BMPs on private lands that are not within the BLM's jurisdiction and would be used voluntarily by the Operators, with technical assistance from the BLM. The BMPs apply to other raptor species as well as bald eagles and were designed to minimize adverse effects during development. Although BMPs suggested by the USFWS are voluntary on private land, the New Fork and Green Rivers BO (USFWS, 2007c) would apply on BLM-administered public lands. The USFWS stated in the New Fork and Green Rivers BO that the following terms and conditions would be applied:

- avoid activities within 1 mile of active bald eagle nests from courtship (February 1) through fledging (August 15),
- avoid activities within 1 mile of roosts used during winter, November 1 through April 1,
- strive to conserve potential nesting, roosting, and foraging habitats of mature and old growth trees, particularly within 0.5 mile of water,
- conduct appropriate surveys before commencement of ground disturbing activities and within 1 mile of proposed disturbance to determine the status of known nests and roosts and to identify new nests and roosts; and
- monitor activities that may adversely impact bald eagles and other raptor species.

The USFWS also recommended other conservation measures in the New Fork and Green Rivers BO (USFWS, 2007c). Ultra, Shell, Questar, and JGGC propose to follow these measures to minimize disturbance to bald eagles when development would be within the spatial buffers during periods when habitats may be used by bald eagles. The measures include:

1. *"During night operations and only when worker's safety is not reduced, direct lighting toward the pad to avoid light disturbances to surrounding areas;*
2. *Reduce unnecessary traffic and encourage travel times to be during daylight hours between 9 a.m. and 3 p.m.;*
3. *In areas within 1 mile of active nests where there is line of sight from active nests to the activity, pipeline installation equipment shall be shielded from the affected area with camouflage netting; and*
4. *Avoid potentially disruptive activities or permanent aboveground structures in the bald eagles' direct flight path between their nest and roost sites and important foraging areas."*

The USFWS advised the Proponents (Ultra, Shell, Questar, and JGGC) that application of any of the above measures within protective spatial and temporal buffers should be used with caution such that "take" or "disturb" would not occur, in violation of legislation protecting bald eagles.

To date the BLM is aware that the following measures have been implemented: Spring 2007, intended activity was spoken about with the USFWS along the river corridor. Noise barriers and raptor surveys were discussed. Future implementation will take place:

- Operations for drilling and completions requiring night lighting has been shielded toward the center of the pad.
- Equipment has been arranged to reduce the amount of noise that would penetrate from operations being conducted.

- Raptor surveys through third party contractor – 3 checks per season to determine activity.

The BLM uses the spatial and temporal buffers recommended by the USFWS as standard practices and will continue to do so through application of measures within the Statewide Bald Eagle Programmatic Biological Opinion (BLM, 2004b). BLM considers activities within 1 mile of forested-dominated riparian vegetation as potentially disruptive to bald eagle use of those habitats during winter. Surface disturbance within 1 mile of the New Fork River riparian zone would occur under each of the Alternatives. Wellfield disturbance is also likely within 1 mile of existing, occupied bald eagle nest sites (Table 4.19-2).

Table 4.19-2
Initial Surface Disturbance in Relation to
1-Mile Buffer of Bald Eagle Habitats by Alternative

	Alternative A (acres)		Alternatives B, C , and D (acres)		Alternative E (acres)	
Bald Eagle Habitat Component	**Federal**	**Total**	**Federal**	**Total**	**Federal**	**Total**
1 mile of Occupied Bald Eagle Nests	155.9	205.7	587.2	830.7	518.9	604.2
1 mile of New Fork River Riparian Zone	339.5	584.8	1,150.2	1,943.8	898.0	1,454.4
Forest-Dominated Riparian Vegetation	31.8	68.4	89.0	181.6	70.2	121.1

Bald eagles may have established communal winter roosts in forest-dominated riparian vegetation in or near the PAPA, although locations of communal roosts have not yet been firmly established. Depending on their locations, wellfield development during winter could be within the 1-mile forest-dominated riparian vegetation buffer during winter, November 1 through April 1.

There are no records of bald eagles killed in the PAPA. Bald eagles have been killed by vehicles in the region during winter and at other times as they feed on roadside carrion (USFWS, 1999). Some level of risk and direct impact to bald eagles may occur by winter traffic that would otherwise be absent with no winter drilling or the year-round development anticipated under Alternatives B, C, and D.

Grizzly Bear. Suitable habitat is not present within the PAPA, and grizzly bears are not likely to occur in the area. Further, WGFD's policy is to limit grizzly bear occurrence outside of the occupancy area boundary established in the Wyoming Grizzly Bear Management Plan. The PAPA is not within the occupancy area boundary. None of the Alternatives would affect grizzly bears.

Gray Wolf. Though occupied ranges of wolves introduced to YNP has expanded to include the region north and east of the PAPA, their presence in the PAPA is not expected. Wolves tend to avoid areas where human-related activities occur (Paradiso and Nowak, 1982), although they have preyed on domestic livestock as well as elk at winter feedgrounds in the region. Wolves depredating on livestock in the PAPA would likely be subject to control actions (USFWS et al., 2006). There is a remote possibility that wolves might prey on mule deer or pronghorn wintering in the PAPA. It is impossible to predict if wolves would pursue elk or other big game wintering in the PAPA. The gray wolf would not be affected by any of the Alternatives.

Special Status Wildlife Species. The extent of surface disturbances produced by any Alternative within specific sites such as white-tailed prairie dog colonies cannot be predicted or estimated with any certainty. However, under all Alternatives, additional surface disturbance in areas currently covered by native vegetation (especially the large areas of sagebrush steppe, desert shrub, and mixed grass prairie) are expected to directly or indirectly impact some BLM-

Sensitive Species. Those species probably include: ferruginous hawks, mountain plovers, long-billed curlew, burrowing owls, sage thrasher, loggerhead shrike, grasshopper sparrow, Brewers sparrow, sage sparrow, pygmy rabbits, white-tailed prairie dogs, and spotted bats. These species have either been documented in the PAPA or their presence was judged to be possible in Chapter 3 (Table 3.21-2). Terrestrial mammals including pygmy rabbits and white-tailed prairie dogs are susceptible to vehicle-related mortality. Any increase or decrease in traffic would likely have direct effects on these species.

Merlins, fringed myotis, and long-eared myotis have likewise either been documented as inhabitants or possibly inhabit forest-dominated riparian vegetation in the PAPA, and could be directly or indirectly impacted by project-related activities within occupied or suitable habitats. Likewise, surface disturbances in wetlands (and possibly irrigated croplands) could affect northern leopard frogs, western boreal toads, snowy egrets, white-faced ibis, and trumpeter swans. Adverse effects to surface water quality could indirectly impact roundtail chubs, bluehead suckers, and flannelmouth suckers, all of which are included as BLM-Sensitive Species. Many of these species have special status as determined by the WGFD (Table 3.21-2). The BLM's Practices and Restrictions as they relate to special status wildlife species would apply to all Alternatives (Appendix 4).

A comparison of the disturbance of habitats used by special status species by Alternative is provided in Table 4.19-3.

Table 4.19-3
Initial Surface Disturbance in Relation to Habitats used by Special Status Wildlife Species by Alternative

Special Status Wildlife Species Habitat Component	Alternative A (acres)		Alternatives B, C , and D (acres)		Alternative E (acres)	
	Federal	Total	Federal	Total	Federal	Total
Sagebrush steppe	3,029.4	3,172.0	9,766.4	10,117.2	7,785.1	7,988.0
Mixed grass prairie	310.2	313.3	964.8	990.8	795.6	806.7
Greasewood flats	69.2	69.2	218.8	218.8	213.6	213.6
Desert shrub	248.2	251.3	627.8	629.6	705.6	709.5
Forest-dominated riparian	31.8	68.4	89.0	181.6	70.2	121.1

Pygmy rabbits inhabit the PAPA. They are active during winter, feeding almost entirely on sagebrush (Green and Flinders, 1980), and apparently have small home ranges (Green and Flinders, 1979). There is no information to indicate how the species responds to winter drilling but diminished habitat function is expected to occur within some distance from edges created by well pads, roads, pipelines, and other wellfield components within sagebrush habitats in the PAPA.

Vehicles have killed pygmy rabbits in the PAPA. The potential for such direct impact to pygmy rabbits by any of the Alternatives is unknown but is expected to increase as traffic volumes increase under all action Alternatives.

The status of some of these special status wildlife species has been recently evaluated from data collected during annual wildlife monitoring studies prior to 2001. The area was evaluated by Ecosystem Research Group (2006) and termed by them as the Pinedale Anticline Wildlife Study Area (PAWSA), included the PAPA and a 2-mile buffer beyond the PAPA boundary.

There were 11,622 acres of prairie dog colonies within the PAWSA, mostly within sagebrush steppe, desert shrub and mixed grass prairie vegetation types. The majority of prairie dog colony areas (69 percent) in the PAWSA were found to be farther than 0.5 mile from the closest natural gas well (Ecosystem Research Group, 2006). However, 78 percent of the PAWSA was farther than 0.5 mile from the closest natural gas well and the data do not indicate that prairie dogs avoided wells, at least not wells within 0.5 mile of colonies.

Ferruginous hawks nest in the PAPA and within the PAWSA. Available data collected from 2003 through 2005 indicated that distance of active ferruginous hawk nests to natural gas wells varied from 1,179 feet to 17,958 feet, with an average distance of 5,873 feet. Similar analyses of distances from active burrowing owl nests to natural gas wells ranged from 379 feet to more than 27,300 feet, averaging 6,356 feet (Ecosystem Research Group, 2006). Because there are no data on nesting distributions for either species prior to wellfield development, the analysis of monitoring data developed for the PAWSA could not lead to any firm conclusions about effects of development on these special status species (Ecosystem Research Group, 2006). Tentative conclusions were that current NSO buffers surrounding nest sites that are stipulated by BLM on APDs extend far enough so that only the most tolerant individuals of each species nest within the current buffer distances from well pads. Nest abandonment with decreased production of young due to wellfield development by less tolerant individuals would be a direct impact to raptors by wellfield development in the PAPA.

Special Status Plant Species. Suitable habitat for BLM-sensitive plant species would be identified prior to construction of new wellfield components. Surveys would be conducted to locate sensitive plant populations, and they would be avoided during construction or otherwise conserved. Special status plant species include meadow pussytoes, Trelease's racemose milkvetch, Cedar Rim thistle, large-fruited bladderpod, Beaver Rim phlox, and tufted twinpod. Of these species, large-fruited bladderpod has been documented in the Ross Butte and Blue Rim areas of the PAPA (Fertig, 1998), within portions of the Sensitive Soils SRMZ and desert shrub vegetation. In 1998, OHV use and surface disturbing activities (road construction) were judged to be the main threats to local sensitive plant populations. Within the Blue Rim Area of sensitive soils, 565.0 acres have been disturbed by wellfield development by the end of 2006, though effects to large-fruited bladderpod are unknown. The BLM's Practices and Restrictions as they relate to special status plant species would apply to all Alternatives (Appendix 4).

<u>Pipeline Corridors and Gas Sales Pipelines</u>

Federally-Listed Species. Potential impacts to threatened and endangered species from pipeline construction would be similar to impacts from wellfield development within the PAPA though extending over a much shorter period.

<u>Black-footed Ferret</u>. Potentially suitable habitat for black-footed ferrets is present within and adjacent to the proposed pipeline corridors. Short-term disturbance to prairie dog colonies in the Moxa Prairie Dog Complex would likely occur as a result of pipeline construction activities. Direct loss of prairie dogs, the principal prey of black-footed ferrets, would likely result from blading, grading, and trenching activities. Despite potential impacts to prairie dogs and suitable habitats for black-footed ferrets, impacts to black-footed ferrets are not expected because recent surveys in the project area failed to locate black-footed ferrets. Furthermore, additional black-footed ferret surveys would be conducted in suitable habitats prior to construction activities. If black-footed ferrets are located within 0.5 mile of proposed activities, the BLM would consult with the USFWS to determine necessary conservation measures. These measures would ensure that pipeline construction would not adversely affect black-footed ferrets.

<u>Kendall Warm Springs Dace</u>. This species is limited to habitat in the BTNF, approximately 30 miles north of Pinedale, and would not be affected by construction of the pipelines.

Canada Lynx. Absence of montane, forested habitat precludes Canada lynx from occurring within the pipeline corridors. Canada lynx would not be affected by construction of the pipelines.

Ute Ladies'-tresses Orchid. This species has not been detected within the proposed pipeline corridors or within southwest Wyoming. Impacts to wetland habitats would be mostly avoided because rivers would be crossed by HDD construction techniques. Ute ladies'-tresses orchid are not expected to be impacted by pipeline construction.

Colorado River Fish. Water withdrawals required for hydrostatic testing and dust control during construction would be subject to the RIP for Endangered Colorado River Fish. Average annual depletion for each alternative is shown in Table 4.19-1. The determination of effect to the Endangered Colorado River Fish species will be addressed in the BLM's Biological Assessment for the project, and after consultation with the USFWS, the USFWS will issue a Biological Opinion. It will be determined at that time if the project would be subject to the depletion fee.

Delisted Species. As discussed above, bald eagles and grizzly bears are no longer listed as threatened or endangered.

Bald Eagle. Suitable habitats for bald eagle are present along the proposed pipeline corridors. Known nesting locations and potential roost sites are present near the BFGC and OPC pipeline corridors in forest-dominated riparian vegetation habitats along the Green River. Bald eagle surveys would be conducted prior to commencement of construction activities within suitable habitats. Increased traffic along the pipeline corridors during construction activities has the potential to cause direct mortality from vehicle collisions although pipeline construction is not expected to impact bald eagles.

Grizzly Bear. Grizzly bears are not likely to occur in the area of the proposed corridors. Pipeline construction would not affect grizzly bears.

Special Status Wildlife Species. Suitable habitats for bald eagle are present along the proposed pipeline corridors. Known nesting locations and potential roost sites are present near the BFGC and OPC pipeline corridors in forest-dominated riparian vegetation habitats along the Green River. Bald eagle surveys would be conducted prior to commencement of construction activities within suitable habitats. Increased traffic along the pipeline corridors during construction activities has the potential to cause direct mortality from vehicle collisions although pipeline construction is not expected to impact bald eagles.

Potential impacts to BLM-Sensitive Species from pipeline construction would be similar to impacts from wellfield development in the PAPA. The following sensitive species, or suitable habitats for these species, have been identified within or adjacent to the proposed pipeline corridors: ferruginous hawk, mountain plover, long-billed curlew, burrowing owl, sage thrasher, loggerhead shrike, grasshopper sparrow, Brewers sparrow, sage sparrow, pygmy rabbit, and white-tailed prairie dog. Long-billed curlew, sage thrasher, loggerhead shrike, grasshopper sparrow, Brewers sparrow, and sage sparrow are addressed under migratory birds in Section 4.20.3.1.

Pygmy rabbits and suitable habitats are present within and along much of the proposed pipeline corridors. Construction activities within these habitats would likely displace individuals. Ground disturbing activities have the potential to cause direct mortality of individuals but would not be likely to directly impact pygmy rabbit populations.

Prairie dog colonies associated with the Moxa Prairie Dog Complex are present within and adjacent to the proposed pipeline corridors. The species is known to colonize disturbed areas and has demonstrated an affinity toward existing adjacent pipeline corridors. Impacts to prairie dogs from pipeline construction would likely include direct mortality of individuals, short-term disturbance and removal of habitat, and short-term reduction in forage for the species. These adverse impacts are anticipated to be short-term. Potentially beneficial long-term impacts may result from pipeline construction activities. These beneficial impacts would include improvements to forage from transitioning vegetative species composition from shrub dominance to reclamation grasses, and facilitating easier burrow development along the reclaimed pipeline right-of-way and other disturbed areas. Adverse impacts to prairie dogs would be minor and short-term.

Mountain plover habitat is present along the proposed pipeline corridors. Construction activities in these areas would be avoided during the plover nesting season. Pipeline construction outside of this period is not likely to have adverse impacts on mountain plover due to the species' preference for disturbed ground and low vegetation.

Potential impacts to ferruginous hawk and burrowing owls are discussed above, in Section 4.19.3.1 (see discussion under Natural Gas Development in the PAPA).

Special Status Plant Species. Potential impacts to BLM-sensitive plant species from pipeline construction would be similar to impacts from wellfield development in the PAPA. None of the special status plant species identified in Chapter 3 (Table 3.21-4) are expected along any of the proposed corridor/pipeline alignments. Though unlikely, Nelson's milkvetch could occur within alkaline clay flats, shale bluffs and gullies, pebbly slopes, sparsely vegetated sagebrush and would be associated with cushion plant communities. Also, persistent sepal yellowcress, a species generally associated with sandy, muddy stream banks, stockponds, and reservoirs, could be directly impacted during pipeline construction. Once surveys for these and other special status plant species are complete, BLM would determine if any would be affected.

4.19.3.2 Alternative A (No Action Alternative)

Federally-Listed Species. Implementation of Alternative A would adversely affect the four Endangered Colorado River Fish species listed under the ESA. It is estimated that 2,546.53 acre-feet of water subject to the RIP for Endangered Fish Species in the Colorado River Basin would be used for hydrostatic testing, drilling and completions, and dust control over the 5-year development period under the No Action Alternative (Table 4.19-1). This results in an average annual depletion of 509.31 acre-feet of water over the 5-year development period.

Special Status Wildlife Species. Under this Alternative, an additional 205.7 acres of disturbance is expected within 1 mile of existing (as of 2007) occupied bald eagle nests (Table 4.19-2). Surface disturbance within the 1-mile buffer of the New Fork Riparian zone would be 584.8 acres of which 68.4 acres would be within forest-dominated riparian vegetation (Table 4.19-2).

Under Alternative A, disturbance in sagebrush steppe vegetation (over 3,172.0 acres) could adversely affect a variety of sagebrush-obligate wildlife species that have some special status (Table 4.19-3). Species closely associated with sagebrush steppe habitats include ferruginous hawks, burrowing owls, sage thrasher, loggerhead shrike, grasshopper sparrow, Brewer's sparrow, sage sparrow, pygmy rabbits, white-tailed prairie dogs, and spotted bats.

Special Status Plant Species. The No Action Alternative would disturb 529.1 acres in the Blue Rim Area of sensitive soils, some of which may provide habitat for populations of large-fruited bladderpod and possibly other BLM-Sensitive plant species.

4.19.3.3 Alternatives B, C, and D

Federally-Listed Species. Implementation of Alternatives B, C, and D would adversely affect the four Endangered Colorado River Fish species listed under the ESA. It is estimated that

9,112.04 acre-feet of water subject to the RIP for Endangered Fish Species in the Colorado River Basin would be used for hydrostatic testing, drilling and completions, and dust control over the 19-year development period under Alternatives B, C, and D (Table 4.19-1). This results in an average annual depletion of 479.58 acre-feet of water.

Special Status Wildlife Species. Under Alternatives B, C, and D, an additional 830.7 acres of disturbance are expected within the 1-mile buffer of existing (as of 2007) occupied bald eagle nests (Table 4.19-2). Additional surface disturbance of 1,943.8 acres would occur within the 1-mile buffer of the New Fork River riparian zone, of which 181.6 acres would be within forest-dominated riparian vegetation (Table 4.19-2).

Most surface disturbance under these Alternatives would be in sagebrush steppe vegetation (10,117.2 acres) which could adversely affect a variety of sagebrush-obligate wildlife species that have some special status (Table 4.19-3). An additional 2,020.8 acres of surface disturbance by Alternatives B, C, and D would directly affect other habitats utilized by special status wildlife species, including mixed grass prairie, greasewood flats, desert shrub and forest-dominated riparian habitats. Such levels of effect by Alternatives B, C, and D to vulnerable and sensitive species' habitats in the PAPA may adversely impact the BLM's (2002) management of the PAPA as a functional ecosystem for conservation of species within the framework of their *Sensitive Species Policy and List.*

Special Status Plant Species. Alternatives B, C, and D would disturb 1,167.7 acres in the Blue Rim Area of sensitive soils (Table 4-15-1), some of which may provide habitat for populations of large-fruited bladderpod and possibly other BLM-Sensitive plant species.

4.19.3.4 Alternative E

Federally-Listed Species. Implementation of Alternative E would adversely affect the four Endangered Colorado River Fish species listed under the ESA. It is estimated that 9,075.02 acre-feet of water subject to the RIP for Endangered Fish Species in the Colorado River Basin would be used for hydrostatic testing, drilling and completions, and dust control over the 27-year development period under Alternative E through 2033 (Table 4.19-1). This results in an average annual depletion of 336.11 acre-feet of water.

Special Status Wildlife Species. Implementation of Alternative E would result in an additional 604.2 acres of disturbance within 1 mile of existing (as of 2007) occupied bald eagle nests (Table 4.19-2). Additional disturbance of 1,454.4 acres would occur within the 1-mile buffer of the New Fork River riparian zone, of which 121.1 acres would be within forest-dominated riparian vegetation (Table 4.19-2).

Most surface disturbance under Alternative E would be within sagebrush steppe vegetation (nearly 8,000 acres) which could adversely affect a variety of sagebrush-obligate wildlife species that have some special status (Table 4.19-3). An additional 1,850 acres of surface disturbances by Alternative E would directly affect other habitats utilized by special status wildlife species, including mixed grass prairie, greasewood flats, desert shrub and forest-dominated riparian habitats. Such levels of effect by Alternative E to vulnerable and sensitive species' habitats in the PAPA may adversely impact the BLM's (2002) management of the PAPA as a functional ecosystem for conservation of species within the framework of their *Sensitive Species Policy and List.*

Special Status Plant Species. Alternative E would disturb 1,390.0 acres in the Blue Rim Area of sensitive soils (Table 4.15-1), some of which is likely to provide habitat for populations of large-fruited bladderpod and possibly other BLM-Sensitive plant species.

4.19.4 Cumulative Impacts

Federally-Listed Species. All alternatives will cause water depletions within the Colorado River System; therefore, BLM will enter into formal consultation with USFWS as required under the ESA. However, adverse effects to Endangered Colorado River Fish species are not anticipated to result from the depletions. Likewise, none of the other species listed as threatened or endangered under ESA that are known to occur or potentially occur in western Wyoming are likely to be adversely affected by implementing any of the PAPA Alternatives. Consequently, there would be no direct effects by the Alternatives to these listed species. However, indirect impacts and/or secondary impacts of the project on listed species may occur with increased human population base and increased access. Secondary impacts could result from the requirements of any of the Alternatives (the workforce needed to construct or operate the project, for example) or from the future consequences of implementing an alternative action (need for ancillary goods, services, opportunities resulting from the project). Potential indirect or secondary effects of a project typically include increased recreation demand (including OHV use), increased habitat conversion, habitat degradation by human encroachment, and increased illegal harvest (Comer, 1982). Such effects are very likely to occur by any of the Alternatives because the human population in the region is expected to increase as direct, indirect, and induced consequence of future development in the PAPA (Section 4.3.2.1).

Available information is inadequate to predict how the anticipated increased human population could contribute to cumulative effects to listed species by any single Alternative and all other past, present, and reasonably foreseeable actions in the region surrounding the PAPA. Possibilities for cumulative impact to listed species could include the following: increased recreational shooting of white-tailed prairie dogs with increased risk of shooting black-footed ferrets, if they occur (Reeve and Vosburgh, 2006), destruction of Ute ladies'-tresses populations by OHV use and/or by urban sprawl (Fertig et al., 2005), and increased dispersed winter recreation effects on lynx in the Wyoming Range (Ruggiero et al., 1999).

Water withdrawals from the Colorado River System by other projects have contributed and will continue to contribute cumulative impacts to endangered Colorado River fish species. Withdrawals of 100 acre-feet or more from any project would be subject to payments under the RIP for Endangered Colorado River fish.

Delisted Species. Cumulative impacts due to past, present and foreseeable future wellfield development in the PAPA will potentially lead to increased human conflicts with grizzly bears (Moody et al., 2002) or with gray wolves (USFWS et al., 2007). Past and present wellfield developments have potentially affected bald eagles within the area administered by the BLM's PFO. Throughout the species' range in the conterminous United States, bald eagles have been adversely affected by human related direct mortality (shooting, poisoning including by pesticide residues, electrocution, collisions with vehicles, wind turbines, and powerlines), and human disturbances that interrupt reproduction and survival of young (USFWS, 1999). Within the area managed by the BLM PFO, principal threats to bald eagle nesting habitat were judged to be from recreation and livestock grazing. Likewise, livestock grazing had been the principal land use near potential wintering habitats along the New Fork and Green rivers The river corridors supported concentrated foraging habitats and, though mostly on private lands, livestock grazing was the predominant land use (BLM, 2003e).

Cumulative impact analysis to bald eagle habitats in the PAPA is based on past, present, and future levels of surface disturbances shown in Table 4.19-4. Existing non-wellfield disturbance within 1 mile of existing bald eagle nest sites and within 1 mile of the New Fork River riparian zone appear substantial, but are mainly due to irrigated and non-irrigated croplands. Roads, residential developments, and some urban infrastructure (e.g., Wenz Field) have contributed to disturbances in bald eagle habitats. Only minor non-wellfield disturbance has occurred in forest-dominated riparian vegetation, primarily from construction of roads and residences. By the end of 2006, disturbance to each of the three areas by existing wellfield development is relatively minor. However, surface disturbances within the 1-mile buffer of the New Fork River riparian zone has been subject to the most wellfield development of the three areas (Table 4.19-4).

Table 4.19-4
Cumulative Surface Disturbance in Relation to
1-Mile Buffer of Bald Eagle Habitats by Alternative

Bald Eagle Habitat Component	Existing Non Wellfield Disturbance (acres)	Existing Wellfield Disturbance (acres)	Proposed Gas Sales Pipeline Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative		
				Alternative A	Alternatives B, C, and D	Alternative E
1 mile of Occupied Bald Eagle Nests	949.5	172.4	0.0	1,327.6	1,952.6	1,726.1
1 mile of New Fork River Riparian Zone	4,020.5	716.1	80.8	5,405.2	6,761.2	6,271.8
Forest Dominated Riparian Vegetation	15.4	10.7	7.3	101.8	215.0	154.5

Implementation of any of the Alternatives would generate considerable cumulative disturbances to bald eagle habitats, even if existing non-wellfield disturbance is ignored, as shown in Table 4.19-4. Each of the Alternatives would cumulatively affect somewhat similar areas within 1 mile of nests, 1 mile of the New Fork River riparian zone, and within forested-dominated riparian vegetation.

Special Status Wildlife Species. Implementation of any of the Alternatives would result in cumulative disturbance to a variety of habitats utilized by BLM-Sensitive species (Table 4.19-5). These were described above under Special Status Wildlife Species in Section 4.19.3.1 – Summary of Impacts Common to All Alternatives.

Table 4.19-5
Cumulative Disturbance in Relation to Habitats
Used by Special Status Wildlife Species by Alternative

Special Status Wildlife Species Habitat Component	Existing Non Wellfield Disturbance (acres)	Existing Wellfield Disturbance (acres	Proposed Gas Sales Pipeline Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative		
				Alternative A	Alternatives B, C, and D	Alternative E
Sagebrush steppe	1,006.1	3,932.5	294.2	8,404.8	15,350.0	13,220.8
Mixed grass prairie	37.0	340.8	34.4	725.5	1,403.0	1,218.9
Greasewood flats	18.2	39.0	0.0	126.4	276.0	270.8
Desert Shrub	27.4	294.0	64.3	637.0	1,015.3	1,095.2
Forest-dominated riparian	15.4	10.7	7.3	101.8	215.0	154.5

Most of the cumulative disturbance by wellfield and non-wellfield actions would be within sagebrush steppe vegetation (ranging from more than 8,000 to over 15,000 acres, depending on Alternative) which could adversely affect a variety of sagebrush-obligate wildlife species that have some special status. An additional 1,590 to 2,900 acres of surface disturbance, depending on Alternative, would directly affect other habitats utilized by special status wildlife species, including mixed grass prairie, greasewood flats, desert shrub, and forest-dominated riparian habitats. Such levels of cumulative effect to vulnerable and sensitive species' habitats in the PAPA may adversely impact BLM's (2002) management of the PAPA as a functional ecosystem for conservation of species within the framework of their *Sensitive Species Policy and List.*

Special Status Plant Species. Cumulative impacts resulting from disturbance to Blue Rim Area sensitive soils from either wellfield or non-wellfield actions could occur. Some of the Blue Rim Area habitats may support populations of large-fruited bladderpod and possibly other BLM-Sensitive plant species.

4.19.5 Threatened, Endangered, and Special Status Species Additional Mitigation Opportunities

Threatened, Endangered, and Special Status Species Mitigation Measure 1. BLM could require Operators to restore and maintain functional riparian habitat, which includes cottonwood vegetation.

Threatened, Endangered, and Special Status Species Mitigation Measure 2. BLM could require research/studies, with BLM-approved methods, relating directly to threatened, endangered, and special status species that reside in the PAPA.

Threatened, Endangered, and Special Status Species Mitigation Measure 3. BLM could require raptor perches in areas of known raptor use.

Threatened, Endangered, and Special Status Species Mitigation Measure 4. Motorized vehicle use in all white-tailed prairie dog towns and complexes could be restricted to designated roads and trails.

Threatened, Endangered, and Special Status Species Mitigation Measure 5. BLM could require Operators to inventory seasonal habitats for sensitive species to determine potential on- and off-site mitigation opportunities and avoidance areas.

Threatened, Endangered, and Special Status Species Mitigation Measure 6. Raptor anti-perching devices within 0.25 mile of prairie dog towns could be installed on all aboveground facilities. Powerlines could be buried near prairie dog towns and placement of power poles within prairie dog towns could be avoided.

4.20 WILDLIFE AND AQUATIC RESOURCES

4.20.1 Scoping Issues

The following concerns related to wildlife and aquatic resources were received during public scoping:

1. Document how the operators' proposal, including removal of seasonal stipulations, would provide compensation and/or protection for mule deer, pronghorn, and greater sage-grouse at least equal to enforcing those stipulations.
2. Concern that winter drilling will contribute to declines in mule deer, pronghorn, and greater sage-grouse populations as a result of lost habitat, ineffective habitat, roadkills, and/or disease.
3. Continue and/or expand existing wildlife studies while making data and study results available to the public.

4. BLM should consider short-term impacts (5 to 20 years) to wildlife (mule deer, pronghorn, and greater sage-grouse) and their habitats as well as long-term impacts.
5. Address any deviations from the Wyoming Game and Fish Department's "*Minimum Recommendations for Development of Oil and Gas Resources Within Crucial and Important Wildlife Habitats on BLM Lands*."
6. BLM should consider off-site mitigation strategies in the region, beyond the agency's administrative boundaries (including reducing impact on big game summer range and restricting development on undeveloped or suspended oil and gas leases), to offset impact to wildlife in the PAPA and potential conflicts with people and other wildlife by off-site mitigation.
7. BLM should ensure that some portion of the PAPA remains unfragmented and undisturbed.
8. BLM should monitor the implementation and effectiveness of applicant-committed mitigation measures and effects of current development over the long-term to allow for better management of continued and future development.

4.20.2 Impacts Considered in the PAPA DEIS

In the PAPA DEIS (BLM, 1999a), BLM considered direct and indirect impacts to wildlife as explicitly related to wellfield development in the PAPA. Direct impacts include:

- mortality from wildlife-vehicle collisions on or off the PAPA;
- mortality during road, pipeline, and well pad construction and other surface-disturbing actions;
- mortality due to consumption of, or exposure to, toxic compounds; and
- interruption or interference with life history functions including courtship, nesting and parturition, migration, and winter survival.

Potential indirect impacts to wildlife considered in the PAPA DEIS included:

- fragmentation of connected habitats;
- removal of vegetation and other features, such as rock outcrops, that provide habitat;
- degradation of terrestrial habitats from erosion and introduction of nonnative vegetation;
- degradation of aquatic habitats due to altering stream banks, siltation, and decreased water quality;
- loss of forage for herbivores; and
- diminished animal use of habitats due to effects of noise, dust, emissions, and human presence.

Anticipated direct and/or primary impacts to wildlife include all effects directly related to the Alternatives (Anderson, 1985 and Comer, 1982). Primary impacts can result from disturbance and/or wildlife mortality and/or disturbance that interfere with requisite life-history functions (e.g., feeding, reproduction) during wellfield development and production.

Indirect impacts may also be primary impacts because they are related to, but removed from, an action by an intermediate step or process. For wildlife, indirect impacts are often associated with alteration, elimination, or degradation of habitats. Indirect effects may result from induced changes to wildlife habitats, principally by conversion of one vegetation cover type to another or by fragmentation of existing wildlife habitats. Indirect impact to habitats decreases their functional capacity to support wildlife populations at non-impacted levels.

Alternatively, indirect impact may be a secondary, rather than primary, effect of the project or Alternative. Secondary impacts of a project on wildlife most commonly follow an increased human population base and increased access, either as a result of the requirements of the action itself (the workforce needed to construct or operate the project) or as a consequence of the action (need for ancillary goods, services, or opportunities resulting from the project). Potential secondary effects of a project often are associated with increased recreation demand including hunting or OHV use, habitat degradation by human encroachment, and increased illegal harvest (Anderson, 1985 and Comer, 1982).

For some species, direct impacts are expected to be interrelated, such as the effects of habitat fragmentation because it might interfere with life history functions. There will probably be indirect or secondary impacts that ensue with increased human presence and/or increased human use (access) of an area. Direct impacts could occur during the project and/or after the project, but are functionally related to secondary impacts. Secondary impacts would not occur without the project. Once initiated though, secondary impacts may continue well beyond the project and may further develop independently of the project. While the effects of secondary impacts on wildlife may be the same as primary, direct impacts, the BLM identified that potential sources of secondary impacts vary and include:

- increased recreation, especially off-highway vehicles;
- increased habitat conversion, especially urban/suburban sprawl;
- habitat degradation by human encroachment;
- increased noise, air, and water pollution;
- increased game poaching;
- increased wildlife road kills; and
- increased harassment of wildlife by uncontrolled pets, especially dogs.

The BLM considered that impacts to wildlife would be significant if any of the following occurred as a direct or indirect result of development in the PAPA:

- increased mortality and/or decreased survival of native wildlife species considered as Vital, High, or Moderate by the WGFD Mitigation Policy;
- loss of habitat function and/or habitat value for habitats classified as Vital or High by the WGFD Mitigation Policy; or
- net loss of habitat value with alterations in habitat function for habitats classified as Moderate by the WGFD Mitigation Policy.

Based on these criteria, significant impacts were predicted for a number of wildlife species by the PAPA DEIS (BLM, 1999a). Evidence collected since the PAPA DEIS has shown that the functions of some wildlife habitats, those classified as “vital” or “high value” by the WGFD, have declined as wellfield development progressed. Such evidence is based on species’ observed use of habitats before and during development. In other cases, species’ use of habitats proximate to disturbance in the PAPA has declined whereas use of the same habitat types farther away from disturbance has not. Diminished habitat function is a significant indirect impact that may ultimately have direct affect on wildlife populations through increased mortality (decreased survival) and/or decreased births (decreased fecundity), both of which affect individuals’ fitness. Such direct impact that leads to decreased fitness of individuals in a population has not been conclusively demonstrated, however.

4.20.3 Alternative Impacts

4.20.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development in the PAPA

Since issuance of the PAPA DEIS (BLM, 1999a), many of the impacts to wildlife that were predicted in the PAPA DEIS have been substantiated by wildlife studies conducted cooperatively by the Operators, the BLM, the WGFD, and the University of Wyoming. Discussions of impacts resulting from removal of vegetation are included in other sections in this chapter, including Surface Water (Section 4.14), Vegetation (Section 4.16), and Wetlands (Section 4.18).

The PAPA DEIS, BLM (1999a) identified a wide range of potential impacts to wildlife that could be expected by aspects of future development in the PAPA. The impacts, the species or species groups likely to be affected, the mechanism of the impact known at the time, location or circumstances where the impact was demonstrated, and sources describing the impact were reviewed and summarized in Table 4-45 in the PAPA DEIS. The information in Table 4-45 (page 4-121, PAPA DEIS) approximated the state of knowledge about potential impact to wildlife by wellfield development in the 1990's. The following types of impact (and species or groups known to be affected by the impact) discussed in the PAPA DEIS include:

1. wildlife-vehicle collisions (affecting mule deer and wildlife in habitats adjacent to roads);
2. wildlife mortality during construction (affecting burrowing animals and wildlife using burrows, ground nesting birds including greater sage-grouse and burrowing owls);
3. mortality from toxic compounds (affecting waterfowl, muskrats, domestic livestock, bird and mammal mortality at drilling pits, aquatic insect, and fish);
4. degradation of aquatic habitats (affecting aquatic insects, fish, and amphibians);
5. fragmentation of habitats (affecting breeding passerine birds, small mammals);
6. impedance of migration (affecting elk, deer, moose, and pronghorn);
7. hastening of migration (affecting pronghorn);
8. loss of forage (affecting herbivores in general);
9. diminished use of habitats – interruption of life history functions (affecting mule deer, pronghorn, moose, greater sage-grouse, nesting and wintering raptors, and breeding passerines);
10. increased recreation use (affecting various wildlife species);
11. recreational ORV use (affecting various wildlife species);
12. encroachment in winter range by subdivisions (affecting big game and various wildlife species);
13. domestic dogs and cats as subsidized predators (affecting various wildlife species); and
14. poaching (affecting big game and furbearers).

The following discussion includes evidence revealed since the PAPA DEIS was released (BLM, 1999a) which documents many of the effects predicted then and are included in the list, above and in Table 4-45 (page 4-121, PAPA DEIS).

For example, one potential direct impact to wildlife that the PAPA DEIS predicted was wildlife mortality associated with reserve pits. BLM reported inadequate fencing around pits and tanks in the PAPA. Wildlife can suffer from toxic effects of ingesting fluids either directly, from preening coated feathers, or grooming coated pelage if they purposely or accidentally utilize reserve pits. Reserve pit fluids are particularly toxic if contaminated with petroleum-based drilling fluids (Ramirez, 2000), other compounds such as benzene and other organic compounds, or chromium, lead, and other metals (EPA, 2000). Simple entrapment and/or drowning can occur in pits regardless of the toxicity of pit contents. BLM has no documented wildlife mortalities at pits in the PAPA. Other examples of predictions are included below.

Habitat Fragmentation and Effectiveness. Fragmentation of connected habitats by wellfield development was predicted in the PAPA DEIS (BLM, 1999a) and concern about fragmented habitat in the PAPA was indicated during public scoping for the Draft SEIS (BLM, 2006a). Fragmentation refers to breaking up contiguous areas of vegetation/habitat into smaller patches that become progressively smaller and isolated over time (Forman, 1995). Among other effects, fragmentation of habitat allows predator access to breeding sites used by birds along newly created corridors and through edges of habitats that were previously continuous. Habitat fragmentation contributes to higher rates of nest predation in grasslands (Burger et al., 1994 and Vickery et al., 1994) and at habitat edges in general (Gates and Gysel, 1978 and Marini et al., 1995).

Measures of habitat fragmentation by the end of 2006, and estimated for each of the Alternatives, are provided in Table 4.20-1. In the analysis, each well pad is considered a patch of altered or unusable wildlife habitat. In 2006, there were 340 existing well pads in the PAPA, 55 of which were constructed prior to 2000. The average size of all existing well pads was approximately 6.9 acres (Table 4.20-1). Because the extent of revegetation at each well pad could not be reliably evaluated, all were assumed to be unreclaimed.

Table 4.20-1
Well Pads and Potential Edge Length Indicative of Fragmentation by Alternative

Wellfield Component	Well Pads and Existing Edge Length in 2006	Alternative A	Alternatives B, C , and D	Alternative E
Total Well Pad Number [1]	340	249	250	415
Average Well Pad Size (acres) [2]	6.9	8.3	17.7	13.8
Total Well Pad Perimeter (miles) [3]	133.0	253.3	370.3	418.9
Total Road Length (miles) [4]	185.5	99.6	100.0	166.0
Total Pipeline Length (miles) [5]	142.6	143.4	636.1	230.8
Total Edge Length (miles)	**461.1**	**496.3**	**1,106.4**	**815.7**

[1] Includes all new well pads in the PAPA by Alternative. Number in 2006 includes 55 well pads constructed before 2000.
[2] Includes areas of new well pads and areas of expanded existing pads.
[3] Includes perimeters of new well pads and perimeters of expanded existing pads.
[4] Includes all new roads (local and resource) in the PAPA by Alternative.
[5] Includes all new pipelines (gas gathering, liquids gathering, water and trunk pipelines) in the PAPA by Alternative.

Another measure of fragmentation is the amount of edge created by wellfield development. In the context of habitat fragmentation, edge is the portion of habitat (or ecosystem on a larger scale) "*near its perimeter, where influences of the surroundings prevent development of interior environmental conditions*" (Forman, 1995). The perimeter of each well pad is an edge between unaffected native vegetation and the surface of the pad, whether or not the pad is reclaimed. Reclamation to equivalent, pre-impact conditions based on species composition, biomass, cover, and/or vegetative structure is unlikely, at least through the development phase of each Alternative.

By the end of 2006, there was a total of 328 miles of edge from roads and pipelines, combined, in the PAPA. When added to total well pad perimeters, there was an estimated 461 miles of edge in the PAPA by the end of 2006 (Table 4.20-1). An estimate of the perimeter of each existing well pad was derived from the average well pad areas. Edge associated with well pads was computed as the average of a circular well pad (circumference) and a square well pad (perimeter). These are conservative estimates because most pads are probably rectangular and perimeters of rectangles can greatly exceed those of circles and squares with the same areas. Roads and pipelines also create edges when constructed through undisturbed habitat. An indication of fragmentation is total length of wellfield roads and pipelines (Table 4.20-1). This measure does not include each side of a road or pipeline corridor nor does it include possible co-locations of multiple pipeline corridors or pipelines located directly adjacent to roads. There is no way to anticipate future contiguity of linear elements. The total miles of edge length estimated for each Alternative is shown in Table 4.20-1.

Habitat Function. Since issuance of the PAPA DEIS, the WGFD (2004b) developed guidance relevant to current and future natural gas development in the PAPA, *Recommendations for Development of Oil and Gas Resources within Crucial and Important Wildlife Habitats*, in which evaluation of impact by varying levels of oil and gas development is related to the function of wildlife habitats. Habitat function is defined (WGFD, 2004b) as "*the arrangement of habitat features, and the features' capability to sustain species, populations, and diversity of wildlife over time*." Impacts that decrease habitat function render the habitat less effective. As the effectiveness and ultimately the function of the habitat is diminished, a species' or population's use of the habitat is expected to diminish as a direct or indirect result of the impact.

The WGFD (2004b) identified vital wildlife habitats for which they recommend no loss of habitat function, although, "*some modification of habitat characteristic can take place*." The vital wildlife habitats include big game crucial winter ranges, greater sage-grouse habitats (leks, nesting and brood-rearing complexes, winter habitat), raptor nesting habitats, and habitats used by native species with NSS1 and NSS2 status (Table 3.21-2 in Chapter 3).

All of the vital habitats for big game, greater sage-grouse, raptors, and a few high priority native species are in the PAPA. The WGFD also defined high value habitats (big game parturition areas, riparian habitats, and habitats of NSS3 species) for which they recommend no loss of habitat function within the biological community that encompasses the project impact site. Impact to high value habitat can be mitigated within the affected biological community (WGFD, 2004b). Though no specific big game parturition areas have been identified in the PAPA, other high value habitats are present including riparian habitats and habitats utilized by NSS3 species (for example pygmy rabbits, ferruginous hawks, white-tailed prairie dogs, and merlins). As discussed below, under specific wildlife species, the function of some vital and high value habitats in the PAPA has diminished as wellfield development progressed.

Criteria advanced by the WGFD (*Recommendations for Development of Oil and Gas Resources within Crucial and Important Wildlife Habitats* -Version 2.0, revised April 20, 2007) is in the process of revision but not yet released. The original document (WGFD, 2004b) would categorize most of the current Pinedale Anticline Crest as an area of "Extreme Impact." Under the criteria, there are locations within the Anticline Crest with more than 16 wells per square mile and more than 80 acres of wellfield disturbance per square mile - including areas of pronghorn and mule deer crucial winter ranges and areas of greater sage-grouse breeding, nesting, and early brood-rearing habitats. As an area of Extreme Impact, the WGFD has recognized that (2004, page 16):

> *"the function and effectiveness of crucial winter habitat would be severely compromised. The long-term consequences are continued fragmentation and*

disintegration of the winter range complex, leading to decreased survival, productivity and ultimately, loss of carrying capacity for the herd. This will result in a loss of ecological functions, recreation opportunity, and income to the State's economy. An additional consequence may include the permanent loss of migration memory from large segments of unique, migratory big game herds in Wyoming."

Under such extreme impact conditions, WGFD recommended developing the wellfield in smaller, incremental phases, applying habitat treatments outside of the wellfield, apply seasonal use restrictions, standard management practices, additional prescriptions and optional mitigation funding. WGFD concluded by acknowledging (2004, page 17):

"habitat effectiveness (of big game crucial winter ranges, sage-grouse nesting and brood rearing habitat) is essentially eliminated from high-density well fields, so the area of the well field will generally serve as the acreage basis for mitigation."

Extreme Impact to habitats with vital and high value to wildlife species would continue to adversely affect habitat function within specific areas that coincide with core areas associated with Alternatives and the Anticline Crest.

Big Game.

Pronghorn. Wellfield development in the PAPA led to surface disturbance in pronghorn seasonal habitats, including crucial winter ranges (Table 4.20-2). Surface disturbance in crucial pronghorn winter range would increase under each of the Alternatives (Table 4.20-2). Effects to non-crucial pronghorn spring/summer/fall ranges in the PAPA have been substantial and would continue with increased disturbance due to wellfield development under all of the Alternatives.

Table 4.20-2
Initial Surface Disturbance in Relation to Pronghorn Seasonal Ranges by Alternative

Pronghorn Seasonal Ranges	Alternative A (acres)		Alternatives B, C , and D (acres)		Alternative E (acres)	
	Federal	Total	Federal	Total	Federal	Total
Crucial Winter Range SRMZ	1,176.3	1,260.7	3,228.6	3,519.3	3,497.7	3,618.3
Spring/Summer/Fall Range	2,684.4	2,862.4	8,947.2	9,366.3	6,558.5	6,808.7
Winter Range	0.0	0.0	0.0	0.0	0.0	0.0
Total	**3,860.7**	**4,123.1**	**12,175.8**	**12,885.6**	**10,056.2**	**10,427.0**

Existing direct impact (area of lost habitat) to pronghorn habitats would continue at least until revegetation of surface disturbance is successful. Also, pronghorn utilizing crucial winter ranges in the PAPA may eventually avoid areas where wellfield development is highly concentrated as it is in the adjacent Jonah Field (Berger et al., 2007), an example of decreased habitat function even though vegetation has not been physically removed. The ongoing study, by Berger et al. (2006), included the PAPA and the Jonah Field Project Area. Preliminary results from winter 2005-2006 indicate that habitat patches of less than about 600 acres are under-utilized or abandoned by wintering pronghorn (Berger et al., 2006) although similar observations were not reported for winter 2006-2007 (Berger et al., 2007). During winter 2006-2007, some study animals utilized portions of the Jonah Field while others completely avoided wellfield disturbances there. Pronghorn wintering in the PAPA did not avoid disturbances within crucial winter ranges as some did in the Jonah Field (Berger et al., 2007). It is possible that increased surface disturbance on crucial winter range would lead to habitat patchiness. Habitat patchiness would likely contribute to diminished effectiveness and lost function of pronghorn habitats in the PAPA under all of the Alternatives, though the extent might vary depending on the specific development scenario under each Alternative. Lost habitat and diminishing habitat function may eventually lead to population declines but such demographic response to impact would probably occur after some time has elapsed.

Mule Deer. Mule deer habitat in the PAPA has been directly impacted by surface disturbance. Approximately 59 percent of existing disturbance in the PAPA is within crucial mule deer winter range (Table 3.22-5 in Chapter 3). Surface disturbance in mule deer crucial winter range would increase under all Alternatives (Table 4.20-3).

Table 4.20-3
Initial Surface Disturbance in Relation to Mule Deer Seasonal Ranges by Alternative

Mule Deer Seasonal Ranges	Alternative A (acres)		Alternatives B, C , and D (acres)		Alternative E (acres)	
	Federal	Total	Federal	Total	Federal	Total
Crucial Winter Range SRMZ	1,144.9	1,174.6	4,396.0	4,593.3	2,199.0	2,285.6
Spring/Summer/Fall Range	5.0	5.0	11.0	16.7	11.8	15.5
Winter Range	752.3	867.0	1,971.6	2,322.3	2,048.3	2,202.9
Winter/Yearlong Range	0.0	0.0	0.1	4.1	3.0	5.0
Total	**1,902.2**	**2,046.6**	**6,378.7**	**6,936.4**	**4,262.1**	**4,509.0**

Mule deer in the Sublette Herd Unit have been intensively studied since 1998, including those inhabiting winter ranges in the PAPA. Phase II of the Sublette Mule Deer Study has been in progress since 2002, continuing as wellfield development progresses. Available information, since 2002, indicates that the mule deer population on the Pinedale Mesa steadily declined from more than 5,000 animals in 2002 to less than 3,000 animals in 2004-2005 (Sawyer et al., 2005a). Mule deer abundance during winter 2005-2006 increased very slightly from the previous winter (Sawyer et al., 2006).

Since issuance of the PAPA ROD (BLM, 2000b), direct loss of habitat has increased annually in mule deer crucial and noncrucial winter ranges in the PAPA and would continue under each Alternative (Table 4.20-3). Another aspect of the Sublette Mule Deer Study focused on distribution of wintering mule deer prior to and since wellfield development on the Mesa. Only 60 percent of mule deer habitats that were classified as high-use areas before development in 2000 were classified as high-use areas in the first year since issuance of the PAPA ROD. In the second year of development, only 49 percent of the predevelopment high-use areas were classified as high-use. By the third year of development, only 37 percent of initial high-use areas were classified as high-use areas (Sawyer et al., 2006).

Winter 2003-2004, the fourth year of the study, was more severe than the previous three winters. Although mule deer abundance further declined on the Mesa, the remaining deer inhabiting the PAPA during winter 2003-2004 were closer to wellfield development than in the previous 3 years. Seventy-seven percent of the predevelopment high-use areas were highly used, though by fewer deer (Sawyer et al., 2005a). It appears that mule deer utilizing winter range in 2003-2004 may have been more tolerant of wellfield development, at least when severe winter conditions rendered habitats near wellfield development apparently more suitable than habitats farther away. More than likely, however, heavy snow conditions during winter 2003-2004 reduced available habitat elsewhere and mule deer utilized traditionally-used habitats even though in close proximity to well pads (Sawyer et al., 2006). Winter conditions in 2004-2005 were mild and mule deer once again were distributed farther from well pads and roads than during the previous severe winter, but closer than any of the first 3 years of the study even though there were fewer deer present than during the first 3 years. This, in combination with a concurrent very slight increase in deer numbers may provide an indication of increased tolerance to the progressing development; however, additional monitoring and research would be needed before this conclusion could be made. Highly-used mule deer habitats during winter 2004-2005 included only 52 percent of predevelopment high-use areas (Sawyer et al., 2006). The study shows that crucial winter ranges in the PAPA are less effective than they were before wellfield development and some level of habitat function has been lost. Further loss of habitat would occur under all Alternatives, and loss of habitat effectiveness and habitat function is expected, given the observed trends, as more development occurs under each of the Alternatives.

Mule deer in the PAPA avoid roads with different levels of traffic to varying extents. During winter 2005-2006, deer distances from roads with very high traffic volumes (263 to 350 vehicles/day) averaged about 4 miles. Distances of mule deer from roads with high volumes (77 to 152 vehicles/day) averaged 2.9 miles; distances from roads with medium volume (19 to 30 vehicles/day) averaged 1 mile; and distances from closed or low use roads (0 to 12 vehicles/day) averaged 0.5 mile. Distances of mule deer to well pads with a liquids gathering system averaged 1.5 miles while distances to pads without a liquids gathering system averaged more than 3 miles (Sawyer et al, 2006). These data show the negative effects of traffic on wintering mule deer distribution but also the benefits of a liquids gathering system.

Mule deer avoidance of roads with very high and high traffic volume would likely become more extensive throughout the crucial winter range as roads with higher traffic volumes proliferate. Mule deer would avoid habitats adjacent to roads with higher traffic volumes by up to 3 or 4 miles under all Alternatives. Crucial winter habitat in all areas adjacent to wellfield development, especially habitats proximate to well drilling locations and roads with high traffic volume, would remain ineffective or nonfunctional as mule deer habitat for the duration of wellfield development.

Over-winter mule deer fawn and adult survival is probably a function of weather severity and habitat quality and quantity. Over-winter fawn survival on the Mesa (impacted study area) and on the Pinedale Front Complex (unimpacted control area) were similar each year until winter 2005-2006 when the mortality rate was significantly higher in the control area than in the study area (Wildlife Technical Report, Appendix 17), though the reason for the difference is not clear. During winter 2006-2007, fawn mortality was again similar on the Mesa and Pinedale Front complexes. If the difference in fawn mortality on the two sites noted the year before is due, even in part, to increased mule deer densities on the Pinedale Front Complex as densities on the Mesa Complex declined, then a similar difference in fawn mortality would have been expected in winter 2006-2007. No statistically significant difference was observed (Wildlife Technical Report, Appendix 17).

Results of the Sublette Mule Deer Study have shown that emigration rates of deer from the impacted study area (Mesa Complex) have been consistently low, averaging 2 percent per year. The authors of the study suggest that the overall decline of mule deer on winter ranges that include the Mesa Complex are likely due to reduced adult and fawn survival and that the reduced survival rates are associated with wellfield development (Sawyer et al., 2006). Because a smaller proportion of mule deer utilize crucial winter ranges in the Mesa Complex than in the past, fawn and adult deer survival on other crucial winter ranges (e.g., the Pinedale Front Complex) would become proportionately more important to the entire population. Study results emphasize the value of all crucial winter ranges to the population.

There is a growing body of research that indicates time lags between landscape changes and population, or demographic, responses to the changes (Nagelkerke et al., 2002). Examples of time lag responses by various species' populations have been reported as a response to construction of new roads. As roads through previously unaffected wildlife habitat proliferate, they would cause lost habitat, reduce habitat quality (or habitat effectiveness), increase vehicle-related mortality, and increase fragmentation (decreased habitat connectivity). Declining populations are expected to follow, but some time after the initial impact of road construction (Forman et al., 2003).

For mule deer in the Sublette Herd Unit, there has not been a measurable demographic response related to over-winter survival (Wildlife Technical Report, Appendix 17) although decreased survival of impacted deer wintering on the Mesa appears to be likely as an effect of wellfield development (Sawyer et al., 2006). There is potential for a declining population, given a time lag between lost habitat effectiveness and function and a population-level response. Current understanding is insufficient to predict how such a demographic response would be manifested, but decreased mule deer survival on or off winter range is one possibility. Other demographic responses that may be observed in the future include overcrowding and over-utilization of unimpacted habitats with increased intraspecific competition, increased prevalence of disease, predation, physiological stress response, and decreased birth rates. All of these could occur in some combination and at varying levels as the extent of wellfield development increases under any of the Alternatives. Any demographic response to wellfield development (increased mortality and/or decreased survival of native wildlife species considered as Vital, High, or Moderate by the WGFD Mitigation Policy) would be a significant impact.

<u>Moose and Elk</u>. By the end of 2006, approximately 252 acres of moose crucial winter/yearlong range was disturbed by wellfield development. Additional surface disturbance in moose crucial winter/yearlong range would occur under each Alternative (Table 4.20-4). Moose response to roads and traffic in crucial winter/yearlong range has not been documented. No new disturbance is likely in the portion of elk winter range coinciding with the PAPA.

Table 4.20-4
Initial Surface Disturbance to Moose and Elk Seasonal Ranges by Alternative

Seasonal Range	Alternative A (acres)		Alternatives B, C , and D (acres)		Alternative E (acres)	
	Federal	Total	Federal	Total	Federal	Total
Moose Crucial Winter/Yearlong Range	103.6	210.2	297.7	603.0	255.2	404.4
Elk Winter Range	0.0	0.0	0.0	0.0	0.0	0.0

Upland Game Birds.

<u>Greater Sage-Grouse.</u> Abundance of greater sage-grouse breeding in the PAPA has decreased since issuance of the PAPA ROD (BLM, 2000b). Male attendance at leks in and outside the PAPA increased in 2005 and 2006, presumably due to heightened juvenile recruitment following 2004, a year of relatively high precipitation accompanied by beneficial sagebrush growth. During the past 10 years, there has been an overall declining trend of male greater sage-grouse attendance in three lek complexes in the PAPA. Each of the leks with declining trends has at least 18 producing natural gas wells (range of 18 to 189 producing wells) within a 2-mile radius. There are only two other leks in the PAPA that have increasing trends in males since 1998 but there are no producing wells within 2 miles of either lek. Conversely, leks in complexes adjacent to the PAPA do not demonstrate decreasing trends but numbers of male greater sage-grouse at nine leks have significantly increased (with statistically significant increasing linear trends) since 1998. As in the PAPA, there are no producing natural gas wells within 2 miles of any of the nine leks.

Producing natural gas wells probably do not exert negative impact on breeding greater sage-grouse *per se*. However, the presence of producing wells within 2 miles of leks indicates that habitat is disturbed (by well pads, roads, possibly pipelines, and other ancillary facilities) and wellfield workers would necessarily conduct production and maintenance operations at each well. Human presence would be required on a regular basis throughout the year, including the breeding period from March through May and during nesting and early brood-rearing through mid-July. There is evidence that seasonal restrictions for greater sage-grouse (Section 2.4.2 in Chapter 2) provide protection during the first year of development when wells are being drilled; however, once wells are in production, noise and human presence are always occurring due to production equipment, traffic, and maintenance activities.

Similar observations followed from an earlier 5-year study conducted on leks in and adjacent to the PAPA. Results from the study indicate that, as distances between greater sage-grouse leks and drilling rigs, producing wells, and main roads decreased with the increased levels of development annually, attendance of male greater sage-grouse at leks declined (Holloran, 2005). The investigation indicates that male counts on heavily impacted leks declined 51 percent, from 1 year prior to well development, through 2004. Numbers of strutting males decreased with increased traffic volumes within 1.86 miles of leks and increased noise intensity at leks (Holloran, 2005).

There are corroborating observations from the Powder River Basin (PRB) of northeastern Wyoming where greater sage-grouse populations on leks, subject to disturbance from coal-bed methane development, have substantially declined, relative to populations on undisturbed leks (Naugle et al., 2006 and Walker et al., *in press*). Results from studies in the PAPA and PRB indicate declining greater sage-grouse populations resulting from loss of habitat, disturbance from roads, and noise during breeding (Braun et al., 2002). Results from the PRB study also indicate a time lag effect (discussed above for impact to mule deer) between the onset of wellfield development and decreasing breeding populations (Walker et al., *in press*). For example, wellfield development in the PRB gradually increased since 1987 and greater sage-grouse attendance at leks in impacted areas dropped precipitously 7 years later (Braun et al., 2002) and have further declined in the past several years (Naugle et al., 2006 and Walker et al., *in press*). Declining attendance at leks proximate to wellfield development is attributed to avoidance of the leks by yearling male greater sage-grouse (Kaiser, 2006). With low or no annual recruitment of yearling males, leks could eventually disappear in a few years as older males die. Once a lek has been abandoned, the vital habitat is no longer functional and has been significantly impacted. According to BLM guidelines, a greater sage-grouse lek is classified as abandoned if suitable habitat is present but it has been inactive during a consecutive 10-year period.

Noise from drilling rigs can exceed 10 dBA above background noise, even if drilling is farther than 0.25 mile from noise sensitive sites such as a greater sage-grouse lek (Section 3.12 – Noise). The 10 dBA above background limit was specified in the PAPA ROD (BLM, 2000b) as an Administrative Requirement and Condition of Approval. The PAPA DEIS (BLM, 1999a) assumed that a 0.25-mile buffer around leks was sufficient to limit noise from wellfield traffic to 10 dBA above background levels. Holloran (2005) and Walker et al. (*in press*) indicate that the 0.25-mile buffer surrounding leks may be insufficient to maintain function of lek habitats due to wellfield development, including associated noise.

Greater sage-grouse nesting and brood-rearing habitats have been affected by wellfield development in the PAPA. Females avoid nesting in areas of high well densities and females with broods of chicks avoid well pads with producing wells (Holloran, 2005). Accumulating evidence on the effects of wellfield development on greater sage-grouse use of habitats indicates that once-functional, non-impacted habitats in the PAPA are less effective, given the level of development though 2006. This is because greater sage-grouse use the habitats less over time. Function of greater sage-grouse habitat in and outside of the PAPA also appears to be affected by climatological conditions, specifically by drought. Whether the combination of effects to greater sage-grouse by wellfield disturbance and drought is synergistic or additive has not been demonstrated. However, the negative effects of one do not diminish the negative effects of the other.

Continued loss of habitat function is likely with levels of development under all Alternatives (Table 4.20-5). Under all Alternatives, effectiveness of greater sage-grouse breeding (leks), nesting, and brood-rearing habitats would continue to decline, as they have through 2007. Declining habitat use would likely be exacerbated by continued drought. With the declines in greater sage-grouse use of the PAPA, it is uncertain if habitats would still provide some function to greater sage-grouse by the end of the development phase under all action Alternatives.

Table 4.20-5
Initial Surface Disturbances to Greater Sage-Grouse Lek Buffers by Alternative

Greater Sage-Grouse Lek Buffer	Alternative A (acres)		Alternatives B, C , and D (acres)		Alternative E (acres)	
	Federal	Total	Federal	Total	Federal	Total
0.25-Mile Buffer	0.0	0.0	0.0	0.0	0.0	0.0
2-Mile Buffer and Sage Grouse SRMZ	2,962.0	3,161.1	9,315.2	9,822.6	7,834.4	8,128.4

Under all Alternatives, development would not occur within 0.25-mile buffer of greater sage grouse leks. Habitats may not provide function even if development activities are restricted within the 0.25-mile buffer and within 2-mile buffers of leks, between March 15 and July 15 (BLM, 2004c), to protect greater sage-grouse breeding, nesting and brood-rearing habitats. Noise, traffic, and habitat elimination would all contribute to diminished effectiveness of habitats used by greater sage-grouse during winter, during breeding, nesting, and brood-rearing, through the development phases of each Alternative and quite possibly through the production phase.

Highly impacted leks, those still active by 2007, are very likely to follow the Mesa Springs and Lovatt Draw Reservoir leks to become inactive (as observed in 2006) even if development activities are restricted within the 2-mile buffers (BLM, 2004c). However, buffers of some leks would be impacted more than others. Abandonment of leks would inevitably follow if yearling males do not replace aging adults at highly impacted leks. New leks may become established following abandonment of former leks, such as the establishment of Lovatt West and Dukes Triangle leks in 2005. Longevity of the newly established leks and their effectiveness (in terms of breeding populations), relative to abandoned leks, is unknown.

<u>Other Upland Game Birds.</u> Other upland game birds, including mourning doves, are expected to occur in all habitats in the PAPA (Table 3.22-15). Ruffed grouse could occur in the PAPA although they are mostly associated with aspen groves and there are only about 2 acres of aspen in the PAPA. Mourning doves may nest on the ground and surface disturbing activities could destroy nests. Increased fragmentation by road and pipeline corridors could increase nest predation, especially predation of ground nests.

Small Game and Furbearing Mammals. Diminished function in habitats utilized by cottontails is expected to occur some distance from edges created by wellfield development in sagebrush steppe and other vegetation types. All small game mammals, furbearers, and nongame mammals are susceptible to mortality by vehicles on roads. The risk of vehicle mortality of small and medium-sized mammals is expected to increase with increased traffic volumes under all Alternatives. This is especially the case in winter because many small mammal species and furbearers are active during winter.

Migratory Birds. There have been concomitant declines of sagebrush-dependent migratory passerine bird species with loss of sagebrush steppe vegetation and increased fragmentation in remaining sagebrush-dominated habitats in Wyoming (Knick and Rotenberry, 1995 and Knick et al., 2003). Results of a study on the effects of wellfield roads on densities of Brewer's sparrow and sage sparrow, as well as other species dependent on sagebrush for nesting habitat, demonstrated that the density of the species was greatly reduced within 300 feet of a road compared to the density beyond 300 feet (Inglefinger, 2001). Traffic accounted for some of the reduced density effects while the presence of an edge (change in vegetative type) in otherwise continuous stands of sagebrush may have had an influence. A similar reduction in sage sparrow density was observed along a pipeline alignment (Inglefinger, 2001).

As discussed earlier, edges are one component of habitat fragmentation. Fragmentation and the amount of edge between disturbed surfaces and wildlife habitat has been considerable through 2006, particularly due to wellfield roads (Table 4.20-1). A study of migratory bird populations (sagebrush obligate species) includes effects by wellfield development in the Jonah Field Project Area (King and Holmes, 2005). Results of effects of fragmentation on populations are not yet available. Amounts of fragmentation would continue to increase in the PAPA under each Alternative. Declines in populations of species associated with sagebrush habitats is expected (Knick et al., 2003). Because sagebrush can take 10 to 15 years to become reestablished (West, 1988), successful revegetation in reestablishing affected wildlife populations has not yet been demonstrated. Effects of fragmentation to migratory breeding birds and other wildlife (small game, furbearers, and small mammals) would increase considerably from 2006 through the development phase of each Alternative.

Raptors nesting in the PAPA are migratory birds. In addition to ferruginous hawks, merlins and burrowing owls discussed above in Section 4.19.3.1, golden eagles, and other raptors nest in the PAPA and within the PAWSA (Section 4.19). Monitoring data collected from 2003 through 2005 indicate that the distance from active golden eagle nests to the nearest well location varied from 895 feet to 16,582 feet with an average distance of 7,327 feet (Ecosystem Research Group, 2006). Except for short-eared owls (there is very limited data), other raptor nests in the PAPA are concentrated in forest-dominated riparian vegetation along the New Fork and Green rivers. Similar analyses of distances from active nests of other raptor species to well locations ranged from 314 feet to more than 28,500 feet, averaging 9,175 feet (Ecosystem Research Group, 2006). The large average distance between raptor nests and well locations probably is a reflection of relatively low levels of wellfield development within forest-dominated riparian zones rather than displacement of raptors away from high wellfield development (Table 4.19-1). The monitoring program in the PAPA was not designed as a scientific study to determine the impacts of energy development on raptor nesting success. It was designed to find nesting locations in order to appropriately protect nesting raptors (Ecosystem Research Group, 2006).

Implementation of all Alternatives would increase disturbance within forested-dominated riparian vegetation through 2011 (Table 4.19-3). Although monitoring data collected for annual raptor nesting activities does not indicate specific conflicts between wellfield development and raptor nesting success, increased disturbance in nesting habitats in the absence of effective mitigation, could affect at least some nests of some species, by decreasing habitat effectiveness. Increased habitat effectiveness would occur with successful reclamation. All existing spatial and timing stipulations intended to protect raptor nesting and wintering habitats would apply to all Alternatives (Appendix 4).

Nongame Wildlife Species. Most nongame reptiles, birds, and mammals that are likely to occur in the PAPA are expected within sagebrush steppe, the most extensive vegetation cover type in the area. Implementation of all Alternatives would increase disturbance within sagebrush vegetation (Table 4.19-3). Other habitats utilized by nongame species (Table 3.22-12 in Chapter 3) are likely to be affected by all Alternatives depending upon distribution of disturbance and duration of each Alternative's development phase.

Aquatic Resources. The New Fork and Green rivers support coldwater fisheries; principally rainbow trout, Snake River cutthroat trout, brown trout, and mountain whitefish. They also support limited kokanee salmon, brook trout, and lake trout. Snake River cutthroat trout and rainbow trout spawn in the spring while mountain whitefish, brook trout, and brown trout are fall spawners (Baxter and Stone, 1995). In lower portions of watersheds, such as the reaches of the New Fork and Green rivers in the PAPA, high sediment loads can limit reproduction of rainbow and cutthroat trout. Sediments are mobilized during runoff from snowmelt and spring precipitation, which in the PAPA is highest during May. Increased sedimentation in the New Fork and Green rivers following spring precipitation and runoff would be detrimental to reproduction of rainbow trout and Snake River cutthroat trout by covering spawning sites (redds) with silt, suffocating eggs, and inducing mortality of embryos developing within intergravel spaces and/or fry. Therefore, populations of fall spawning nonnative salmonids (brook and brown trout) would increase at the expense of native species (Behnke, 1992).

Surface disturbing activities that remove riparian vegetation and cause erosion and sediment transport on slopes are sources of sediment that promote degradation of aquatic environments (Reid, 1993). Surface disturbance within the forest-dominated riparian zone of the New Fork River may generate sediment into surface waters even though the amount is small compared to the estimates of new disturbance in all sub-watersheds under all Alternatives (Table 4.14-1). The potential for sedimentation in aquatic habitats increases as a direct function of surface disturbance (Section 4.14.3.1). Implementation of all Alternatives would increase existing surface disturbance in several sub-watersheds in the PAPA. The greatest erosion impacts would occur on the Anticline Crest under all Alternatives. Mack Reservoir and New Fork Alkali Creek basins show the largest potential increase in annual erosion over the current conditions. Erosion would likely increase in Sand Draw-Alkali Creek Basin for large storms (Table 4.14-3). Increased surface disturbance associated with the action Alternatives have the potential to increase annual sediment yields to surface waters by up to 20 percent above current conditions (HydroGeo, 2006). Depending on specific conditions in any given year, especially precipitation and runoff during spring, surface disturbance could potentially indirectly impact spawning by native salmonids. The BLM’s Practices and Restrictions for the Pinedale Anticline Project Area as they relate to erosion and sediment control would apply to all Alternatives (Appendix 4).

<u>Pipeline Corridors and Gas Sales Pipelines</u>

Potential impacts to wildlife species from pipeline construction would be similar to impacts resulting from development in the PAPA.

Big Game. Loss of habitat function and disturbance to big game activities would occur as direct and indirect results of pipeline construction. These impacts would be limited to short-term loss of forage and short-term displacement of individuals near the construction right-of-way. Most of the pipeline construction would occur adjacent to existing pipelines and therefore, these impacts would be minimal. Long-term impacts to big game forage would not occur because the pipeline right-of-way would be reclaimed within one growing season after construction. Right-of-way maintenance would include control of noxious weeds and invasive nonnative species.

Upland Game Birds. Several greater sage-grouse leks have been identified within 2 miles of the proposed pipeline corridors. Ground disturbing activities would be avoided during the seasonally restricted periods within a 2-mile buffer of identified leks. No surface facilities would be constructed within 0.25 mile of leks. Impacts to greater sage-grouse from pipeline construction would include loss of habitat and increased habitat fragmentation. Short-term disturbance to the species and displacement of individuals could occur because of construction activities and increased human presence. These impacts are likely to reduce greater sage-grouse reproductive success and survival rates near the pipeline corridors until reclamation of shrub habitats is successful. These impacts would be localized and are not anticipated to lead to the decline of the species.

Migratory Birds. Potential impacts to migratory birds such as loss of sagebrush habitats and increased habitat fragmentation would be greater in areas of cross-country pipeline construction where the pipeline right-of-way does not parallel existing pipeline rights-of-way. One possible indirect impact would be reduced breeding success due to increased human presence. There could be direct impacts to nests and mortality to individuals as a result of construction activities. The availability of similar habitats near the proposed pipeline corridors would lessen the potential impacts to these species.

BLM imposes temporal and spatial limitations for pipeline construction activities around active raptor nest sites. Pipeline construction would not occur within temporal and spatial buffers that are determined by the BLM based on site-specific conditions. Raptor surveys would be conducted prior to commencement of construction activities as required by the BLM. No impacts to nesting raptors are anticipated as a result of pipeline construction.

Due to the avoidance of occupied raptor and mountain plover habitats during the nesting season, migratory bird species occupying the habitats would be protected. Potential impacts to migratory birds within the proposed pipeline corridors would be localized and minor.

Aquatic Resources. Impacts to fisheries are not expected as a result of pipeline construction. The only perennial waterbodies crossed by the proposed corridor/pipeline alignments are the New Fork, Green, and Blacks Fork rivers. All of these rivers would be crossed by HDD construction methods unless otherwise directed by the BLM. Any potential impacts to the rivers would be avoided by HDD because the pipeline would be placed beneath the rivers by drilling away from the stream banks and stream channel. There would be no excavation in the rivers or any other in-stream work.

4.20.3.2 Alternative A (No Action Alternative)

Under the No Action Alternative, initial surface disturbance of 4,123.1 acres would result from construction of 249 new well pads, 99.6 miles of new roads, gathering pipelines, and associated ancillary facilities. Initial surface disturbance includes expansion of existing pads by 3 to 16 acres each. Surface disturbance under the No Action Alternative would be randomly spread across the Anticline Crest, most likely within areas identified as having moderate and higher potential for gas development by the BLM's RMG (Map 2.4-4 in Chapter 2).

Year-round development under this Alternative would be limited to Questar's leasehold in the northern portion of the PAPA as allowed by BLM's 2004 Decision Record (BLM, 2004a) although development could occur outside of the seasonally restricted areas during winter. All development outside of Questar's leasehold must take place while adhering to seasonal restrictions for big game and greater sage-grouse seasonal habitats, unless an exception is granted.

Under the No Action Alternative, there is little opportunity for interim reclamation and timely final reclamation until all development has ceased. Reclamation would be similar to what is it currently under the PAPA ROD (Appendix 8A). Because development must be conducted within seasonal restrictions for wildlife in seasonally restricted habitats, well pads would be left open while Operators move rigs to areas which do not have seasonal restrictions. This lessens opportunities for concentrated development and therefore, requires more pads for a given number of wells which increases habitat fragmentation and edge length.

Under this Alternative (in 2009 – estimated peak year), average traffic volume (light and heavy vehicles) has been estimated at 2,978 vehicles per day during summer throughout the PAPA and 2,239 vehicles per day during winter (Tables 4.4-1 and 4.4-2). Once development is complete and all wells are in production in 2012, wellfield traffic would decline (Table 4.4-3). Wellfield traffic during production would be steady for several decades and then slowly decline toward the end of the production period in 2051.

Development-related traffic in mule deer crucial winter range would be about the same as traffic evaluated during winter 2005-2006 in Questar's leaseholds. Traffic in Questar's leaseholds has been estimated to be 0.7 vehicle/day to each producing well (Table 3.6-5). Year-round development traffic would exceed 66 vehicles per day to each drilling location. Mule deer avoidance of roads with very high, high, medium, and low traffic volume would be similar to observed avoidance in winter 2005-2006. Mule deer would continue to avoid habitats adjacent to roads with higher traffic volumes resulting from development (North Anticline Road, local roads, and resource roads) by up to 3 or 4 miles. Production-related traffic both in the development phase and in the production-only phase would continue to be reduced in Questar's leases in the northern portion of the PAPA due to the existing liquids gathering system.

Under this Alternative, development-related traffic would not occur in big game crucial winter ranges (mostly pronghorn) in the central and southern portions of the PAPA during the seasonally restricted periods. This would provide similar protections to big game as is currently occurring under the PAPA ROD. Production-related traffic would continue through each winter and would increase with additional development. Estimated traffic to producing wells could be 1.6 vehicles per day per producing well (Table 3.6-5), based on winter 2005-2006 data (1.6 vehicle round trips per day per pad based on 2006-2007 data) without a liquids gathering system.

There would be approximately 1,174.6 acres of new disturbance in mule deer crucial winter range under the No Action Alternative (Table 4.20-3). Although there would be no development-related traffic in the central and southern portions of the PAPA within pronghorn crucial winter ranges during winter, the No Action Alternative would disturb an additional 1,260.7 acres of pronghorn crucial winter range (Table 4.20-2), north and south of the New Fork River. Similarly, there would be 210.2 acres of new disturbance in moose crucial winter/yearlong range along the New Fork River (Table 4.20-4).

There would be 3,161.1 acres of surface disturbance within 2-mile buffers of greater sage-grouse leks under this Alternative. Except for development in Questar's leases under BLM's 2004 Decision Record (BLM, 2004a), all development would comply with the BLM's seasonal restrictions for greater sage-grouse seasonal habitats.

Construction of 249 new well pads would disturb an average of 8.4 acres which would lead to 470 acres of disturbance by expansion of existing pads. Due to the large number of new pads, the average size of new well pads and expansion area of existing pads, the average patch size under the No Action Alternative would increase from 6.9 to 8.3 acres per pad (Table 4.20-1). Wellfield development under the No Action Alternative would generate 496 miles of new edge length (Table 4.20-1). Most new fragmentation would be within sagebrush steppe vegetation in which 3,172.0 acres of would be disturbed under the No Action Alternative (Table 4.16-1).

4.20.3.3 Alternative B

Alternative B includes 250 new well pads, expansion of 283 existing well pads, and construction of 100 miles of new roads, gathering pipelines, and ancillary facilities for an initial surface disturbance of 12,885.6 acres (Table 2.4-10 in Chapter 2).

Year-round development under this Alternative would be allowed in CDAs in the Alternative B Core Area. Under Alternative B, development within a specific CDA (Map 2.4-3 in Chapter 2) would occur year-round on pads in big game crucial winter ranges and within 2-mile buffers of greater sage-grouse leks at any time of year. Consequently, vehicular traffic related to drilling and completions during winter on crucial winter ranges and within 2 miles of occupied leks during otherwise seasonally restricted periods would be substantially greater than what it is currently. Year-round development allows for a greater degree of concentrated development, generally completing development and reclamation prior to moving to the next CDA. In areas where this cannot be done, Proponents have committed to interim reclamation on pads that have not had development for 2 years. The Proponents' Reclamation Plan is included in Appendix 8B. Effects to wintering pronghorn within crucial winter range by increased wellfield activities and year-round development may resemble pronghorn responses to concentrated development in the Jonah Field wherein some animals clearly avoid areas of dense development while other animals appear more tolerant of them (Berger et al., 2007).

Under Alternative B, a liquids gathering system would be installed in the central and southern portions of the PAPA. Use of liquids gathering systems and increased use of computer-assisted operations would reduce daily production-related traffic to producing wells in winter as well as in other seasons. The reduction in production-related traffic due to the liquids gathering system does not equal the increase in development-related traffic during the development period. Once all wells are in production, it is estimated that use of the liquids gathering system and computer-assisted operations could reduce traffic by over 3,820 vehicle trips per day across the entire PAPA (Table 4.4-4).

Potential impacts to big game would continue and increase in areas of year-round development; however, use of the liquids gathering system and computer-assisted operations would lessen the impact, especially during the production-only phase. Under Alternative B there would be 4,593.3 acres of new disturbance in mule deer crucial winter range and 3,519.3 acres and 603.0 acres would be disturbed in pronghorn crucial winter range (Table 4.20-2) and moose crucial winter/yearlong range (Table 4.20-4), respectively.

Declines of greater sage-grouse would be more rapid and more extensive in areas of year-round development due to increased noise and traffic which would occur within the otherwise seasonally restricted areas (Section 2.4.2, Chapter 2). However, use of the liquids gathering system and computer-assisted operations would lessen potential impacts, especially during the production-only phase. Under Alternative B there would be 9,822.6 acres of surface disturbance within 2-mile buffers of greater sage-grouse leks (Table 4.20-5). Increased development, especially year-round development, within 2 miles of any occupied lek would likely lead to lek inactivity and ultimate lek abandonment whether or not there is a reduction in human presence at producing wells.

For new and expanded well pads developed under Alternative B, the average size for all well pads in the PAPA would be 17.7 acres. This estimate is due to the area of each new pad (3,614 acres total) and the area for expansion of existing pads (4,499 acres total). Habitat fragmentation (edge length) would increase with Alternative B due to increased surface disturbance. Wellfield development under Alternative B is expected to generate an estimated 1,106 miles of new edge length (Table 4.20-1). Most new fragmentation would be within sagebrush steppe vegetation in which 10,000 acres of additional surface disturbance is projected through 2023 (Table 4.16-1).

4.20.3.4 Alternative C

Implementation of Alternative C would result in the same potential initial surface disturbance as Alternative B and it is reasonable that the disturbance would occur in the same location and would affect the same wildlife habitats (Tables 4.20-2 through 4.20-5).

Year-round development would occur in the Alternative C Core Area as described in Section 2.4.2.4 in Chapter 2. This Alternative requires that once development is complete on any given pad within a development area, reclamation must be implemented and Operators cannot return to the area. For example, development must be complete in DA-2 prior to moving to DA-3. Seasonal restrictions for the protection of species protected under the MBTA and ESA could preclude systematic progression within and between development areas. These restrictions would provide some areas of lesser impact for big game. Consequently, big game crucial winter habitats would be substantially more effective and functional for certain portions of the development period.

Similar to Alternative B, impacts would be reduced due to installation and use of the liquids gathering system and computer-assisted operations in the central and southern portions of the PAPA. A reduction in potential impacts to big game and greater sage-grouse may also be realized through concentrated drilling and interim reclamation (Appendix 8C) as described for Alternative B.

Effectiveness of greater sage-grouse breeding (leks), nesting, and brood-rearing habitats would continue to decline under Alternative C due to wellfield development and production; however, year-round development would not be allowed in DA-5. This may provide additional protection to greater sage-grouse, especially during the first year of development but additional producing wells within 2 miles of any occupied lek would likely lead to lek inactivity and ultimate abandonment.

The number of new and expanded pads under Alternative C would be the same as under Alternative B. Levels of habitat fragmentation (edge length) and disturbance in sagebrush steppe would also be the same as for Alternative B (Tables 4.20-1 and 4.16-1).

4.20.3.5 Alternative D

Implementation of Alternative D would result in the same potential initial surface disturbance as Alternatives B and C and it is reasonable that the disturbance would occur in the same location and would affect the same wildlife habitats (Tables 4.20-2 through 4.20-5).

Under Alternative D, year-round development would be allowed within the Alternative D Core Area. It would also be allowed within the Alternative's PDA if approved by the BLM AO following recommendations made during the Annual Planning Meeting. Development would be concentrated allowing for construction, drilling, completion, and reclamation to occur sequentially without leaving pads open during seasonally restricted periods. This would allow for timely reclamation because pads would be fully developed prior to leaving the pad. The Alternative D Reclamation Plan states that interim reclamation would be conducted on well pads where there is no development for 2 years (Appendix 8D). These elements of Alternative D would potentially lessen impacts to wintering big game, reducing fragmentation and edge length and leaving large areas without development while development is concentrated in other areas. However, with higher traffic volumes in winter during the development phase, mule deer avoidance behavior of roads and well pads may become more pronounced than avoidance behaviors described so far. Avoidance behavior would occur in the vicinity of year-round development pads and roads used to access those pads and would extend through the development phase.

Development progression is designed with the intent of minimizing the extent of east-west development at any point in time for the purposes of maintaining wildlife corridors. The effectiveness of this would be evaluated through monitoring and the results would be reviewed during the Annual Planning Meeting. Seasonal restrictions for the protection of species protected under the MBTA and ESA could preclude systematic progression within and between development areas.

Similar to Alternatives B and C, impacts would be reduced due to installation and use of the liquids gathering system and computer-assisted operations in the central and southern portions of the PAPA. A reduction in potential impacts to big game and greater sage-grouse may also be realized through concentrated drilling and interim reclamation (Appendix 8D) as described for Alternatives B and C.

Alternative D includes a Wildlife and Habitat Mitigation Plan (Appendix 9C) and a Wildlife Monitoring and Mitigation Matrix (Appendix 10). Alternative D also includes an expected fund of $36 million that would, in combination with the AM process, provide the means and direction for implementation of monitoring and mitigation. The Wildlife Monitoring and Mitigation Matrix targets mule deer, pronghorn, greater sage-grouse, sensitive species, and sensitive sagebrush associated bird species. For each species or group, the Monitoring and Mitigation Matrix describes proposed monitoring and suggests the level of change in the monitored parameter that is determined to require mitigation. Levels of change would be based on current (2005-2006) conditions rather than changes that have already occurred. The Matrix specifies the sequence in which mitigation would be applied:

On-site:

- Protection of flank areas from disturbance (e.g., voluntary lease suspensions, lease buyouts, voluntary limits on area of delineation/development drilling) to assure continued habitat function of the Flanks, and to provide areas for enhancement of habitat function.
- Habitat enhancements of the PAPA (Core Area, PDA and Flanks) at an appropriate (initially 3:1) enhancement-to-disturbance acreage ratio.

On-site/Off-site

- Conservation Easements or property rights acquisitions to assure their continued habitat function, or provide an area for enhanced habitat function (e.g., maintenance of corridor and bottleneck passages, protection from development, establishment of forage reserves, habitat enhancements at an appropriate (initially 3:1) enhancement-to-disturbance acreage ratio).

Modification of operations

- Recommend, for consideration by Operators and BLM, adjustments of spatial arrangement and/or pace of ongoing development.

The BLM would require review of annual monitoring program results during the Annual Planning Meeting and apply the recommended measures from the Wildlife Monitoring and Mitigation Matrix. Some mitigation response would be employed upon signing of the ROD, which includes protection of some leased portions of the flank areas from disturbance through the voluntary lease suspensions and term NSOs. Other mitigation responses would be employed if monitoring data suggests that desired results are not being achieved. The BLM expects that there would be some delay between the detection of the impact and implementation of the mitigation measure. Further, there would be a delay in determining the effectiveness of the mitigation measure because additional monitoring would be necessary.

The BLM fully recognizes the potential importance of on-site habitat enhancement efforts but also realizes that such efforts may require more than one year to meet success criteria. Habitat enhancements (either on-site and/or off-site) and conservation easements are recognized as acceptable first attempt approaches to mitigation but do not necessarily mitigate the cause of the impact to the various wildlife species or groups in the Wildlife Monitoring and Mitigation Matrix; they are designed to mitigate the impact by compensating for the impact. The use of conservation easements would be effective in maintaining the status quo and may provide locations for off-site habitat enhancements. The greatest value of conservation easements is estimated by the BLM to be providing places for habitat enhancements.

Adjustments of spatial arrangements and/or pace of ongoing development would be implemented when it becomes apparent, based on monitoring data, that previous mitigation efforts are not achieving the desired results. Any such adjustments would be made taking into account the other resources. Adjustments of spatial arrangements and/or pace of ongoing development are designed to mitigate the cause of the impacts. The BLM estimates that modification of spatial arrangement of year-round development and access to the locations would be more effective in mitigating impacts than changing the pace of development.

During at least the first 5 years after implementation of Alternative D, there would be no additional surface disturbance on the 49,903 acres of federal suspended and term NSO leases in the Flanks (outside of the Alternative D PDA). Therefore, there would be no development-related traffic in these areas; however, production-related traffic from existing development would continue. The federal suspended and term NSO leases coincide with 16,954 acres of big game crucial winter range and 37,019 acres within 2-mile buffers of greater sage-grouse leks. In these areas, impacts to big game and greater sage-grouse would be reduced at least for the first 5 years and would continue until habitat function is again available in the Alternative D Core Area, as determined during the Annual Planning Meeting. Development could occur while adhering to seasonal restrictions in the Flanks in leases that are not federal suspended or term NSO leases. Additional development and production within 2 miles of any occupied lek would likely lead to lek inactivity and ultimate abandonment, similar to other Alternatives.

The number of new and expanded pads under Alternative D would be the same as under Alternative B. Levels of habitat fragmentation (edge length) and disturbance in sagebrush steppe would also be the same as for Alternatives B and C (Tables 4.20-1 and 4.16-1).

4.20.3.6 Alternative E

Under Alternative E, initial surface disturbance of 10,427.0 acres would result from construction of 415 new pads, 166 miles of new roads, gathering pipelines, and associated ancillary facilities. Alternative E is a full-field development Alternative and development would extend through 2033. Under Alternative E, there are limits on amounts of surface disturbance within the Alternative E Core Area, the Buffer Area, and in the Flanks at any one time in each Management Area (Appendix 13).

Year-round development under this Alternative would be limited to Questar’s leasehold in the northern portion of the PAPA as defined by BLM’s 2004 Decision Record (BLM, 2004a) at least through 2013-2014, although development could occur outside of the seasonally restricted areas during winter. All development outside of Questar’s leasehold must take place while adhering to seasonal restrictions for big game and greater sage-grouse seasonal habitats, unless an exception is granted.

Similar to Alternative A, there is little opportunity for interim reclamation and timely final reclamation under this Alternative; however, unlike Alternative A or current practices, there is a requirement for interim reclamation on pads that have had no development for 2 years (Appendix 8D). Drilling rigs operating in sensitive wildlife habitats subject to seasonal restrictions for big game and greater sage-grouse seasonal habitats would be removed prior to the seasonally restricted period and return once the seasonally restricted period ends. Heavy traffic associated with rig movements, setting up and taking down, would occur in seasonal pulses as long as drilling lasts within the seasonal habitats. This lessens opportunities for concentrated development and therefore, requires more pads for a given number of wells which increases habitat fragmentation and edge length.

Under this Alternative, development-related traffic would not occur on big game crucial winter ranges (with the exception of Questar's leases) in the seasonally restricted periods. This would provide similar protections to big game as is currently occurring under the PAPA ROD.

A liquids gathering system is not included in this Alternative, except as required in the northern portion by the BLM's 2004 Decision Record (BLM, 2004a). Production-related traffic would continue through each winter and would increase with additional development. Estimated traffic to producing wells could be 1.6 vehicles per day per producing well (Table 3.6-5), based on winter 2005-2006 data (1.6 vehicle round trips per day per pad based on 2006-2007 data) without a liquids gathering system. Seasonal traffic estimated during 2009, the most intense year of development for Alternative E, are 2,978 vehicles per day during summer throughout the PAPA and 2,239 vehicles per day during winter (estimates for traffic in 2009, Tables 2.4-1 and 2.4-2).

There would be approximately 2,285.6 acres of new disturbance in mule deer crucial winter range under Alternative E (Table 4.20-3). Although there would be no development-related traffic in the central and southern portions of the PAPA within pronghorn crucial winter ranges during winter, the No Action Alternative would disturb an additional 3,618.3 acres of pronghorn crucial winter range (Table 4.20-2), north and south of the New Fork River. Similarly, there would be 404.4 acres of new disturbance in moose crucial winter/yearlong range along the New Fork River (Table 4.20-4). Development within seasonal restrictions for big game seasonal habitats would retain habitats that are more functional than would occur with year-round development.

Except for development in Questar's leases under BLM's 2004 Decision Record (BLM, 2004a), all development would comply with the BLM's seasonal restrictions for greater sage-grouse habitat. There would be 8,128.4 acres of surface disturbance within 2-mile buffers of greater sage-grouse leks under this Alternative. Effectiveness of greater sage-grouse breeding, nesting, and brood-rearing habitats would continue to decline under Alternative E. Declines may be less rapid and less extensive under Alternative E because winter development, traffic and associated noise would be considerably less within 2-mile buffers around occupied greater sage-grouse leks. Production-related traffic and habitat elimination from a longer development phase would continue to diminish effectiveness of habitats used by greater sage-grouse during winter, during breeding, nesting, and brood-rearing. Future levels of decline in male sage-grouse attendance at leks in the PAPA are assumed to continue with development of more producing wells and concomitant wellfield developments within 2 miles of leks, even with seasonal restrictions on new surface disturbing activities (BLM, 2004c).

Levels of habitat fragmentation would increase under Alternative E, somewhat less than anticipated under Alternatives B, C, or D, potentially generating over 800 miles of new edge length (Table 4.20-1). As with other Alternatives, most new fragmentation would be within sagebrush steppe (Table 4.16-1). The average size of all well pads in the PAPA under Alternative E would be 13.8 acres (Table 4.20-1). Implementation of Alternative E would produce more patches than any other Alternative.

4.20.4 Cumulative Impacts

The CIAAs that are applicable to wildlife vary by species. The CIAA for pronghorn includes the northern portion of the Sublette Herd Unit while the CIAA for moose and mule deer are the respective species' herd units in their entireties. The CIAA applicable to greater sage-grouse includes the area encompassed by SUGMAs 3 and 7. The CIAA for all other wildlife and aquatic species is the PAPA.

Changes in land use in the region surrounding the PAPA affect wildlife and their habitats. Livestock grazing was the predominant traditional land use and is compatible with wildlife use, where appropriately managed. However, other changes in land use have occurred that affected the function of some wildlife habitats. For example, fragmentation of wildlife habitat by development includes proliferation of roads associated with mineral resource development (Weller et al., 2002) and subdivision of former agricultural private lands (Coupal et al., 2004 and Taylor, 2003). Fragmentation changed the landscape by removing habitat and leaving remnant areas of native habitat physically and biologically less functional (Saunders, et al., 1991).

Fragmentation in the PAPA occurs due to human actions regardless of wellfield development. Approximately 75 miles of roads were constructed in the PAPA prior to wellfield development (Table 4.20-6). These roads include major arterial highways and a variety of collector, local, and resource roads mostly utilized by livestock operators and recreation users. Wellfield development increased the total edge length in the PAPA by more than an estimated 460 miles by the end of 2006. Implementation of all Alternatives would substantially increase habitat edge (Table 4.20-6).

Table 4.20-6
Cumulative Existing and Potential Additional Edge Length Indicative of Fragmentation by Alternative

Wellfield Component	Existing Non Wellfield Edge Length (miles)	Existing Wellfield Edge Length (miles)	Proposed Gas Sales Pipeline Length (miles)	Cumulative Edge Length (miles) by Alternative		
				Alternative A	Alternatives B, C, and D	Alternative E
Total Well Pad Perimeter [1]	0.0	133.0	0.0	253.3	370.3	418.9
Total Road Length [2]	75.1	185.5	0.0	360.2	360.6	426.6
Total Pipeline Length [3]	0.0	142.6	29.3	315.3	808.0	402.7
Total Edge Length	**75.1**	**461.1**	**29.3**	**600.7**	**1,210.8**	**920.1**

[1] Includes perimeters of new well pads and perimeters of expanded existing pads.
[2] Includes all new roads (local and resource) in the PAPA by Alternative.
[3] Includes all new pipelines (gas gathering, liquids gathering, water and trunk pipelines), not the Gas Sales Pipelines.

In addition to the effects of fragmentation, wildlife habitats associated with native vegetation have been altered by land uses in the PAPA (Section 4.16.3.5). These habitats would be physically eliminated through implementation of Alternatives until surface disturbance is reclaimed.

Big Game. Pronghorn in the region surrounding the PAPA have been affected by a variety of land uses including livestock grazing, fences constructed to manage livestock, development by mineral industries, roads, right-of-way fences, and other human development (Lee et al., 1998 and Sheldon, 2005). In the region, fences, constructed along highways (Sheldon, 2005) and associated with housing developments (Sawyer et al., 2005b), have affected pronghorn access to habitats and impede migrations between seasonally used ranges.

In addition to fragmentation and migration impediments, both of which cumulatively impact pronghorn in the Sublette Herd Unit, human development has affected seasonal habitats utilized by pronghorn in the PAPA (Table 4.20-7). As of 2006, 7,639.0 acres of pronghorn habitats were affected by disturbance associated with non-wellfield development including agriculture, residences, roads, urban infrastructure, and livestock facilities. Wellfield development in the PAPA disturbed more than 4,834.6 acres through 2006. Implementation of future natural gas development in the PAPA under all Alternatives is expected to increase the cumulative loss of pronghorn habitats by several thousand acres (Table 4.20-7).

Table 4.20-7
Cumulative Surface Disturbance in Relation to Pronghorn Seasonal Ranges by Alternative

Pronghorn Seasonal Ranges	Existing Non Wellfield Disturbance (acres)	Total Existing Surface Disturbance (acres)	Proposed Gas Sales Pipeline Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative		
				Alternative A	Alternatives B, C, and D	Alternative E
Crucial Winter Range SRMZ	1,609.0	1,577.3	136.6	4,583.6	6,842.2	6,941.2
Spring/Summer/Fall Range	5,985.7	3,257.3	289.7	12,395.1	18,899.0	16,341.4
Winter Range	44.3	0.0	0.0	44.3	44.3	44.3
Total	**7,639.0**	**4,834.6**	**426.3**	**17,023.0**	**25,785.5**	**23,326.9**

Mule deer habitats in the region have been affected by various past management practices and changes in land use including fire suppression, livestock grazing, residential proliferation, barriers to migration, and habitat access (Lutz et al., 2003). Similar to effects on pronghorn, human development within the Sublette Herd Unit has affected mule deer migrations and access to seasonally used ranges, including seasonal ranges in the PAPA (Sawyer et al., 2005b).

Development not associated with wellfield activities has affected 7,639.0 acres of seasonal habitats utilized by mule deer in the PAPA (Table 4.20-8) including disturbance associated with agriculture, residences, roads, urban infrastructure, and livestock facilities. Wellfield-related developments in the PAPA have disturbed an additional 2,480.2 acres in mule deer seasonal habitats. Implementation of any of the Alternatives is expected to increase the cumulative loss of mule deer habitats by several thousand acres (Table 4.20-8).

Table 4.20-8
Cumulative Surface Disturbance in Relation to Mule Deer Seasonal Ranges by Alternative

Mule Deer Seasonal Ranges	Existing Non Wellfield Disturbance (acres)	Total Existing Surface Disturbance (acres)	Proposed Gas Sales Pipeline Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative		
				Alternative A	Alternatives B, C, and D	Alternative E
Crucial Winter Range SRMZ	1,423.9	1,459.1	0.0	4,057.6	7,476.3	5,168.6
Spring/Summer/Fall Range	4,433.0	7.7	0.0	4,445.7	4,457.4	4,456.2
Winter Range	861.2	998.8	76.5	2,803.5	4,258.8	4,139.4
Winter/Yearlong Range	672.1	14.6	349.8	1,036.5	1,040.6	1,041.5
Total	**7,639.0**	**2,480.2**	**426.3**	**12,592.1**	**17,481.9**	**15,054.5**

Crucial winter/yearlong ranges in the PAPA utilized by moose in the Sublette Herd Unit are affected by 1,195 acres of surface disturbance, mostly associated with agriculture, residences, and roads unassociated with wellfield development. Existing wellfield development disturbed another 252 acres of crucial moose habitat.

Upland Game Birds. Throughout their range, greater sage-grouse have been adversely affected by habitat loss due to agriculture, energy development, rural and urban housing, and roads, as well as by habitat fragmentation from fences and powerlines (Braun, 1998). Oil and gas development, and associated infrastructure, have affected large expanses of sagebrush vegetation that support greater sage-grouse populations (Braun et al., 2002). Changes in land uses have affected sagebrush steppe vegetation in the greater sage-grouse CIAA and in the PAPA. Cumulative impact to sagebrush by the Alternatives is expected to be substantial (Section 4.16.3.5).

Past human-related activities in the PAPA, unassociated with wellfield development, within various distances to greater sage-grouse leks have been relatively modest. Only 5.4 acres have been disturbed within 0.25 mile of all leks, combined and 725.3 acres were disturbed within 2 miles of all leks by non-wellfield actions through 2006 (Table 4.20-9). There is considerable surface disturbance associated with existing wellfield development in the PAPA, especially within 2 miles of leks (Table 4.20-9). Surface disturbance and wellfield development activities contribute to declines of greater sage-grouse in the PAPA (Section 4.20.3.1). Cumulative surface disturbance within 2-mile buffers of greater sage-grouse leks would increase substantially with implementation of any of the Alternatives (Table 4.20-9).

Table 4.20-9
Cumulative Surface Disturbance to Greater Sage-Grouse Lek Buffers by Alternative

Greater Sage-Grouse Lek Buffer	Existing Non Wellfield Disturbance (acres)	Total Existing Surface Disturbance (acres)	Proposed Gas Sales Pipeline Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative		
				Alternative A	Alternatives B, C, and D	Alternative E
0.25-Mile Buffer	5.4	20.4	0.0	25.8	25.8	25.8
2-Mile Buffer and Sage Grouse SRMZ	725.3	3,626.8	296.7	7,809.9	14,471.4	12,777.2

Other Wildlife. Cumulative actions described in this section affect migratory birds (including raptors), small game mammals, furbearers, and nongame wildlife. Although monitoring efforts focused on some of these wildlife species have not revealed any effects by current wellfield development, there are no predevelopment data to compare against the monitoring data. Species' populations in the PAPA are expected to decline, with fewer unaffected habitats available, based on projected levels of development for each Alternative.

Aquatic Resources. No data is available to address the potential impacts to fisheries in the New Fork and Green rivers due to surface disturbance activities that remove riparian vegetation or cause erosion and sediment transport on slopes. Existing disturbance within riparian zones, unassociated with wellfield development, is primarily associated with agriculture that limits erosion as sediment transport into aquatic habitats. Bare ground from unreclaimed wellfield development does not prevent such erosion. Increased surface disturbance caused by wellfield development in the PAPA could increase cumulative sedimentation and may adversely affect fisheries in both rivers (Section 4.14.3.5). Coldwater fisheries in the rivers could be cumulatively affected by increased sedimentation and other adverse factors such as declining dissolved oxygen concentrations and algal blooms that have been detected in Fontenelle Reservoir (Section 3.16.1.2).

4.20.5 Wildlife and Aquatic Resources Additional Mitigation Opportunities

Wildlife and Aquatic Resources Mitigation Measure 1. The liquids gathering system could be installed and used throughout the PAPA to reduce production-related impacts.

Wildlife and Aquatic Resources Mitigation Measure 2. Access during winter could be limited to either the Boulder South Road or South Anticline Road.

Wildlife and Aquatic Resources Mitigation Measure 3. Operators could be required to use computer-assisted monitoring at all producing well locations to reduce production-related impacts.

Wildlife and Aquatic Resources Mitigation Measure 4. BLM could require the use of scientific peer-reviewed papers for mitigation decisions for wildlife.

Wildlife and Aquatic Resources Mitigation Measure 5. BLM could require Operators to enhance or rehabilitate wildlife habitat that was important and used historically by wildlife in the PAPA, but has been reduced, degraded, or eliminated due to development in the PAPA.

Wildlife and Aquatic Resources Mitigation Measure 6. BLM, Operators, and other willing participants could provide outreach and incentives to private landowners to conserve wildlife and use wildlife friendly grazing regimes.

Wildlife and Aquatic Resources Mitigation Measure 7. Willing participants could create and fund incentives to assist landowners in constructing/erecting wildlife friendly fencing, either new or replace old “non-wildlife friendly” fencing.

Wildlife and Aquatic Resources Mitigation Measure 8. Pipeline crossings and surface disturbing activities through ephemeral drainages and in basin Wyoming and big sagebrush could be avoided.

Wildlife and Aquatic Resources Mitigation Measure 9. Seasonal habitats for species such as greater sage-grouse, migratory and sagebrush obligate birds, and pygmy rabbits could be inventoried to determine potential on-and off-site mitigation opportunities and avoidance areas.

4.21 HAZARDOUS MATERIALS

4.21.1 Scoping Issues

There are no scoping concerns related to hazardous materials.

4.21.2 Impacts Considered in the PAPA DEIS

The PAPA DEIS (BLM, 1999a) did not address hazardous materials.

4.21.3 Alternative Impacts

The same hazardous materials are expected to be present in the PAPA under each of the Alternatives. Hazardous materials that have been identified by the Proponents and which are expected in the PAPA some time during the life of the project are provided in Appendix 12. There are requirements for reporting quantities under 40 CFR § 355 - Emergency Planning and Notification under the Comprehensive Environmental Response, Compensation and Liability Act (CERLA) of 1980. In particular, acrylamide is listed as an Extremely Hazardous Substance utilized in drilling materials, cementing and plugging materials. Appendix A to 40 CFR § 355 requires that users must report 5,000 pounds of acrylamide (1,000 pounds the minimum threshold planning quantity) to state/federal officials. Acrylamide is primarily used to synthesize polyacrylamide, water-soluble thickeners such as those used in drilling materials. There is evidence that exposure to large doses can cause damage to the male reproductive glands. Direct exposure to pure acrylamide by inhalation, skin absorption, or eye contact irritates the exposed mucous membranes. In addition, the acrylamide monomer is a potent neurotoxin (Merck, 2001).

4.21.4 Cumulative Impacts

Impacts from hazardous materials could result from accidental spills of hazardous materials, pipeline ruptures, and/or exposure to hazardous materials but events would be localized. Proper containment of oil and fuel in storage areas, containment of fluids in reserve pits, appropriate pipeline design and construction, proper well casing and cementing, and location of wells away from drainages would prevent potential surface water and groundwater contamination.

All existing, proposed, and future development projects in the PAPA and similar projects elsewhere in the region would apply mandatory mitigation measures similar to those described in Appendix 12 to prevent pollution and exposure to hazardous materials. Cumulative impacts are not expected to be significant.

4.21.5 Hazardous Materials Additional Mitigation Opportunities

No additional mitigation measures have been identified.

Chapter 5
Consultation and Coordination

5.1 LIST OF PREPARERS AND PARTICIPANTS

The list of preparers and participants, including BLM Interdisciplinary Team members and cooperating State of Wyoming and Sublette County personnel, is presented in Table 5.1-1.

Table 5.1-1
List of Preparers and Participants

Name	SEIS Responsibility
BLM Interdisciplinary Team	
Denver Regional Office	
Craig Nicholls	Air Quality and Climate
Paul Summers	Water and Soil Resources
Wyoming State Office	
Roy Allen	Socioeconomics
Susan Caplan	Air Quality and Climate
Dale Hansen	Regional Paleontologist
Ken Peacock	State Office Project Management
Dave Roberts	Wildlife and T&E Wildlife
Rick Schuler	Water Resources
John Zachariassen	Air Quality and Climate
Pinedale Field Office	
Matt Anderson	Project Management and NEPA
J.D. (Sam) Drucker	Paleontology
Merry Gamper	Supervisory Natural Resource Specialist
Caleb Hiner	Project Management & NEPA
Kirk Hoover	Natural Resource Specialist and Reclamation
Martin Hudson	Recreation, Noise and Visual
Bill Lanning	Associate Field Manager
Steve Laster	Vegetation and T&E
Chuck Otto	Acting Pinedale Field Office Manager
Karen Rogers	GIS Coordination and Maps
Summer Schultz	Rangeland, Vegetation, Invasive Nonnative Species
Pauline Schutte	Wildlife and T&E Wildlife
Lisa Solberg	T&E Wildlife
Stephanie Smith	Wildlife and T&E Wildlife
Dennis Stenger	Pinedale Field Office Manager
Dave Vlcek	Cultural and Historic Resources
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Vern Stelter	Wildlife
Mark Thiesse	Groundwater
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Betty Fear	Representative for Sublette County Commissioners
Edge Environmental, Inc.	
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Nichole Gagnon	Transportation, Document Editing
Kelley Gove	Socioeconomics
Carolyn Last	Document Review
Rosalie Massoth	Document Preparation
Josh Moro	Cultural, Grazing and Soils
Melissa Pros	Document Editing
Archie Reeve	Project Management, Wildlife, T&E, Noise, Vegetation, Wetlands, Transportation and Hazardous Materials
Aimee Thomas	Document Preparation
Joe Thomas	GIS Coordinator
Amy Thurow	Socioeconomics, Recreation, Flood Plains and Environmental Justice
Norwest Applied Hydrology	
Terry Gulliver	Surface Water, Groundwater, Geology, and Paleontology
French Creek Consulting	
Roger Coupal	Socioeconomics
Tom Foulke	Socioeconomics
David Taylor	Socioeconomics
Petros Environmental	
Richard Bell	Pipeline Corridors & Sales Pipelines
Chris Gayer	Wildlife & T&E
Sage Environmental Consulting	
Susan Connell	Air Quality and Climate
Brian Mitchell	Air Quality and Climate
Jim Zapert	Air Quality and Climate
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Sandra Goodman	Socioeconomics
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Ralph Morris	Air Quality Modeling

5.2 PERSONS CONTACTED OR CONSULTED

Persons contacted or consulted during preparation of the Draft SEIS, the Revised Draft SEIS and the Final SEIS and scoping respondents are listed in Table 5.1-2. Table 5.1-2 also lists the names and affiliations (if known) of those who submitted written comments during the scoping comment period from October 21, 2005 through November 20, 2005 and from April 14, 2006 through May 17, 2006.

Table 5.1-2
Persons Contacted or Consulted during Preparation of the SEIS and Scoping Respondents

Agency/Organization	Individual
Alpine Geophysics, LLC	Dennis McNally
Anadarko E&P Company LP	Patrick M. Navratil
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Anschutz Pinedale Corporation	Keith Bonati
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	David Thayer
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Devon Energy Corporation	Linda Guthrie
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Gene R. George & Associates	Gene George
Greater Yellowstone Coalition	Craig Kenworthy
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Mountaintop Consulting	Robin Smith
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	John Keck
	John Reber
National Resource Conservation Service	Ruben Vasquez
National Wildlife Federation	Kathleen C. Zimmerman
Petroleum Association of Wyoming	Ericka Cook
Point Reyes Bird Observatory	Aaron Holmes
Pinedale Volunteer Fire Department	Alvin Mitchell
Public Lands Advocacy	Claire Moseley
Questar Gas Management	Jimmy Druce
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	Peter Guernsey

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South Lincoln Medical Center	Jennifer Moffet
Southwest Counseling Service	Laura Schmid
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State of Wyoming – Office of State Lands	Lynne Boomgaarden
State of Wyoming – State Geologic Survey	Joan Binder
State of Wyoming – Governor's Office	Governor Dave Freudenthal
State of Wyoming – WDEQ-AQD	Cynthia Madison
State of Wyoming – WDEQ-AQD	Ken Rairigh
Stop Drilling-Save the Bridger-Teton	Glenn Paulson
Stone Energy	Tracy Opp
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Sublette County School District #9	Amy Anschutz
Sublette County Assessor	J.L. Montgomery
Sublette County Conservation District	Carrie Hatch
	Kathy Raper
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Sublette County Government	Janet Montgomery
Sublette County Rural Health Care District	T. McGinnis
Sublette County Sheriff's Office	Bob Hanson
Sublette County Weed and Pest	Adrianne Peterson
Sublette Socioeconomic Analysis Advisory Committee	Jeffrey Jacquet
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Wyoming Oil and Gas Conservation Commission	Don Likwartz
Wyoming Outdoor Council	Bruce Pendery
	Meredith Taylor
Wyoming Wildlife Consultants LLC	John Dahlke
	Matt Holloran
Wyoming Wildlife Federation	Ben Lamb
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Anne Blamaceda	Citizen
Jim Bond	Citizen
Dr. John P. Bryant	Citizen
Peggy Bryant	Citizen
Jamie Burgess	Citizen
Linda J. Cooper	Citizen
Julie Degraffenreid	Citizen
Eugene Decker	Citizen

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Betty Fear	Citizen
Evangelos C. Germeles	Citizen
Elizabeth Greenwood	Citizen
Paul Hagenstein	Citizen
Hall	Citizen
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J. Thomas Johnston, M.D.	Citizen
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Bob Laybourn	Citizen
Richard LaBrecque	Citizen
David A. Lien	Citizen
John Linn	Citizen
John Martin	Citizen
Bob McCarty	Citizen
Ken Meade	Citizen
Charles E. Nye	Citizen
Katherine Oberhardt	Citizen
Loren Racich	Citizen
Steve and Judy Raridan	Citizen
Barry Reiswig	Citizen
Nancy Reno	Citizen
Fred Sanchez	Citizen
Rose Sanchez	Citizen
Sylovia Mocroft Sandoval	Citizen
David Shipek and Melissa DeFoor	Citizen
Rose Skinner	Citizen
Albert Sommers	Citizen
Jonita Sommers	Citizen
Antone Spar	Citizen
Rollin D. Sparrowe	Citizen
Jeff Stinson	Citizen
Jerry E. Tully	Citizen
Steve Yenko	Citizen

Chapter 6
References

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Chapter 7
Glossary

abandon: To cease producing oil or gas from a well when it becomes unprofitable. Usually, some of the casing is removed and salvaged, and one or more cement plugs are placed in the bore hole to prevent migration of fluids between formations.

acre-foot or acre-feet (acre-ft): The volume of water that covers an area of 1 acre to a depth of 1 foot (43,560 cubic feet or 325,851 gallons).

active nest: An active eagle nest is one that has been occupied once in the past 5 years.

ad valorem: Tax levied according to assessed value.

affected environment: A section in an environmental assessment or environmental impact statement that succinctly describes the environment of the area to be affected by the alternatives (Council on Environmental Quality Regulations - 40 CFR §1502.15).

air quality: The properties and degree of purity of air to which people and natural and heritage resources are exposed.

alkaline: Condition of a solution or soil when its pH is above 7.0.

allotment: An area of land where one or more permittees graze their livestock. Generally consists of public land but may include parcels of private or state lands. The number of livestock and season of use are stipulated for each allotment. An allotment may consist of several pastures or only one pasture.

alluvium: Clay, silt, sand, and gravel or other rock material transported by flowing water and deposited as sorted or semi-sorted sediments. Flood and stream deposits of recent time.

alternate fuels: Fuels that are substantially non-petroleum and yield energy security and environmental benefits. As defined by the Energy Policy Act of 1993, the Department of Energy currently recognizes the following as alternative fuels: mixtures containing 85% or more by volume of alcohol fuel, including methanol and denatured ethanol; natural gas (compressed or liquefied); liquefied petroleum gas (propane); hydrogen; coal-derived liquid fuels, fuels derived from biological materials; electricity (including electricity from solar energy); 100% biodiesel (B100).

ambient: The environment as it exists at the point of measurement and against which changes or impacts are measured.

ambient air: The portion of the atmosphere, external to buildings, to which the public has general access (National Ambient Air Quality Standards - 40 CFR § 50).

ambient concentration: The mass of a pollutant in a given volume of air, typically measured as micrograms of pollutant per cubic meter of air.

ancillary facilities: Facilities often required in an oil and gas field other than the wells and pipelines, such as compressor stations.

animal unit month (AUM): The amount of forage necessary to sustain one cow/calf pair for 1 month.

anticline: A geological formation described usually as a dome or inverted saucer. If covered by an impermeable layer of rock, the anticline is a potential oil or gas reservoir.

anticline crest: A fold with strata folding downward on both sides from a common ridge. The area where most of the development would occur in the PAPA.

Application for Permit to Drill (APD): The Department of Interior's application permit form to authorize oil and gas drilling activities on federal land or mineral estate.

aquifer: A water-bearing bed or layer of permeable rock, sand, or gravel capable of yielding water.

archaeological: The scientific studies of past people and cultures by analysis of physical remains (artifacts).

background concentration: The existing levels of air pollutant concentration in a given region. In general, it includes natural and existing emission sources but not future emission sources.

berm: A raised area with vertical or sloping sides.

best available control technology (BACT): It is an emission limitation that considers the cost of energy, environment, and economics in developing a degree of emission reduction that is achievable through application of good production processes, control systems, and techniques. BACT is determined on a case-by-case basis and is applied to each pollutant regulated under the Federal Clean Air Act.

calcareous: Containing calcium carbonate.

CALMET: A diagnostic three-dimensional meteorological model.

CALPUFF: An advanced non-steady-state meteorological and air quality modeling system.

casing: Steel pipe placed in an oil or gas well to prevent the hole from collapsing.

categorical exclusions: A category of project actions, which a federal agency identifies in its NEPA procedures that do not individually or cumulatively have a significant effect on the environment (Council on Environmental Quality Regulations - 40 CFR § 1508.4).

cement: Cement is used to "set" casing in the well bore and to seal off unproductive formations and apertures.

central gathering facility: A facility centrally located that collects condensate and produced water from more than one well pad.

collector roads: BLM roads that provide primary access to large blocks of land and connect with, or are extensions of, a public road system.

colluvium: A general term applied to loose and incoherent deposits, usually at the foot of a slope or cliff and brought there chiefly by gravity including talus and cliff debris.

completion: The activities and methods to prepare a well for production. Includes installation of equipment for production from an oil or gas well.

compression: The ratio of the volume of an engine's cylinder at the beginning of the compression to its volume at the end of the compression process.

compressor station: A facility consisting of many compressors, auxiliary treatment equipment and pipeline installations to pump natural gas under pressure over long distances.

condensate (gas condensate): Hydrocarbons (oil) contained in the natural gas stream, often removed by condensation.

conditions of approval (COAs): A set of restrictions, or conditions, included in the approval of a federal permit, including NEPA documents.

conglomerate: Rounded water-worn fragments of rock or pebbles cemented together by another mineral substance.

corridor: A narrow strip of land.

Council on Environmental Quality (CEQ): An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

criteria pollutants: Air pollutants for which the EPA has established state and national ambient air quality standards. These include particulate matter (PM), nitrogen oxides (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), and volatile organic compounds (VOCs).

crucial winter range: A vital winter habitat that directly limits a community, population, or subpopulation and restoration or replacement may not be possible by WGFD management.

crude petroleum: Either the direct or indirect liquid hydrocarbon product of natural gas production.

cultural resources: The physical remains of human activity (artifacts, ruins, burial mounds, petroglyphs, etc.) and the conceptual content or context (as a setting for legendary, historic, or prehistoric events, such as a sacred area of native peoples, etc.) of an area of prehistoric or historic occupation.

culvert: A drain or conduit often under a road.

cumulative impact: The impact on the environment that 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 (Council on Environmental Quality Regulations - 40 CFR § 1508.7).

cuttings: The material removed from the bore hole by the drill bit and lifted to the surface.

decibel: A unit of measurement of noise intensity. The measurements are based on the energy of the sound waves and units are logarithmic. Changes of 5 decibels or more are normally discernible to the human ear.

deciduous: Trees or shrubs that lose their leaves each year during a cold or dry season.

deciview: The unit of measurement of haze developed to uniformly describe levels of monitored and modeled visibility impairment.

direct impacts: Impacts that are caused by an action and occur at the same time and place as the action.

directional drilling: The intentional deviation of a wellbore from vertical to reach subsurface areas off to one side from the surface drilling site.

dispersion: The spreading out of pollutants. Generally used to show how much an air pollutant will spread from a particular point.

displacement: As applied to wildlife, forced shifts in the patterns of wildlife use, either in location or timing of use.

disposal well: A well into which produced water from other wells is injected into an underground formation for disposal.

dissolved solids: The total amount of dissolved material, organic and inorganic, contained in water or wastes.

diversity: The distribution and abundance of different plant and animal communities and species.

drainage: Natural channel through which water flows some time of the year. Natural and artificial means for effecting discharge of water as by a system of surface and subsurface passages.

drilling rig: The mast, draw works, and attendant surface equipment of a drilling unit.

drought: Prolonged dry weather (precipitation less than 75% of average annual amount).

ecosystem: An interacting system of organisms considered together with their environment (e.g., forest, marsh, and stream ecosystems).

emergent vegetation: Erect, rooted, herbaceous plants that project out of or emerge from the water.

emission: Air pollution discharge into the atmosphere, usually specified by mass per unit time.

endangered species (animal): Any animal species in danger of extinction throughout all or a significant portion of its range.

endangered species (plant): Species of plants in danger of extinction throughout all or a significant portion of their ranges.

environment: The aggregate of physical, biological, economic, and social factors affecting organisms in an area.

environmental assessment (EA): A concise public document that analyzes the environmental impacts of a proposed federal action and provides sufficient evidence to determine the level of significance of the impacts (Council on Environmental Quality Regulations - 40 CFR § 1508.7).

environmental impact statement (EIS): A detailed written analysis of alternative actions and their predictable environmental impacts, including physical, biological, economic, and social consequences and their interactions; short-and long-term impacts; and direct, indirect, and cumulative impacts as required by Section 102(2)(c) of the National Environmental Policy Act.

Eocene: 1) The next to the oldest of the five major epochs of the Tertiary Period in the Cenozoic Era lasting from about 54.8 to 33.7 million years ago. 2) The series of strata deposited during that epoch.

eolian (aeolian): erosion and deposition accomplished by the wind.

epicenter: The portion of the earth's surface directly above the focus of an earthquake.

erosion: The removal, detachment, and entrainment of earth materials by weathering, dissolution, abrasion, and corrosion, later to be transported by moving water, wind, gravity, or glaciers.

fault: A fracture in bedrock along which there has been vertical and/or horizontal movement caused by differential forces in the earth's crust.

federal lands: All lands and interests in lands owned by the U.S., which are subject to the mineral leasing laws, including mineral resources or mineral estates reserved to the U.S. in the conveyance of a surface or non-mineral estate.

field: 1) A set of rocks containing hydrocarbons. 2) An oil and gas reservoir.

flare: Process that burns and evacuates unused gases.

flood plain: That portion of a river valley, adjacent to the channel, which is built of recently deposited sediments and is covered with water when the river overflows its banks at flood stages.

fluvial: Of or pertaining to rivers or streams.

forage: Vegetation of all forms available for animal consumption.

forb: A broad-leafed flowering herb other than grass.

formation: A rock/mineral deposit or structure covering an area with the same physical properties.

fracing (fracturing): A method of stimulating well production by increasing the permeability of the producing formation. Under extremely high hydraulic pressure, the fracturing fluid (water, oil, dilute hydrochloric acid, or other fluid) is pumped into the formation that parts or fractures it. Proppants or propping agents such as sand or glass beads are pumped into the formation as part of the fracturing job. The proppants become wedged in the open fractures, leaving channels for oil or gas to flow into the well after the hydraulic fracture pressure is released. This process is often called a “frac job.” When high concentrations of acid are used, it may be called an “acid frac job.”

fugitive dust: Airborne particles emitted from any source other than through a controllable stack or vent.

gathering pipelines: Pipelines within a field that transport gas or oil from the well to a central production facility or to the point of sale.

groundwater: Water contained in the pore spaces of consolidated and unconsolidated material.

habitat: A specific set of physical conditions that surround a single species, a group of species, or a large community. In wildlife management, the major components of habitat are considered to be food, water, cover, and living space.

habitat function: The arrangement of habitat features and capability of those features to sustain species, population, and diversity of wildlife over time.

herd unit: A unique big game population inhabiting a specific area that is managed by the Wyoming Game and Fish Department.

horizontal directional drilling (HDD): drilling directionally at a well bore inclination angle exceeding 85 degrees. Technique used for placing pipelines under stream channels.

human environment: The factors that include but are not limited to biological, physical, social, economic, cultural, and aesthetic factors that interrelate to form the environment.

hydrocarbon: A compound formed from carbon and hydrogen, for example oil and gas.

hydrology: A science that deals with the properties, distribution, and circulation of surface and subsurface water.

hydrostatic testing: Testing of the integrity of a newly placed but uncovered pipeline for leaks. The pipeline is filled with water and pressurized to operating pressures, and the pipeline is visually inspected.

impacts: These include a) direct impacts, which are caused by the action and occur at the same time and place and b) indirect impacts, which are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect impacts may include growth-inducing impacts and other impacts related to induced changes in the pattern of land use, population density, or growth rate and related impacts on air and water and other natural systems, including ecosystems. Impacts include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Impacts may also include those resulting from actions which may have both beneficial and detrimental impacts, even if on balance the agency believes that the impact will be beneficial (Council on Environmental Quality Regulations - 40 CFR § 1508.8).

IMPLAN (Impact Analysis for Planning): The input-output model used to estimate economic effects by tracing the interrelationships between producers and consumers in an economy as measured by jobs and income.

impoundment: The accumulation of any form of water in a reservoir or other storage area.

increment: Incremental standards (prevention of significant deterioration [PSD]) are the maximum amounts of pollutants allowed above the baseline in regions of clean air.

indirect impacts: Impacts that are caused by an action and occur later in time, or at another location, yet are reasonably foreseeable in the future (Council on Environmental Quality Regulations - 40 CFR § 1508.8).

infiltration: The movement of water or some other liquid into the soil or rock through pores or other openings.

infrastructure: The basic framework or underlying foundation of a community including road networks, electric and gas distribution, water and sanitation services, and facilities.

interdisciplinary team (IDT): A group of BLM resource specialists and possibly those from cooperating agencies selected to work within the NEPA process in scoping, analysis, and document preparation.

interim reclamation: Temporary reclamation initiated to stabilize disturbed surfaces on well pads, roads, and pipelines prior to final reclamation.

intermittent stream: A stream or reach of a stream that is below the local water table for at least some part of the year and obtains its flow from both surface runoff and groundwater discharge.

key observation point (KOP): Established points from which view shed analyses and visibility assessments can be made, and are an element of the BLM's visual resource management guidelines. Typically located on hilltops, popular stopping points on roads and trails, or near sensitive cultural or Native American sites.

land use: The types of activities allowed or evolved on a parcel of land (e.g., mining, agriculture, timber production, residential, industrial).

landslide: A perceptible downhill sliding or falling of a mass of soil and rock lubricated by moisture or snow.

lead agency: The agency that has primary regulatory authority and responsibility for preparing the environmental impact statement.

lease: 1) A legal document that conveys to an operator the right to drill for oil and gas. 2) The tract of land on which a lease has been obtained, where producing wells and production equipment are located.

lease stipulation: A legal requirement, specifically a requirement that is part of the terms of a mineral lease. Some stipulations are standard on all federal leases. Other stipulations may be applied to the lease at the discretion of the surface management agency to protect valuable surface resources. Stipulations are supported by the NEPA process; without NEPA support, a stipulation cannot be added to the lease.

lek: A traditional courtship display attended by male greater sage-grouse in or adjacent to sagebrush-dominated habitat.

life-of-project (LOP): Begins with the first disturbance authorized under the ROD for this project and ends when all wells are plugged and abandoned and all surface disturbance (each disturbed site) meets the reclamation performance objectives.

lithic scatter: A surface scatter of cultural artifacts and debris that consists entirely of lithic (i.e., stone) tools and chipped stone debris. This is a common prehistoric site type that is contrasted to a cultural material scatter (which contains other or additional artifact types such as pottery or bone artifacts), or to a camp (which contains habitation features, such as hearths, storage features, or occupation features), or to other site types that contain different artifacts or features.

lithology: The description of the physical character of a rock as determined by eye or with a low-powered magnifier, based on color, structures, mineralogical components, and grain size.

loam: A mixture of sand, silt, and clay containing between 7% and 27% clay, 28% to 50% silt and less than 50% sand.

local roads: BLM roads that provide primary access to large blocks of land and connect with or are extensions of a public road system.

long-term impacts: For the purpose of this NEPA analysis, long-term impacts last for the life of the project or beyond.

management areas: Area with specific development restrictions and limitations for resource protection. Nine management areas, authorized by the PAPA ROD exist within the PAPA.

maximum concentration level: maximum concentration level for a constituent, defined in the Safe Drinking Water Act.

mesa: Broad, flat-topped hill rounded by cliffs and capped with a resistant rock layer.

migrate: To pass periodically from one region or climate to another.

mitigation: Avoiding the impact altogether by not taking a certain action or parts of an action; minimizing impacts by limiting the degree of magnitude of the action and its implementation; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and/or compensating for the impact by replacing or providing substitute resources or environments (Council on Environmental Quality Regulations - 40 CFR § 1508.20).

mitigation measures: Actions taken to reduce or minimize potential impacts to the environment.

modeling: A mathematical or physical representation of an observable situation. In air pollution control, models afford the ability to predict pollutant distribution or dispersion from identified sources for specified weather conditions.

Modified Mercalli (MM) Intensity Scale of 1931: A scale designed to describe the effects of an earthquake, at a given place, on natural features, on industrial installations, and on human beings.

monitor: To systematically and repeatedly watch, observe, or measure environmental conditions in order to track changes.

mud: Mud is drilling fluid that consists mainly of a mixture of water, or oil distillate, and “heavy” minerals such as bentonite or barites.

mud system: A system used to manage suspended mud in the well-drilling process.

National Ambient Air Quality Standards (NAAQS): The allowable concentrations of air pollutants in the air specified by the federal government. The air quality standards are divided into primary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public health) and secondary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public welfare from any unknown or expected adverse effects of air pollutants).

National Environmental Policy Act of 1969 (NEPA): The federal law established in 1969, which went into effect on January 1, 1970, that 1) established a national policy for the environment, 2) requires federal agencies to become aware of the environmental ramifications of their proposed actions, 3) requires full disclosure to the public of proposed federal actions and a mechanism for public input into the federal decision-making process, and 4) requires federal agencies to prepare an environmental impact statement for every major action that would significantly affect the quality of the human environment.

National Register of Historic Places: A list of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, and culture.

native species: Plants or animals that originated in the area in which they are found (i.e., they naturally occur in that area); with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

natural gas: Those hydrocarbons, other than oil and other than natural gas liquids separated from natural gas, that occur naturally in the gaseous phase in the reservoir and are produced and recovered at the wellhead in gaseous form.

No Action Alternative: The management direction, activities, outputs, and effects that are likely to exist in the future if the current plan would continue unchanged.

nonnative invasive species: Plant species that are introduced into an area in which they did not evolve, and in which they usually have few or no natural enemies to limit their reproduction and spread. These species can cause environmental harm by significantly changing ecosystem composition, structure, or processes, and can cause economic harm or harm to human health.

no surface occupancy (NSO): A stipulation in a lease that disallows any surface disturbance in the lease area at any time. Natural gas or oil from an NSO area, for instance, would have to be recovered by directional drilling.

Notice of Intent (NOI): A notice published in the Federal Register to announce the intent to prepare an EIS.

noxious weeds: Officially designated (State of Wyoming-designated, Sublette County-declared) undesirable or invading weedy species generally introduced into an area due to human activity.

off highway vehicle (OHV): is considered to be any type of vehicle which is capable of driving off any paved or gravel surface.

oil and gas lease: A federal oil and gas lease is a legal document that gives the lease holder the right to explore for and develop any oil and gas that may be present under the area designated in the lease while complying with any surface use conditions which may have been stipulated when the lease was issued.

operator: The company that (1) contracts to drill a well or (2) is responsible for maintaining a producing lease.

ozone (O_3): A molecule containing three oxygen atoms produced by passage of an electrical spark through air or oxygen (O_2).

paleontology: The science that deals with the history and evolution of life on earth.

particulate matter: A particle of soil or liquid matter (e.g., soot, dust, aerosols, fumes, and mist).

passerine: Passerines are the perching birds, and most are also songbirds.

perennial stream: A stream or reach of a stream that flows throughout the year.

permittee (grazing): A person who has livestock grazing privileges on an allotment or allotments within the resource area.

playa: The shallow central basin of a desert plain in which water gathers and is evaporated.

PM_{10}: Airborne suspended particles with an aerodynamic diameter of 10 microns or less.

$PM_{2.5}$: Airborne suspended particles with an aerodynamic diameter of 2.5 microns or less.

preferred alternative: The alternative identified in an EIS as the action favored by the responsible agency.

prevention of significant deterioration (PSD): A classification established to preserve, protect, and enhance the air quality in National Wilderness Preservation System areas in existence prior to August 1977 and other areas of national significance, while ensuring economic growth can occur in a manner consistent with the preservation of existing clean air resources.

PSD increments: The maximum allowable increase in pollutant concentrations permitted over baseline conditions as specified in the EPA Prevention of Significant Deterioration regulations (40 CFR § 52.21).

production: Phase of commercial operation of an oil field.

public land: Lands or interests in lands owned by the United States and in this case administered by the Secretary of Interior through the Bureau of Land Management, without regard to how the United States acquired ownership.

Quaternary: The latest period of time, from the present to 2 million years ago and represented by local accumulations of glacial and post-glacial deposits.

range: Land producing native forage for animal consumption and lands that are revegetated naturally or artificially to provide forage cover that is managed like native vegetation, that are amenable to certain range management principles or practices.

raptor: A group of carnivorous birds consisting of hawks, eagles, falcons, kites, vultures, and owls.

recharge: Replenishment of the water supply in an aquifer through the outcrop or along fracture lines.

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 it for use.

Record of Decision (ROD): A decision document for an EIS or Supplemental EIS that publicly and officially discloses the responsible official's decision regarding the actions proposed in the EIS and their implementation.

reserve pit: An excavated pit that may be lined with plastic that holds drill cuttings and waste mud.

reserves/recoverable reserves: Areas of mineral-bearing rock from which the mineral can be extracted profitably with existing technology and under present economic conditions.

Reservoir: The "pool" of oil or gas that is being tapped.

resource roads: Spur roads that provide point access, as to a well site, and connect to local or collector roads.

revegetation: The reestablishment and development of self-sustaining plant cover. On disturbed sites, human assistance will speed natural processes by seedbed preparation, reseeding, and mulching.

rig: A collective term to describe the equipment needed when drilling a well.

right-of-way (ROW): The legal right for use, occupancy, or access across land or water areas for a specified purpose or purposes. riparian: Land areas which are directly influenced by water. They usually have visible vegetative or physical characteristics showing this water influence. Streamsides and lake borders are typical riparian areas.

roosting: To rest or sleep in a roost. A bird will typically use the same roost for an extended period of time.

runoff: That part of precipitation that appears in surface streams. Precipitation that is not retained on the site where it falls and is not absorbed by the soil.

salinity: 1) A measure of the amount of mineral substances dissolved in water; 2) salty.

scatter (archeological): Archaeological evidence of prior disturbance that is distributed about an area rather than concentrated in a single location.

scope: Extent or range of view.

scoping: An early and open process for determining the scope of issues to be addressed in an EIS and for identifying the significant issues related to a proposed action. Scoping may involve public meetings, field interviews with representatives of agencies and interest groups, discussions with resource specialists and managers, and written comments in response to news releases, direct mailings, and articles about the proposed action and scoping meetings.

seasonal restriction: prohibits surface use by either a Condition of Approval or a lease stipulation during specified time periods to protect identified resource values. This restriction does not apply to the operation and maintenance of production facilities unless findings of analysis demonstrate the continued need for such mitigation and that less stringent project-specific mitigation would be insufficient.

sediment: Soil or mineral transported by moving water, wind, gravity, or glaciers, and deposited in streams or other bodies of water or on land.

sediment load: The amount of soils material transported by a stream or river.

sensitive resource management zones (SRMZs): an area that contains resources that require specific surface disturbance limitations, seasonal construction constraints, monitoring, or other actions to assure that undue impacts to the resource do not occur. SRMZs occupy distinct spatial areas and in many cases, SRMZs for a number of resources overlap.

seismic: Pertaining to an earthquake or earth vibration, including those that are artificially induced.

seismic geophysical survey: A petroleum exploration method in which sound energy is put into the earth with a source. The sound energy reflects off subsurface sedimentary rock layers and is recorded by detectors on the surface of the earth. An image of the subsurface rock layers is made with seismic to find petroleum traps.

sensitive viewshed: Viewsheds that are visible from communities, public use areas, and travel corridors, including roadways and waterways, and any other viewpoint so identified through referral or planning processes.

shale: A laminated sediment in which the constituent particles are predominantly of the clay grade.

short-term impacts: For the purpose of this analysis, short-term impacts are generally defined as those that would last for 5 years or less.

shut-in: The process of stopping production at an otherwise producing well.

significant impact: A meaningful standard to which an action may impact the environment. Impact significance may be related to the context of the impact (such as society as a whole (human, national), the affected region, the affected interests, and the locality) and/or the intensity (severity) of the impact (Council on Environmental Quality Regulations - 40 CFR § 1508.27).

silt Any earthy material composed of fine particles, smaller than sand but larger than clay, suspended in or deposited by water.

slope wash: Soil and rock material that is being or has been moved down a slope predominantly by the action of gravity assisted by running water that is not concentrated into channels.

socioeconomics: Study of an impact region on the current and projected population and relative demographic characteristics (housing, economy, government, etc.).

soil productivity: The capacity of a soil to produce a specific crop such as fiber and forage, under defined levels of management. It is generally dependent on available soil moisture, nutrients, and length of growing season.

spacing: The number of acres per given well in the subsurface. For instance, 160-acre spacing means that one well would be drilled in each quarter section (160 acres) or up to four wells per section (640 acres).

standard visual range (SVR): Farthest distance at which an observer can just see a black object viewed against the horizon sky. The larger the SVR, the cleaner the air.

strata: An identifiable layer of bedrock or sediment.

structural basin: A large depression of structural origin.

substrate: Material consisting of silts, sands, gravels, boulders, and/or woody debris found on the bottom of a stream channel.

supplemental environmental impact statement (SEIS): A supplement to either draft or final environmental impact statements prepared when 1) the agency makes substantial changes in the proposed action that are relevant to environmental concerns, and/or 2) there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts (Council on Environmental Quality Regulations - 40 CFR § 1502.9(c)).

surface disturbing activities: Any authorized action that disturbs vegetation and surface soil, increasing erosion potential above normal site conditions. This definition typically applies to mechanized or mechanical disturbance. However, intense or extensive use of hand or motorized hand tools may fall under this definition. Examples of surface disturbing activities include construction of well pads and roads, pits and reservoirs, pipelines and powerlines, mining, and vegetation treatments.

Term NSO leases: producing leases that would have no additional development.

Tertiary: The older of the two geologic periods comprising the Cenozoic Era; also the system of strata deposited during that period.

Tier 1-3 Standards. Federal EPA standards for new non-road (or off-road) diesel engines adopted in 1998 for engines over 37 kW (50 hp).

threatened species: Any species (plant or animal) that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Threatened species are identified by the Secretary of the Interior in accordance with the 1973 Endangered Species Act.

thrust fault: A low angle fault in which the rocks above the fault plane move up relative to the rocks below. The rocks that move up are the thrust sheet.

topography: The features of the earth, including relief, vegetation, and waters.

topsoil: The uppermost layers of naturally occurring soils suitable for use as a plant growth medium.

total dissolved solids (TDS): Total amount of dissolved material, organic or inorganic, contained in a sample of water.

total suspended solids (TSS): The weight of particles that are suspended in water. Suspended solids in water reduce light penetration in the water column, can clog the gills of fish and invertebrates, and are often associated with toxic contaminants because organics and metals tend to bind to particles.

turbidity: A measurement of the total suspended solids.

two-track: A road that has not been constructed or maintained but that has been created by repeated use.

understory: A layer of vegetation underlying a layer of taller vegetation, such as brush and grass under trees.

vegetation type: A plant community with visually distinguishable characteristics, named for the apparent dominant species.

viewshed: The areas seen from any given point.

visibility: Refers to the visual quality of the view or scene in daylight, with respect to color, rendition, and contrast definition. The ability to perceive form, color, and texture.

visual range: The distance at which a black object just disappears from view.

visual resource: The composite of basic terrain, geologic features, water features, vegetation patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for viewers.

Visual Resource Management (VRM): A system of visual management used by the BLM. The program has a dual purpose - to manage the quality of the visual environment, and to reduce the visual impact of development activities while maintaining effectiveness in all BLM resource programs.

water recharge: The natural process whereby surface water enters a groundwater aquifer.

watershed: The total land area that drains to a given watercourse or body of water.

well or wellbore: The hole drilled from the surface to the gas-bearing formation, several of which may be developed from a single well pad.

wellfield: Area containing one or more wells that produce usable amounts of water or oil.

wellhead: The forged or cast steel fitting on the top of a well.

well pad: Relatively flat work area (surface location) that is used for drilling a well or wells and producing from the well once it is completed.

wetlands: Areas that are inundated or saturated by surface water or groundwater with a frequency sufficient to support - and under normal circumstances do or would support - a prevalence of vegetation typically adapted for life in saturated soil conditions (EPA definition).

wilderness: A designated area defined in the Wilderness Act of 1964 in the following way: A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which – (a) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (b) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (c) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (d) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

winter range: The place where migratory (and sometimes non-migratory) animals congregate during the winter season.

Wyoming Ambient Air Quality Standards (WAAQS): The allowable concentrations of air pollutants in the air specified by the State of Wyoming. The air quality standards are divided into primary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public health) and secondary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public welfare from any unknown or expected adverse effects of air pollutants).

year-round development: Simultaneous construction, drilling, completion and production.

zone: The area between two depths in a well containing reservoir or other characteristic.