DECISION RECORD
Environmental Assessment (EA), WY-070-EA13-240
Devon Energy Corporation, Spruce 2 Plan of Development (POD)
Bureau of Land Management, Buffalo Field Office, Wyoming

DECISION. The BLM approves Devon Energy Corporation's (Devon) Spruce 2 POD with 5 oil and gas well applications for permit to drill (APD) from 4 pads as described in Alternative B of the environmental assessment, EA, WY-070-EA13-240. This approval includes the wells' support facilities.

Compliance. This decision complies with:

- Federal Land Policy and Management Act of 1976 (FLPMA) (43 USC 1701); DOI Order 3310.
- Mineral Leasing Act of 1920 (MLA) (30 U.S.C. 181); to include Onshore Order No. 1.
- National Environmental Policy Act of 1969 (NEPA) (42 USC 4321).
- National Historic Preservation Act of 1966 (NHPA) (16 USC 470).
- Buffalo Resource Management Plan (RMP) 1985, Amendments 2001, 2003, 2011.

BLM summarizes the details of the approval of Alternative B, below. The EA includes the project description, including specific changes made at the onsites, and site-specific mitigation measures.

Well List. BLM approves the following APDs and support facilities:

#	Well Name & #	Pad #	Qtr	Sec	Twn	Rng	Lease #
1	Iberlin Ranch Fed 074276-2FH	1	NENW	7	42N	76W	WYW147313
2	Iberlin Ranch Fed 084276-2FH	2	SESW	8	42N	76W	WYW147313
3	Iberlin Ranch Fed 184276-2FH	3	SESW	18	42N	76W	WYW147314
4	Iberlin Ranch Fed 194276-2FH		SESW	18	42N	76W	WYW147314
5	Iberlin Ranch Fed044176-1XFH	4	SESW	4	41N	76W	WYW147310

Limitations. There are no denials or deferrals. Also see the conditions of approval (COAs).

THE FINDING OF NO SIGNIFICANT IMPACT (FONSI). Analysis of Alternative B of the EA, WY-070-EA13-240 and the FONSI (both incorporated here by reference) found Devon's proposal for Spruce 2 POD will have no significant impacts on the human environment beyond those described in the Powder River Basin Final Environmental Impact Statement (PRB FEIS). There is no requirement for an EIS.

COMMENT OR NEW INFORMATION SUMMARY. BLM publically posted the proposed APDs for 30 days, received no comments, and then internally scoped them. BLM experience in the PRB (outside of the Fortification Creek Planning Area) revealed little public input or new issue discovery other than those revealed after public scoping during development of the PRB FEIS. New information regarding Greater Sage-Grouse (GSG) includes the receipt of the cooperative strategy for use of the density and disturbance calculation tool, WY Instruction Memorandum (IM) 2013-035.

DECISION RATIONALE. BLM bases the decision authorizing the selected project on:

1. BLM and Devon included mitigation measures such as centralized water pit location, use of existing oil and gas infrastructure and well pad citing to reduce environmental impacts while meeting the BLM's need. For a complete description of all site-specific COAs see the COAs.
2. The PRB FEIS analyzed and predicted that the PRB oil and gas development would have significant impacts to the region's GSG population. The impact of this development cumulatively contributes to the potential for local extirpation yet its effect is acceptable because it is outside priority habitats and

is within the parameters of the PRB FEIS and ROD and current BLM and Wyoming GSG conservation strategies.

3. Nesting habitat for BLM special status specie migratory birds will occur outside the breeding season or will receive a pre-disturbance clearance survey to reduce the likelihood of a "take" under the Migratory Bird Treaty Act.
4. Devon will conduct operations to minimize adverse effects to surface and subsurface resources, prevent unnecessary surface disturbance, and conform to currently available technology and practice.
5. The selected alternative will help meet the nation's energy needs, and help stimulate local economies by maintaining workforce stability.
6. Devon committed to:
   - Comply with the approved APD, applicable laws, regulations, orders, and notices to lessees.
   - Obtain necessary permits from agencies.
   - Offer water well agreements to the owners of record for permitted wells.
   - Incorporate several measures to alleviate resource impacts into their submitted surface use plan and drilling plan.
7. Devon certified it has a surface access agreement or posted a bond.
8. The operator provided the BLM a true and complete copy of a document in which the owner of the surface authorizes the operator to drill a federal well from non-federal lands, and in which the surface owner or representative guarantees the Department of the Interior (Department), including BLM, access to the non-federal lands to perform all necessary surveys and inspections. (See BLM WO Instruction Memorandum No. 2009-078, p. 2, para 6).
9. The project is clearly lacking in wilderness characteristics as there is no federal surface.
10. These APDs are pursuant to the Mineral Leasing Act for the purpose of exploring or developing oil or gas and do not satisfy the categorical exclusion directive of the Energy Policy Act of 2005, Section 390 because no site-specific analysis was completed that would cover the project area.

ADMINISTRATIVE REVIEW AND APPEAL. This decision is subject to administrative review according to 43 CFR 3165. Request for administrative review of this decision must include information required under 43 CFR 3165.3(b) (State Director Review), including all supporting documentation. Such a request must be filed in writing with the State Director, Bureau of Land Management, P.O. Box 1828, Cheyenne, Wyoming 82003, no later than 20 business days after this Decision Record is received or considered to have been received. Parties adversely affected by the State Director's decision may appeal that decision to the Interior Board of Land Appeals, as provided in 43 CFR 3165.4.

Field Manager: _____ Date: 7/30/13

FINDING OF NO SIGNIFICANT IMPACT
Environmental Assessment (EA), WY-070-EA13-240
Devon Energy Corporation, Spruce 2 Plan of Development (POD)
Bureau of Land Management, Buffalo Field Office, Wyoming

FINDING OF NO SIGNIFICANT IMPACT (FONSI). Based on the information in the EA, WY-070-EA13-240, which BLM incorporates here reference; I find that: (1) the implementation of Alternative B will not have significant environmental impacts beyond those addressed in the Buffalo Final Environmental Impact Statement (FEIS) 1985, and the Powder River Basin (PRB) FEIS, 2003 to which the EA tiers; (2) Alternative B conforms to the Buffalo Field Office (BFO) Resource Management Plan (RMP) (1985, 2001, 2003, 2011); and (3) Alternative B does not constitute a major federal action having a significant effect on the human environment. Thus an EIS is not required. I base this finding on consideration of the Council on Environmental Quality's (CEQ) criteria for significance (40 CFR 1508.27), with regard to the context and to the intensity of the impacts described in the EA, and Interior Department Order 3310.

CONTEXT. Mineral development is a common PRB land use, sourcing over 42% of the nation's coal. The PRB FEIS foreseeable development analyzed the development of 54,200 wells. The additional development analyzed in Alternative B is insignificant in the national, regional, and local context.

INTENSITY. The implementation of Alternative B will result in beneficial effects in the forms of energy and revenue production however; there will also be adverse effects to the environment. Design features and mitigation measures included in Alternative B will minimize adverse environmental effects. The preferred alternative does not pose a significant risk to public health and safety. The geographic area of project does not contain unique characteristics identified in the 1985 RMP, 2003 PRB FEIS, or other legislative or regulatory processes.

BLM used relevant scientific literature and professional expertise in preparing the EA. The scientific community is reasonably consistent with their conclusions on environmental effects relative to oil and gas development. Research findings on the nature of the environmental effects are not highly controversial, highly uncertain, or involve unique or unknown risks. The PRB FEIS predicted and analyzed oil development of the nature proposed with this project and similar projects. The selected alternative does not establish a precedent for future actions with significant effects. The proposal may relate to the PRB Greater Sage-Grouse and its habitat decline having cumulative significant impacts; yet the small size of this project is within the parameters of the impacts in the PRB FEIS. There are no cultural or historical resources present that will be adversely affected by the selected alternative. The project area is clearly lacking in wilderness characteristics AS there is no federal surface acreage. No species listed under the Endangered Species Act or their designated critical habitat will be adversely affected. The selected alternative will not have any anticipated effects that would threaten a violation of federal, state, or local law or requirements imposed for the protection of the environment.

ADMINISTRATIVE REVIEW AND APPEAL. This finding is subject to administrative review according to 43 CFR 3165. Request for administrative review of this finding must include information required under 43 CFR 3165.3(b) (State Director Review), including all supporting documentation. Such a request must be filed in writing with the State Director, Bureau of Land Management, P.O. Box 1828, Cheyenne, Wyoming 82003, no later than 20 business days after this FONSI is received or considered to have been received. Parties adversely affected by the State Director's finding may appeal that finding to the Interior Board of Land Appeals, as provided in 43 CFR 3165.4.

Field Manager: _____ Date: 7/30/13

ENVIRONMENTAL ASSESSMENT (EA), WY-070-EA13-240
Devon Energy Corporation, Spruce 2 Plan of Development (POD)
Bureau of Land Management, Buffalo Field Office, Wyoming

1. INTRODUCTION

BLM provides an environmental assessment (EA) for Devon Energy Corporation's (Devon) Spruce 2 POD (plan of development) 5 applications for permit to drill (APD) from 4 pads. This site-specific analysis tiers into the information and analysis in the Final Environmental Impact Statement and Proposed Plan Amendment for the Powder River Basin Oil and Gas Project (PRB FEIS), WY-070-02-065, 2003 and the PRB FEIS Record of Decision (ROD) pursuant to 40 CFR 1508.28 and 1502.21. One may review these documents at the BLM Buffalo Field Office (BFO) and on our website: http://www.blm.gov/wy/st/en/field_offices/Buffalo.html. The APDs are pursuant to the Mineral Leasing Act for the purpose of exploring or developing oil or gas. They do not satisfy the categorical exclusion directive of the Energy Policy Act of 2005, Section 390 because no site-specific analysis adequately covered the project area. BLM's jurisdiction is through spilt estate: fee surface over federal minerals.

Congress made a 4-part process for federal fluid mineral decisions under the long-term needs of multiple-use. First is the land use / resource management plan (RMP); here the PRB FEIS and ROD amendment to the BFO RMP. Second are the decisions of whether and, if so, under what conditions, to lease lands for fluid mineral development. Courts held leasing decisions are an almost irrevocable resource commitment. Third, (this phase) is deciding on the proposed POD or APD, or both: the site-specific analysis, and mitigation. Fourth is the monitoring and reclamation of wells and their features. (Pendery 2010)

1.1. Background

Devon submitted the Spruce 2 POD proposal on May 1, 2013 to the BFO to produce oil and natural gas from federally managed fluid mineral bearing formations of the PRB, on fee surface.

- November 14, 2012 - March 6, 2013, BLM received 5 notices of staking, posted, assigned, and conducted onsite visits, evaluating and modifying the proposal to minimize environmental impacts.
- May 1, 2013- Devon submitted the Spruce 2 POD to the BFO with 5 APDs
- May 23, 2013- BFO sent Devon deficiencies
- June 14-21, 2013- BFO received deficiencies

1.2. Need for the Proposed Project

BLM's need for this project is to determine whether, how, and under what conditions to support the Buffalo RMP goals, objectives, and management actions (2003 Amendment) with allowing the exercise of the operator's conditional lease rights to develop fluid minerals on federal leases. APD information is an integral part of this EA, which BLM incorporates here by reference (CFR 1502.21). Conditional fluid mineral development supports the RMP and the Mineral Leasing Act of 1920, the Federal Land Policy Management Act (FLPMA), and other laws and regulations.

1.3. Decision to be Made

The BLM will decide whether or not to approve the proposed development, and if so, under what terms and conditions agreeing with the Bureau's multiple use mandate, environmental protection, and RMP.

1.4. Scoping and Issues

BLM posted the APDs for 30 days and received no comments. BLM will timely post the EA on the BFO website. Previously BLM conducted extensive external scoping for the PRB FEIS - discussed on p. 2-1 of the PRB FEIS and on p. 15 of the PRB ROD. This project is similar in scope to other fluid mineral

development the BFO analyzed. External scoping is unlikely to identify new issues, as verified with fluid mineral EAs BLM recently externally scoped. External scoping of the horizontal drilling in Crazy Cat East EA, WY-070-EA13-034, 2013, in the PRB area received 3 comments, revealing no new issues.

The BFO interdisciplinary team (ID team) conducted internal scoping by reviewing the proposed development and project location to identify potentially affected resources and land uses. This EA will not discuss resources and land uses that are either not present, not affected, or that the PRB FEIS adequately addressed. The ID team identified important issues for the affected resources to focus the analysis. This EA addresses the project and its site-specific impacts that were unknown and unavailable for review at the time of the PRB FEIS analysis to help the decision maker come to a reasoned decision. Project issues include:

- Air quality
- Soils: site stability, reclamation potential, riparian and wetland communities, invasive species
- Water: ground water, quality, and quantity of produced water.
- Wildlife: raptor productivity, migratory birds, special status species

These issues are not present, or minimally so. BLM analyzed them in the PRB FEIS and not in this EA:

Geological resources	Recreation	Wilderness characteristics
Cave and karst resources	Heritage & Visual Resources	Livestock & grazing
Mineral resources: locatable, leasable-coal, salable	Paleontological resources	Areas of critical environmental concern
Fire, fuels management, and rehabilitation	Transportation & Access	Socio-economic resources
Forest Products	Tribal Treaty Rights	Environmental justice
Lands & Realty	Wilderness characteristics	

2. PROPOSED PROJECT AND ALTERNATIVES

2.1. Alternative A – No Action

The no action alternative would deny this APD requiring the operator to resubmit an APD that complies with statutes and the reasonable measures in the PRB RMP Record of Decision (ROD) in order to lawfully exercise conditional lease rights. The PRB FEIS considered a no action alternative, pp. 2-54 to 2-62. The BLM keeps the no action alternative current using the aggregated effects analysis approach – tiering to or incorporating by reference the analyses and developments approved by the subsequent NEPA analyses for adjacent and intermingled developments to the proposal area.

2.2. Alternative B Proposed Action

Overview. Devon Energy Corporation proposes drilling and developing 5 horizontal oil and gas wells into federal mineral estate from fee surface. The target formation is the Frontier with an approximate depth of 12,000 ft. The proposal is 37 miles north northwest of Wright, Campbell County, Wyoming. Iberlin Ranch owns the fee surface so it clearly lacks federal wilderness characteristics. The proposal requires the construction of 4 engineered (cut and fill) well pads. The total surface disturbance with these pads and access roads will be about 32 acres. Interim reclamation of well pads will restore 11 acres during the production phase (21 acres of the original surface disturbance remains). These figures include disturbance from the well pads, the spoil and topsoil storage areas, construction equipment, and vehicle disturbance. The access roads will be constructed to meet the standards of the anticipated traffic flow and all-weather requirements. Road construction will include ditching, draining, graveling, and crowning of the roadbed. See the drilling program with each APD for details on targeted zones, legal descriptions, surface, and bottom holes – summarized at Table 2.1, below.

Table 2.1. Well Name/#/Lease/Locations

#	Well Name & #	Pad #	Qtr	Sec	Twn	Rng	Lease #
1	Iberlin Ranch Fed 074276-2FH	1	NENW	7	42N	76W	WYW147313
2	Iberlin Ranch Fed 084276-2FH	2	SESW	8	42N	76W	WYW147313
3	Iberlin Ranch Fed 184276-2FH	3	SESW	18	42N	76W	WYW147314
4	Iberlin Ranch Fed 194276-2FH		SESW	18	42N	76W	WYW147314
5	Iberlin Ranch Fed 044176-1XFH	4	SESW	4	41N	76W	WYW147310

The proposal involves:

Activity	Length (feet)	Width (feet)	Acres of Disturbance	Interim Disturbance
074276-2FH constructed pad, including spoils/tank battery	510	350	6.5	2.5
Access Road	300	70	0.48	
Total Disturbance for this location			6.9	

NOTE: Length/Width represent working pad dimensions. Acres of disturbance represent the fenced in area of disturbance. For all locations an existing oil/gas road infrastructure (12' running surface) will be used for access. Improvements will be needed to upgrade the road to a 20' and 24' running surface (see MSUP for details). The well be drilled using a semi-closed loop system.

Activity	Length (feet)	Width (feet)	Acres of Disturbance	Interim Disturbance
084276-2FH constructed pad, including spoils/tank battery	510	350	8.6	3.1
Access Road	300	70	0.48	
Total Disturbance for this location			9.1	

NOTE: The well will be drilled using a reserve pit thus pit spoils and spoils from an extensive engineered pad have increased disturbed area.

Activity	Length (feet)	Width (feet)	Acres of Disturbance	Interim Disturbance
184276-2FH constructed pad including spoils/tank battery 194276-2FH (twin well pad)	803	350	6.8	2.5
Access Road	660	70	1.1	
Total Disturbance for this location			7.9	

NOTE: Well will be drilled using a reserve pit.

Activity	Length (feet)	Width (feet)	Acres of Disturbance	Interim Disturbance
044176-1XFH constructed pad including spoils/tank battery	510	350	6.7	2.9
Access Road	660	70	1.1	
Total Disturbance for this location			7.8	

NOTE: Well will be drilled using a reserve pit.

Activity	Acres of Disturbance
Spruce 2 Frac Pit 350'x350'	6.5
Iberlin Ranch Fed Frac Pit 250'x250'	3.8
Total Disturbance	10.3

Drilling, Construction and Production Design Features Include:

- Devon anticipates completing drilling and construction in 2 years. Drilling and construction is year-round in the PRB. Weather may cause delays rarely last multiple weeks. Timing limitations in the form of conditions of approval (COAs) and/or agreements with surface owners may impose longer temporal restrictions. Timeframes for drilling into the Frontier formation are approximately 45 days. The completion and placement of production infrastructure can be from 45-80 days.
- A road network consisting of existing improved roads.
- An existing above ground power line network with 4 proposed power drops.
- Potential production facilities for each well will consist of 6-400 bbl tanks, a separator/heater treater, a gas lift system and eventually a pumping unit with electric motor, vapor recovery unit (VRU) and possibly a gas separator. All tanks will be 20 feet tall and 12 feet in diameter. An impermeable dike/berm will surround these facilities.
- Fresh water used for drilling, cementing and completion work will be obtained from the West Pine Tree coalbed natural gas (CBNG) Field Fink Prong pipeline. This is existing infrastructure of buried waterlines and pump stations associated with Devon's CBNG wells in the area. This system will also supply water to 2 proposed hydraulic fracturing pits via proposed surface pipelines. Drilling and cementing operations require approximately 25,000 bbls per well, completion procedures will require approximately 80,000-100,000 bbls per well except for the Iberlin Ranch Fed 044176-1XFH this well is an extended reach lateral well with a proposed 2 miles of horizontal lateral. Thus an estimated 200,000 barrels of water will be required for completion purposes. Flowback water will be disposed in a Wyoming Department of Environmental Quality (WDEQ) permitted and authorized facilities (see p. 11 of Spruce 2 POD surface use plan (SUP).
- Devon estimates that during the drilling phase of each individual well (6 to 8 week period per well) the average daily traffic to and from the location is approximately 2 large trucks (water hauler, cement trucks, etc.) and 6 personal pickup trucks per day. During the well completion process (3 to 4 week period per well) the average daily traffic increases to 4 to 6 large trucks and 6 personal pickup trucks per day. During the production phase the average daily traffic will decrease to 1 to 2 pickup trucks per day.
- If the wells produce, Devon will store their produced water in tanks on the location and truck it off to a WDEQ approved Class I disposal well or evaporation facility. Specifics related to production and potential buried flow lines will be addressed by sundry action. Potential quantities of produced water are unknown at this time.

For a detailed description of design features and construction practices associated with the proposed project, refer to the SUP and drilling plan included with the APD. Also see the subject APD for maps showing the proposed well locations and associated facilities described above. BLM incorporated and analyzed the implementation of committed mitigation measures in the SUP and drilling plan, in addition to the COAs in the PRB FEIS ROD, as well as changes made at the onsite.

Additionally, Devon, in their APD, committed to:

1. Comply with the approved APD, applicable laws, regulations, orders, and notices to lessees.
2. Obtain necessary permits from agencies.
3. Offer water well agreements to the owners of record for permitted wells.
4. Incorporate several measures to alleviate resource impacts into their submitted surface use plan and drilling plan.

The reasonably foreseeable development (RFD) for this and adjacent areas includes oil/gas exploration on 640 acre spacing and possible 1280 acre spacing. (This does not preclude the RFD spacing analysis in the PRB FEIS or applying to drill multiple wells from these 4 pads further reducing the surface disturbance per well). Devon's RFD consists of 18 wells on 14 well pads on 9 federal leases, to the Frontier formation over the next 2-3 years. RFD may use existing well pads and infrastructure put in place for fee and/or

federal mineral development. Potential APD submittals could consist of multiple wells on an existing pad or tie into existing supporting infrastructure such as; tank batteries, pipelines, powerlines, and transportation networks. Additionally, Devon owns a significant amount of fee mineral leases in the surrounding area and could potentially drill adjacent federal leases in the spacing unit. BLM will evaluate future development and resource parameters in light of its multiple use mandate – highlighting similarities and distinction between any proposals, this EA, other analysis, and the RMP.

2.3. Conformance with the Land Use Plan and Other Environmental Assessments

This proposal does not diverge from the goals and objectives in the Buffalo Resource Management Plan (RMP), 1985, 2001, 2003, 2011, and generally conforms to the terms and conditions of that land use plan, its amendments, and supporting FEISs, 1985, 2003.

3. AFFECTED ENVIRONMENT

This section briefly describes the physical and regulatory environment that may be significantly affected by the alternatives in Section 2, or where changes in circumstances or regulations occurred since adoption of analyses to which the EA tiers or incorporates by reference. The PRB FEIS considered a no action alternative (pp. 2-54 to 2-62) in evaluating a development of up to 54,200 fluid mineral wells. Nearly all of the PRB's CBNG wells and over 60% of the deep oil and gas wells are hydraulically fractured; BLM and Goolsby 2012. The BLM uses the aggregated effects analysis approach incorporating by reference the circumstances and developments approved via the subsequent NEPA analyses for adjacent and intermingled developments coincident to proposal area to retain currency in the no action alternative. 615 F. 3d 1122 (9th Cir. 2010). There are 788 wells in the cumulative effects analysis area, Wyoming Oil and Gas Conservation Commission (WOGCC) 2013. The total number of conventional wells in the Buffalo planning area is 1313, which includes 783 horizontal wells (federal, fee, and state) (as of April 2013). This represents 41% of the projected 3,200 in the 2003 PRB ROD. (The current surface disturbance in the analysis area is about 100 acres.) This agrees with the PRB FEIS which analyzed the reasonably foreseeable development rolling across the PRB of 51,000 CBNG and 3,200 natural gas and oil wells. The State of Wyoming and BLM also approved wells that operators may develop in the near future. In addition, and other operators are likely to continue seeking permits to develop unconnected leases in or in the affects analysis areas near the project area; decisions to approve or deny future proposals will occur following APD submittal. Development occurring on non-federal surface and non-federal mineral estate would continue. A summary of the proposed disturbance is in Section 2, above.

BLM's position is there is a rare lack of surface disturbance impacts attributable to well type, subject to showing a distinction, not a mere difference. See, State Director Reviews WY-2010-023, Part 2, p. 3, and fn. 7, and 2013-005, pp. 2-3. This supports BLM and national policy in 43 CFR 3160 et seq, leasing, APD Form 3160-3, and 2005's Energy Policy Act (Kreckel 2007). The US Geological Survey noted there is only a remote chance of induced seismic activity from the nations hydraulic fracturing and water injection at volumes contemplated in the PRB.

BLM incorporates by reference the hydraulic fracturing analysis in Crazy Cat East EA, WY-070-EA13-028, Devon's Barlow Ranch Federal 074974-3NH, WY-070-EA12-173, and Federal 20 Mile 225174-2NH, WY-070-EA12-172. These projects use similar operations and are in the PRB analysis area.

Project Area Description

The Spruce 2 POD is incorporated in the Devon Pine Tree Unit which is in southwestern Campbell and southeastern Johnson Counties. The Pine Tree Unit encompasses 23,268 acres. The Spruce 2 POD area includes all or portions of sections 4 of T41NR76W and sections 6,-8,18,20,28,33 of T42N, R76W approximately 7.5 miles east of Linch, Johnson County, Wyoming.

Elevations within the area range from 4,700 to 5,340 feet above sea level. Topography consists of fairly flat, broad highlands to deep, steep-sided, broad-bottomed gully systems, particularly along Von Burg Draw, Hay Draw and Davis Draw and their tributaries. Rocky outcrops occur on ridge tops in the north and far west, and eroded embankments with exposed sandstone and bare soil exist in drainages throughout the project area. The climate is semi-arid, averaging 13.1 inches of precipitation annually, about 68% of which occurs between April and September. The 57-year mean maximum and minimum temperatures for July and January were 90°F and 12°F, respectively. A network of existing roads within the project area will be used to access wells in the Spruce 2 POD. These roads were constructed or improved to accommodate the existing fee and federal CBNG development and production. Land ownership in the project area consists of private, state, and federal surface. Existing land uses in the project area include livestock grazing, CBNG, development and conventional oil production.

3.1. Air Quality

The Wyoming Department of Environmental Quality (WDEQ) regulates air quality with oversight provided by the Environmental Protection Agency (EPA). Refer to the PRB FEIS pp. 3-291 to 3-299, for a 2003-era description of the air quality conditions. BLM incorporates by reference, Update of Task 3A Report for the Powder River Basin Coal Review Cumulative Air Quality Effects for 2020, BLM (AECOM), 2009, (Cumulative Air Quality Effects, 2009) as it captures the cumulative air quality effects of present and projected PRB fluid and solid mineral development. The EPA established ozone standards in 2008, finalizing them in 2011. Existing air quality in the PRB is "unclassified/attainment" with all ambient air quality standards. It is also in an area that is in prevention of significant deterioration zone. PRB air quality is a rising concern due to ozone in the oil and gas producing Upper Green River Basin that became 1 of the nation's 40 "nonattainment" zones for ozone in 2012; in addition to PRB-area air quality alerts issued in 2011and 2012 for particulate matter (PM), attributed to coal dust. Four sites monitor the air quality in the PRB: Cloud Peak in the Bighorn Mountains, Thunder Basin northeast of Gillette, Campbell County south of Gillette, and Gillette. In addition, the Wyoming Air Resource Monitoring System (WARMS) measures meteorological parameters from 6 sites, and particulate concentrations from 5 of those sites, monitors speciated aerosol (3 locations), and evapotranspiration rates (3 locations). These sites are at Sheridan, Taylor Reservoir, South Coal Reservoir, Buffalo, Juniper, and Newcastle. The northeast Wyoming visibility study is ongoing by the WDEQ. Sites adjacent to the Wyoming PRB-area are at Birney on the Tongue River 24 miles north of the Wyoming-Montana border, Broadus on the Powder River in Montana, and Devils Tower.

Existing air pollutant emission sources in the region include:

- Exhaust emissions (primarily CO and nitrogen oxides (NOx)) from existing natural gas fired compressor engines used in production of natural gas and CBNG; and, gasoline and diesel vehicle tailpipe emissions of combustion pollutants;
- PM (dust) generated by vehicle travel on unpaved roads, windblown dust from neighboring areas, road sanding during the winter months, coal mines, and trains;
- Transport of air pollutants from emission sources located outside the region;
- NOx, PM, and other emissions from diesel trains; and
- SO2 and NOx from power plants.

3.2. Soils and Vegetation

Ecological site descriptions provide soils and vegetation data for resource identification, management, and reclamation recommendations. Using the Natural Resource Conservation Service, (NRCS, USDA), Technical Guides for the Major Land Resource Area 58B Northern Rolling High Plains, in the 10-14 inch Northern Plains precipitation zone, verified through onsite field reconnaissance, the project area primarily consists of loamy ecological site (see Table 3.1 below). Refer to ecological site narrative sections below for description of vegetation species observed during onsite field visits. For detailed ecological site interpretations see Spruce 2 POD, Pre-Disturbance Reclamation Assessment.

Project area soils differ with topographic location, slope, and elevation. Topsoil depths to be salvaged for reclamation range from 0 to 4 inches. Erosion potential varies depending on the soil type, vegetative cover, and slope. Interpretations of soil modeling data show soils disturbed from construction of well pads, specifically cut and fill slopes, are highly susceptible to water and wind erosion. Reclamation potential of soils also varies in the project area. The area's main soil limitations include: depth to bedrock, low organic matter content, and high erosion potential especially in areas of steep slopes.

Detailed soils identification and data for the project area were obtained from the South Campbell County Survey Area, Wyoming Soil Survey Geographic (SSURGO) Database (WY605). The soil survey was performed by the Natural Resource Conservation Service (NRCS) according to National Cooperative Soil Survey standards. The BLM uses county soil survey information to predict soil behavior, limitations, or suitability for a given activity or action. Many of the soils and landforms of this area present distinct challenges for development, and /or eventual site reclamation.

Soils developed in alluvium and residuum derived mainly from the Wasatch Formation. Lithology consists of light to dark yellow and tan siltstone and sandstones with minor coal seams resulting in a wide variety of surface and subsurface textures. Soil depths vary from deep on lesser slopes to shallow and very shallow on steeper slopes. Differences in lithology produced topographic and geomorphic variations in the area. Ridges and hills are often protected by an erosion resistant cap of clinker, terrace gravels, or sandstone. Parent material chemistry may result in local concentration of salts. Table 3.1 is a tabulated summary of the dominant soil map units, and associated ecological site that the proposal would impact. Dominant ecological sites and plant communities identified in this POD and field verified are predominately loamy sites.

Loamy Sites: This site occurs on gently undulating to rolling land on landforms which include hill sides, alluvial fans, ridges and stream terraces, in the 10 to 14 inch precipitation zone. The soils of this site are moderately deep to deep (greater than 20 inches to bedrock), well drained soils that formed in alluvium and residuum derived from sandstone and shale. These soils have moderate permeability.

Table 3.1. Dominant Soils

Well Location	Map Unit Name	Ecological Site
Iberlin Ranch Fed 074276-2FH	Briggsdale-Renohill,3-4% slopes	Loamy
Iberlin Ranch Fed 084276-2FH	Hiland-Bowbac, 0-10% slopes	Sandy Loam
Iberlin Ranch Fed 184276-2FH	Briggsdale-Pugsley,4% slopes	Loamy
Iberlin Ranch Fed 194276-2FH	Same as above	
Iberlin Ranch Fed 044176-1XFH	Shingle-Worf, 3-30% slopes	Loamy

NOTE: area of analysis includes access (proposed, new disturbance) to well location

The Historic Climax Plant Community (HPCP) for this ecosite would be a Rhizomatous Wheatgrasses/Needleandthread/Blue Gramma Plant Community. Past management activities altered the project area. It is currently a crested wheatgrass pasture with downy brome, western wheatgrass, intermediate wheatgrass, and various forb components present. For further specific details pertaining to soils and vegetation, for each well pad, see the MSUP: Vegetative Analysis

3.3. Reclamation Suitability (Source Material)

BLM identified the reclamation potential of soils disturbed by well pad/access construction to be fair to good (See POD's Pre-Disturbance Reclamation Assessment, AR). The main project area reclamation limitations include: soil characteristics such as; depth to bedrock, low organic matter content, and grazing/livestock management.

3.4. Water Resources

WDEQ regulates Wyoming's water quality with oversight by the EPA per the Clean Water Act, 33 USC 1251 et seq. (1972). The Wyoming State Engineer's Office (WSEO) has authority for regulating water rights issues and permitting impoundments for the containment of the State's surface waters. The Wyoming Oil and Gas Conservation Commission (WOGCC) has authority for permitting and bonding off-channel pits located over state and fee minerals.

3.4.1. Groundwater

WSEO data identifies 5 permitted water wells (stock) within 1 mile of the proposed wells. These wells have an average depth of 218 feet, with minimum and maximum well depths of 19 and 839 feet, respectively. Depth to the Fox Hills formation, which is a documented water source, is over 5300 feet in this area. Refer to the PRB FEIS for additional information on groundwater, pp. 3-1 to 3-36.

3.4.2. Surface Water

The project area lies in tributaries to the Upper Powder River watershed. Most of the drainages in the area are ephemeral (flowing only in response to a precipitation event or snow melt). Some of the drainages, Davis Draw and Artesian Draw in particular, could be characterized as intermittent (flowing only at certain times of the year when it receives water from alluvial groundwater, springs, or other surface source – PRB FEIS Chapter 9 Glossary). The channels range from steep gullies to gentle, well vegetated grassy swales, without defined beds and banks. See the PRB FEIS for a surface water quality discussion, pp. 3-48 to 3-49, and for surface water, pp. 3-36 to 3-56.

3.5. Minerals – Leasables; Locatables; Salables

The project area is over and amidst uranium mineral leases with ongoing developement. The Fort Union Formation and the Wasatch Formation are the most important uranium-bearing formations in the PRB. These formations are at depths of less than 800 feet, while the depth of the formations for Devon's proposed wells are about 12,000 feet. Uranium recovery has surface disturbance for construction of roads, facilities, and well locations. These activities are similar to those required for oil and gas projects, including construction of surface facilities, access roads, well fields, utilities, and pipelines, as well as top soil removal, land grading, and interim reclamation. At this time there is no active uranium development occurring within the Spruce 2 area of development .

3.6. Wetlands/Riparian

There are no wetlands or riparian areas near the proposed well pads or infrastructure so the project should not impact wetlands or riparian areas.

3.7. Invasive and Noxious Species

The following state-listed noxious weed and/or weed specie of concern infestations were discovered by a search of inventory databases on the Wyoming Energy Resource Information Clearinghouse (WERIC) web site (www.weric.info): Scotch thistle (*Onopordum acanthium L.*).

The WERIC database was created cooperatively by the University of Wyoming, BLM and county Weed and Pest offices. Additionally, the operator inspected the Spruce 2 POD for noxious weeds, and confirmed isolated patches within the project area. The following is a list of State and County Designated Noxious Weeds that were encountered within Spruce 2 POD:

- Canada thistle (*Cirsium arvense L.*)
- Skeleton leaf bursage (*Franseria discolor Nutt.*)
- Spotted knapweed (*Centaurea maculosa Lam.*)
- Diffuse knapweed (*Centaurea diffusa Lam.*)

In addition, Campbell County Weed and Pest declared the following five species as weeds of concern within the Spruce 2 POD Area.

- Black henbane (*Hyoscyarnus niger L.*)
- Buffalobur (*Solanum rostratum Dun.*)
- Common cocklebur (*Xanthium strumarium L.*)
- Salt cedar (*Tamarix ramosissima Ledeb.*)
- Leafy spurge (*Euphorbia esula L.*)

Cheatgrass is prevalent throughout the project area.
The state-listed noxious weeds are listed in PRB FEIS, Table 3-21, p. 3-104; and the Weed Species of Concern are listed in Table 3-22, p. 3-105.

3.8. Fish and Wildlife

This section describes the affected environment and impacts to wildlife known or likely to occur in the area of the proposed project. The PRB FEIS identified wildlife species occurring in the PRB, pp. 3-113 to 3-206. ICF International performed wildlife surveys for the project on April 28 and June 21, 2013. The BLM biologist evaluated impacts to wildlife resources and recommended project modifications where wildlife issues arose. BLM wildlife biologists also consulted databases compiled and managed by BLM BFO wildlife staff, the PRB FEIS, WGFD datasets, and the Wyoming Natural Diversity Database (WYNDD) to evaluate the affected environment for wildlife species that may occur in the project area.

3.8.1. Non-Game

3.8.1.1. Raptors

The PRB FEIS discussed the affected environment for raptors, pp. 3-141 to 3-148. Most raptor species nest in a variety of habitats including (but not limited to): native and non-native grasslands, agricultural lands, live and dead trees, cliff faces, rock outcrops, and tree cavities. Suitable nesting habitat is present in the project area. According to the BLM raptor database, and ICF surveys, there are 3 raptor nest sites that have been active in the past 3 years within 0.5 miles of the project boundary (ICF 2013). Great-horned owl nest 3502 (active in 2012) is ¼ mile from the pump station; great-horned owl nest 6280 (active in 2012) and red-tailed hawk nest 11369 (active in 2012) are 0.4 and 0.3 miles respectively from 044176-1XFH. No nests were active in 2013.

3.8.1.2. Migratory Birds

The PRB FEIS discussed the affected environment for migratory birds on pp. 3-150 to 3-153. Migratory birds are birds that move long distances between breeding and winter habitats. The BLM-Fish and Wildlife Service (FWS) Memorandum of Understanding (MOU) (2010) promotes the conservation of migratory birds, complying with Executive Order 13186 (Federal Register V. 66, No. 11). Under the Migratory Bird Treaty Act (MBTA), BLM must include migratory birds in every NEPA analysis of actions that have potential to affect migratory bird species of concern. The MBTA (and Bald and Golden Eagle Protection Act (BGEPA)) are strict liability statutes that prohibit intentional or taking.

A wide variety of migratory birds may be found in the proposed project area at some time throughout the year. Many species that are of high management concern use shrub-steppe and shortgrass prairie areas for their primary breeding habitats (Saab and Rich 1997). Nationally, grassland and shrubland birds declined more consistently than any other ecological association of birds over the last 30 years (WGFD 2009). The WGFD Wyoming Bird Conservation Plan (Nicholoff 2003) identified 3 groups of high-priority bird species in Wyoming: Level I – those that clearly need conservation action, Level II – species where the focus is on monitoring, rather than active conservation, and Level III – species that are not a high priority but are of local interest. Several migratory species which are also BLM special status (sensitive) species are suspected to occur in the project area: Brewer's sparrow, loggerhead shrike, and sage thrasher.

3.8.2. Threatened, Endangered, Candidate, Special Status (Sensitive) Species

3.8.2.1. Ute Ladies'-Tresses Orchid (ULT)

The FWS lists the Ute ladies'-tresses orchid (ULT) as threatened The PRB FEIS discussed the affected environment for ULT, p. 3-175, which BLM incorporates here by reference. The Wyoming Natural Diversity Database model predicts undocumented populations may be present in southern Campbell and northern Converse Counties. Scientists only documented 4 orchid populations in Wyoming prior to 2005. Scientists found 5 additional sites in 2005 and 1 in 2006. The new locations were in the same drainages as the original populations, with 2 on the same tributary and within a few miles of an original discovery. Drainages with documented orchid populations include Antelope Creek in northern Converse County, Bear Creek in northern Laramie and southern Goshen Counties, Horse Creek in Laramie County, and Niobrara River in Niobrara County. The project area does not support habitat for this species.

3.8.3. Candidate Species - Greater Sage-Grouse (GSG)

The FWS determined that the Greater Sage-Grouse (GSG) warrants federal listing as threatened or endangered across its range, but precluded listing due to other higher priority listing actions, 75 Fed. Reg. 13910 to 14014, Mar. 23, 2010; 75 Fed. Reg. 69222 to 69294, Nov. 10, 2010. GSG are a WY BLM SSS and a WGFD species of greatest conservation need, because populations are declining and they are experiencing ongoing habitat loss. The Wyoming Bird Conservation Plan rates them as a Level I species, indicating they are clearly in need of conservation action. GSG are also a BCC for FWS's Region 17. The PRB FEIS addressed the affected environment for GSG, pp. 3-194 to 3-199.

In its *Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats* (2009), WGFD categorized impacts to GSG by number of well pad locations per square mile within 2 miles of a lek and within identified nesting/brood-rearing habitats greater than 2 miles from a lek. Moderate impacts occur when well density is between 1 and 2 well pad locations per square mile or where there is less than 20 acres of disturbance per square mile. High impacts occur when well density is between 2 and 3 well pad locations per square mile or when there are between 20 and 60 acres of disturbance per square mile. Extreme impacts occur when well density exceeds 3 well pad locations per square mile or when there are greater than 60 acres of disturbance per square mile.

The State Wildlife Agencies' Ad Hoc Committee for Consideration of Oil and Gas Development Effects to Nesting Habitat (2008) recommends that impacts to leks occur within 4 miles of oil and gas developments. WGFD records indicate that eight GSG lek occur within four miles of the proposed wells. In 2013, two of those leks, Collins SW and Collins SE were active with a maximum of 6 and 4 males respectively. The Cedar Canyon lek is within 2 miles of the proposed pump station 1, the 084276-2FH well and the access road (section 17, 20, 21, 28). Suitable GSG habitat (as defined in Soehn, et al., 2001), is present in the project area. The project area constitutes Preliminary General Habitat (WY-2012-019).

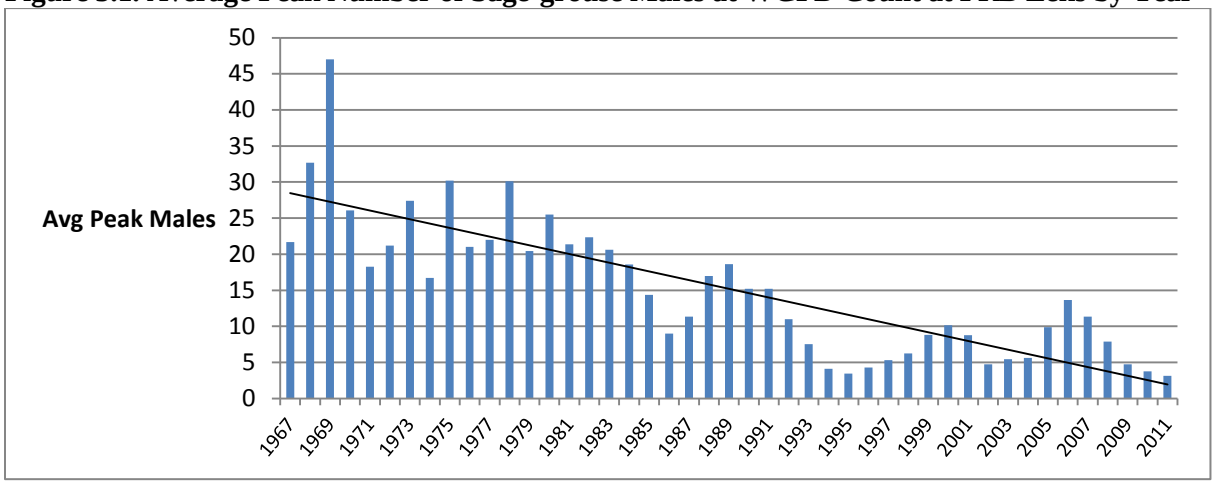
The GSG population in northeast Wyoming exhibited a steady long term downward trend, as measured by lek attendance (WGFD 2008b). Figure 3.1 illustrates a 10-year cycle of periodic highs and lows. Each subsequent population peak is lower than the previous peak. The research described below suggests that these declines may be a result, in part, of CBNG development in this region of Wyoming and that the leks in the cumulative impact assessment area are experiencing similar declines.

Research shows that declines in lek attendance correlate with oil and gas development. Projections show in a typical PRB landscape that energy development within 2 miles of leks reduces the average probability of lek persistence from 87% to 5% percent (Walker et al. 2007). Several studies showed that well density is a useful metric for evaluating impacts to GSG, as measured by declines in lek attendance (Braun et al. 2002, Holloran et al. 2005, and Walker et al. 2007). These studies indicated that oil or gas development exceeding approximately 1 well pad per square mile, resulted in calculable impacts on breeding populations, as measured by the number of male GSG attending leks (State Wildlife Agencies'

Ad Hoc Committee for Sage-Grouse and Oil and Gas Development 2008).

The Wyoming BLM adopted the State of Wyoming's Core Area Strategy through issuance of Instruction Memorandum, WY-2012-019. The proposed project is within preliminary general habitat and outside preliminary priority habitat.

Figure 3.1. Average Peak Number of Sage-grouse Males at WGFD Count at PRB Leks by Year



3.8.4. Special Status (Sensitive) Species (SSS)

The PRB FEIS discussed the affected environment for SSS, p. 3-174 to 201. The authority for the SSS comes from the ESA, as amended; Title II of the Sikes Act, as amended; the FLPMA; Department Manual 235.1.1A and BLM Manual 6840. Table A-1, lists those SSS that may occur in the project area. The Table also includes a brief description of the habitat requirements for each species. Wyoming BLM annually updates its list of SSS to focus management to maintain habitats to preclude listing as a threatened or endangered species. The policy goals are:

- Maintaining vulnerable species and habitat components in functional BLM ecosystems;
- Ensuring sensitive species are considered in land management decisions;
- Preventing a need for species listing under the Endangered Species Act (ESA); and
- Prioritizing needed conservation work with an emphasis on habitat.

Wyoming BLM updates SSS on its website: http://www.blm.gov/wy/st/en/programs/Wildlife.html. BLM discusses those SSS impacted beyond the level analyzed in the PRB FEIS, below.

3.8.4.1. Ferruginous Hawk

The PRB FEIS discussed the affected environment for ferruginous hawk, p. 3-183. The species is widely distributed; its population status and trends are unknown but are suspected as stable. Populations are experiencing habitat loss, and they are sensitive to human disturbance. In the PRB, this hawk inhabits grasslands and sage shrublands in the PRB. They typically nest on the ground, increasing its exposure to ground predators. The project area is suitable for ferruginous hawk nesting and is on the western boundary of an important breeding area (high density of nests) in southern Campbell County.

3.8.4.2. Western Burrowing Owl

The PRB FEIS discussed the affected environment for western burrowing owl (burrowing owl), p. 3-186. Burrowing owls typically inhabit prairie dog burrows. The project area supports black tailed prairie dogs, however the landowners are actively controlling the colonies. No suitable burrowing owl habitat was threatened by the proposed development.

3.8.4.3. Loggerhead Shrike

The PRB FEIS discussed the affected environment for loggerhead shrike, p. 3-187. Sagebrush grasslands in the project area provide suitable nesting habitat for loggerhead shrike. Suitable nesting habitat will be removed with construction of the Iberlin Ranch Fed 084276-2FH well.

3.8.4.4. Mountain Plover

The PRB FEIS discussed the affected environment for mountain plover, pp. 3-177 to 3-178. The ESA proposed the mountain plover for ESA listing as a threatened species when BLM approved the PRB FEIS. FWS withdrew the proposal, finding that the population larger than thought and was no longer declining. On June 29, 2010 The FWS reinstated, on June 29, 2010, a December 5, 2002 proposed rule (67 FR 72396) to list the mountain plover as a threatened species. On May 12, 2011, The FWS withdrew the proposal to list the mountain plover as a threatened species on May 12, 2011. The project area supports black-tailed prairie dogs, however the landowners are actively controlling the colonies. No suitable mountain plover habitat was threatened by the proposed development.

3.8.4.5. Brewer's Sparrow

The PRB FEIS discussed the affected environment for Brewer's sparrow, p. 3-200. Sagebrush grassland areas in the project area provide suitable nesting habitat for Brewer's sparrows. 07-4276-1FH and 08-4276-FH wells have suitable Brewer's sparrow nesting habitat that will be destroyed.

3.8.4.6. Sage Thrasher

The affected environment for sage thrasher is discussed in the PRB FEIS on pg. 3-199 to 3-200. Well pad 08-4276-FH has suitable sage thrasher nesting habitat that will be destroyed.

3.8.4.7. Swift Fox

The PRB FEIS discussed the affected environment for swift fox, p. 3-189. The project area supports black-tailed prairie dogs, however the landowners are actively controlling the colonies. No identified dens were threatened by the proposed development.

3.9. Cultural Resources

In accordance with section 106 of the National Historic Preservation Act, BLM must consider impacts to historic properties (sites that are eligible for or listed on the National Register of Historic Places (NRHP)). For an overview of cultural resources that are generally found in the PRB the reader is referred to the *Draft Cultural Class I Regional Overview, Buffalo Field Office* (BLM, 2010). A Class III (intensive) cultural resource inventory (BFO project no. 070130059) was performed in order to locate specific historic properties which may be impacted by the proposed project. The following resources are located in or near the proposed project area.

Cultural Resources Located In or Near the Project Area

Site Number	Site Type	NRHP Eligibility
48JO134	Bozeman Trail	Listed on NRHP
48JO3059	Ft. Fetterman to Ft. McKinney Telegraph line	Eligible
48CA4360	Historic Site	Not Eligible

Sites 48JO134 (Bozeman Trail), and 48JO3059 (Ft. Fetterman to Ft. McKinney Telegraph Line) are eligible for the National Register. Contributing portions of the Bozeman Trail (typically expressed as wagon ruts) are present in the project area. None of the contributing portions of the trail retain their integrity of setting due to modern additions to the landscape including CBNG wells, upgraded roads, pipelines, reservoirs, POD buildings, compressor stations, etc.

4. ENVIRONMENTAL EFFECTS

4.1. Air Quality

4.1.1. Direct and Indirect Effects

Project area air quality could be affected during construction (due to surface disturbance by earth-moving equipment, vehicle traffic fugitive dust, well testing, and drilling rig and vehicle engine exhaust and production, including well production equipment and booster and pipeline compression engine exhaust). Air quality impacts modeled in the PRB FEIS and Cumulative Air Quality Effects 2009 concluded that PRB projected fluid and solid development would not violate state, tribal, or federal air quality standards and this project is well within the projected development parameters, in addition to the 2011 ozone standards. This EA incorporates the air quality analysis in the draft Crazy Cat East EA, WY-070-EA13-028, which estimated per well criteria pollutant emissions for typical conventional oil and gas and CBNG wells in the PRB during pad construction, drilling/completion, and production phases. Based on that analysis, no violations to the NAAQS would be anticipated from implementation of the proposed action. Localized, short-term, increases in NO_X, CO, VOCs, and PM_{10} concentrations would occur, but maximum concentrations would be well below applicable state and federal criteria. Air pollutants in the vicinity would return to background levels at the end of production and would be de minimis during the production phase.

4.1.2. Cumulative Effects

Cumulative air quality impacts were assessed for the WY PRB. The PRB FEIS discusses the cumulative effects to air quality, pp. 4-386 to 4-392. For each alternative, potential air pollutant project sources were combined with non-project sources, including sources from the Montana Statewide Oil and Gas EIS, to determine the total potential cumulative air quality impacts. The analysis in the PRB FEIS compared potential air quality impacts from 4 alternatives to applicable ambient air quality standards and PSD increments, but comparisons to the PSD Class I and II increments were intended to evaluate a threshold of concern for potential impacts and did not represent a regulatory PSD Increment Consumption Analysis. The proposed action would contribute to the cumulative impacts described in the PRB FEIS. The Update of the Task 3A Report for the Powder River Basin Coal Review Cumulative Air Quality Effects for 2020 also evaluated the air quality-related environmental impacts of ongoing development in the region, to which the proposed action would contribute.

4.1.3. Mitigation Measures

The BLM proposes no additional mitigation beyond the operator committed measures.

4.1.4. Residual Effects

BLM anticipates no residual effects.

4.2. Soils and Vegetation

4.2.1. Direct and Indirect Effects

The effects to soils resulting from well pad and access road construction include:

- Mixing of horizons – occurs where construction on roads, or other activities take place. Mixing may result in removal or relocation of organic matter and nutrients to depths where it would be unavailable for vegetative use. Soils which are more susceptible to wind and water erosion may be moved to the surface. Soil structure may be destroyed, which may impact infiltration rates. Less desirable inorganic compounds such as carbonates, salts, or weathered materials may be relocated and have a negative impact on revegetation. This drastically disturbed site may change the ecological integrity of the site and the recommended seed mix.
- Loss of soil vegetation cover, biologic crusts, organic matter and productivity. With expedient reclamation, productivity and stability should be regained in the shortest time frame.

- Soil erosion would also affect soil health and productivity. Erosion rates are site specific and are dependent on soil, climate, topography, and cover.
- Soil compaction – the collapse of soil pores results in decreased infiltration and increased erosion potential. Factors affecting compaction include soil texture, moisture, organic matter, clay content and type, pressure exerted, and the number of passes by vehicle traffic or machinery. Compaction may be remediated by plowing or ripping.
- Modification of hill slope hydrology.
- Direct effects (removal and/or compaction) to vegetation would occur from ground disturbance caused by drilling rig equipment and construction of a well pads, tank batteries, and roads. Short term effects would occur where vegetated areas are disturbed but later reclaimed within 1 to 3 years of the initial disturbance. Long-term effects would occur where well pads, compressor stations, roads, water-handling facilities or other semi-permanent facilities may result in loss of vegetation and affect reclamation success for the life of the project.
- Soils will be subjected to wind and water erosion.

The BLM evaluates reclamation success using the requirements in the BLM State Wide Reclamation Policy: http://www.blm.gov/wy/st/en/programs/reclamation, see this EA's Appendix B.

4.2.2. Cumulative Effects

The PRB FEIS defined the duration of disturbance, see residual effects, below. Most soil disturbances would be short term impacts with expedient interim reclamation and site stabilization, as committed to in Devon's Surface Use Plan, Reclamation Plan and as required by the BLM in COAs. Geomorphic effects of roads and other surface disturbance range from chronic and long-term contributions of sediment into waters of the state to catastrophic effects associated with mass failures of road fill material during large storms. Roads can affect geomorphic processes primarily by: accelerating erosion from the road surface and prism itself through mass failures and surface erosion processes; directly affecting stream channel structure and geometry; altering surface flow paths, leading to diversion or extension of channels onto previously unchannelized portions of the landscape; and causing interactions among water, sediment, and debris at road-stream crossings. These impacts, singly or in combination, could increase the potential for valuable soil loss due to increased water and wind erosion, invasive/noxious/poisonous plant spread, invasion and establishment, and increased sedimentation and salt loads to the watershed system.

4.2.3. Mitigation Measures

The proponent planned their project to maximize the fluid mineral drainage while avoiding areas with soil limitation where possible. The proponent also designed the infrastructure such that no engineering roads will be required and uses existing oil/gas roads as possible to access the proposed wells. The constructed well pads were designed to minimize cut and fill slopes. Operator committed measures committed to in the SUP, Reclamation Plan, and pad design drawings will rectify impacted areas by repairing, rehabilitating and/or restoring the affected environment. The operator's design features will reduce or eliminate impacts over time by preservation and maintenance operations during the project's life. Refer to the surface use plan (SUP), Reclamation Plan, and the APDs for pad design drawings and a detailed description of design features, operator committed measures and construction practices.

4.2.4. Residual Effects

Residual effects across the POD would include a long-term loss of soil productivity associated with well pads and roads. The PRB FEIS identified residual effects (p. 4-408) such as the loss of vegetative cover, despite expedient reclamation, for several years until reclamation is successfully established. Due to the presence of erosive soils and the topography of the project area erosion will occur. Rilling and gullying of cut and fill slopes on, access/utility corridors, will take place. Impacts from livestock to stabilized cut and fill slopes will limit soils becoming stable and getting vegetation establish. The PRB FEIS defined the designation of the duration of disturbance, pp. 4-1 and 4-15. "For this EIS, short-term effects are defined

as occurring during the construction and drilling/completion phases. Long-term effects are caused by construction and operations that would remain longer".

Impacts to vegetation and soils from surface disturbance will be reduced, by following the operator's plans and BLM applied mitigation. Construction of new access roads has been reduced by placing the well locations such that existing oil/gas access roads are used and one existing fee mineral pad location is being used for federal mineral development. This practice results in less surface disturbance and overall environmental impacts. See Section 2.2 for a summary of the disturbance. All disturbances associated with the proposed action are long term. With the reclamation status of the project area being rated as fair and field observations showing areas of reclamation success expedient reclamation of disturbed land with stockpiled topsoil, proper seedbed preparation techniques, and appropriate seed mixes, along with utilization of erosion control measures (e.g., waterbars, water wings, culverts, rip-rap, etc.) would ensure land productivity/stability is regained and maximized.

4.3. Water Resources

Adherence to the drilling COAs, the setting of casing at appropriate depths, following safe remedial procedures in the event of casing failure, and using proper cementing procedures should protect fresh water aquifers above the drilling target zone. The operator committed to cement surface casing to 2200+ feet to protect shallow groundwater formations as well as insure that cement tops behind the production string are above the Fox Hills formation. Compliance with the drilling and completion plans and Onshore Oil and Gas Orders Nos. 2 and 7 will ensure there is no adverse impact on ground water. The volume of water produced by this federal mineral development is unknowable at the time of permitting.

The WSEO, WDEQ, and WOGCC regulate waters and chemicals for drilling, "BLM may rely on the actions of state regulators. The IBLA and federal courts recognized it is appropriate for BLM to assume a proposed action complies with state permitting requirements, and rely on state analysis when evaluating the significance of effects. Wyo. Outdoor Council v. U.S. Army Corps of Eng'rs, 351 F. Supp. 2d 1232, 1244 (D. Wyo. 2005); PRBRC, 180 IBLA 32, 57 (2010); Bristlecone Alliance, 179 IBLA 51, 74-77 (2010)." In Wyoming Outdoor Council, the District Court held the Corps may rely on the WDEQ permitting process to "ameliorate any concerns that impacts to water quality will be significant." Id.

4.3.1. Groundwater

4.3.1.1. Direct and Indirect Effects

There are no reasonable/forseeable direct/indirect/cumulative or residual effects with the drilling of the proposed wells. Additionally the cumulative industry and regulatory experience shows that thousands of wells pierce the nation's largest aquifer in western Texas, Oklahoma, and Kansas with essentially no direct or indirect impact to that groundwater, see generally, http://www.spe.org/jpt/print/archives/2010/12/10Hydraulic.pdf. Lastly, the EPA 2004 study and its on-going, detailed study of hydraulic fracturing yielded no immediate cautions, concerns, or warnings that present industry and regulatory practices endanger ground water or require immediate changes.

The volume of water produced by this mineral development is unknowable at the time of permitting. Devon will have to produce the wells for a time to be able to estimate the volume and quantity of water production. To comply with Onshore Order Oil and Gas Order No. 7 Disposal of Produced Water, Devon will submit a Sundry to the BLM within 90 days of first production which includes a representative water analysis and the final proposal for water management. The quality of water produced in association with conventional oil and gas historically was such that surface discharge would not be possible without treatment. Initial water production is quite low in most cases. There are 3 common alternatives for water management: re-injection, deep disposal, or disposal into pits. All alternatives would be protective of groundwater resources when performed in compliance with state and federal regulations.

4.4. Minerals – Leasables; Locatables; Salables

Direct, indirect, cumulative, and residual effects of this proposal on locatable minerals may impact in-situ uranium recovery. There is potential for timing and/or location conflicts between the oil and gas and uranium development projects. Potential effects, "conflicts" with uranium development could occur where these mineral extraction activities overlap. Devon and any uranium mining companies will need to take the initiative to keep informed about the others' projects and design plans for pipelines, electrical power, and roads so they can optimize their own projects without impeding each other. Operator-to-operator coordination would preclude the need for federal or state solutions or mitigation measures to address conflicts.

4.5. Invasive Species

4.5.1. Direct and Indirect Effects

The direct, indirect, cumulative and residual effects of ground disturbance may create an environment for weed establishment. The operator has committed to the control of noxious weeds and species of concern using the following measures identified in their Integrated Pest Management Plan (IPMP):

1. Control Methods, including frequency
2. Preventive practices
3. Education

Cheatgrass or downy brome (*Bromus tectorum*) and to a lesser extent, Japanese brome (*B. japonicus*) exist in the affected environment. These 2 species are found in such high densities and numerous locations throughout NE Wyoming that a control program is not presently feasible. The use of existing facilities along with the surface disturbance associated with construction of proposed access roads, pipelines, and related facilities would present opportunities for weed invasion and spread. The activities related to the performance of the proposed project would create a favorable environment for the establishment and spread of noxious weeds/invasive plants such as salt cedar, Canada thistle, and perennial pepperweed. However, mitigation as required by BLM applied COAs will reduce potential impacts from noxious weeds and invasive plants.

4.6. Fish and Wildlife

4.6.1. Non-Game

4.6.1.1. Raptors

4.6.1.1.1. Direct and Indirect Effects

The PRB FEIS analyzed direct and indirect effects to raptors, pp. 4-216 to 4-221. This project will result in disturbance in proximity of nesting raptors, including direct loss of foraging habitats and indirect losses associated with declines in habitat effectiveness. All raptors using nests in the vicinity of the project will likely be impacted to some extent by the human disturbance associated with operation and maintenance. To reduce the risk of decreased productivity or nest failure, the BLM BFO implements a 0.5 mile radius timing limitation during the breeding season around active raptor nests and recommends all infrastructures requiring human visitation be located to provide adequate biologic buffer for nesting raptors. A biologic buffer is a combination of distance and visual screening that provides nesting raptors with security such that they will not be flushed by routine activities. The BLM biologist and operator worked to reduce impacts to raptors from placement of wells and infrastructure. The following were changes made as a result of the onsite:

- Well 074276-2FH well was moved west, out of sight from raptor nests in cottonwoods along the Dry Fork Power River.

4.6.1.1.2. Cumulative Effects

The cumulative effects are within the analysis parameters and impacts described in the PRB FEIS, p. 4-221.

4.6.1.1.3. Mitigation Measures

The BLM BFO implements a 0.5 mile radius timing limitation during the breeding season around active raptor nests to reduce the risk of decreased productivity or nest failure. This timing restriction will be applied to:

- Pump Station #1 is within 0.5 miles of nests 3502 (active in 2012 with a great-horned owl).
- The Iberlin Ranch Fed 084276-2FH is within 0.5 miles of nests 3502 (active in 2012 with a great-horned owl).
- The Iberlin Ranch Fed 044176-1XFH well is within 0.5 miles of nests 11369 (active in 2012 with a red-tailed hawk).

4.6.1.1.4. Residual Impacts

Timing restrictions will only be applied to surface disturbance (ie drilling) the completion and fracturing activities may not be subject to this restriction if they occur after the well has become operational. Even with timing restrictions, raptors may abandon nests due to foraging habitat alteration associated with development or sensitivity to well or infrastructure placement. Declines in breeding populations of some species that are more sensitive to human activities may occur.

4.6.1.2. Migratory Birds

4.6.1.2.1. Direct and Indirect Effects

The PRB FEIS discussed direct and indirect effects to migratory birds on pp. 4-231 to 4-235. The PRB FEIS states on p. 4-231, "Surface disturbance associated with construction, operation, and abandonment of facilities, including roads, has the potential to result in direct mortality of migratory birds. Most birds would be able to avoid construction equipment; however, nests in locations subject to disturbance would be lost, as would any eggs or nestlings." Direct mortality of a bird or destruction of an active nest due to construction activities could result in a "take" as defined (and prohibited) by the MBTA, a nondiscretionary statute, and in turn a violation of the law. See also, FLPMA, Sec. 302(b) and Raptors – Direct and Indirect Effects (4.6.2.1.1).

Habitat disturbance and disruptive activities (i.e. drilling, construction, completion, operations, and maintenance) resulting from implementation of the project is likely to affect migratory birds in the entire area. Native habitats will be lost directly with the construction of well pads, access roads, and overhead power lines. Surface disturbing activities that occur in the nesting season may kill migratory birds. Prompt re-vegetation of short-term disturbance areas should reduce habitat loss impacts. Pad construction, drilling, and to a lesser degree production, will displace edge-sensitive migratory birds from otherwise suitable habitat adjacent to the well pad. Drilling and construction noise can be troublesome for songbirds by interfering with the males' ability to attract mates and defend territory, and the ability to recognize calls from conspecifics (BLM 2003). Habitat fragmentation will result in more than just a quantitative loss in the total area of habitat available; the remaining habitat area will also be qualitatively altered (Temple and Wilcox 1986). Ingelfinger and Anderson (2004) identified that the density of breeding Brewer's sparrows declined by 36% and breeding sage sparrows declined by 57% within 100 meters of dirt roads in a natural gas field. Effects occurred along roads with light traffic volume (less than 12 vehicles per day). The increasing density of roads constructed in developing natural gas fields exacerbated the problem creating substantial areas of impact where indirect habitat losses through displacement were much greater than the direct physical habitat losses.

Those species that are edge-sensitive will be displaced further away from vegetative edges due to increased human activity, causing otherwise suitable habitat to be abandoned. If the interior habitat is at carrying capacity, then birds displaced from the edges will have no place to relocate. One consequence of habitat fragmentation is a geometric increase in the proportion of the remaining habitat that is near edges (Temple 1986). In severely fragmented habitats, all of the remaining habitat may be so close to edges that no interior habitat remains (Temple and Cary 1988). Over time, this leads to a loss of interior habitat

species in favor of edge habitat species. Other migratory bird species that use the disturbed areas for nesting may be disrupted by the human activity, and nests may be destroyed by equipment.

During the onsites, the BLM biologist identified suitable nesting habitat present for BLM sensitive sagebrush obligates. Construction of the following well pads and associated infrastructure will remove habitat and could kill BLM sensitive migratory birds, or destroy eggs near: Iberlin Ranch Fed 074276-2FH, Iberlin Ranch Fed 084276-2FH, and Iberlin Ranch Fed 044176-1XFH.

Migratory bird species in the PRB nest in the spring and summer and are vulnerable to the same effects as GSG and raptor species. Though no timing restrictions are typically applied specifically to protect migratory bird breeding or nesting, where GSG or raptor nesting timing limitations are applied, nesting migratory birds are also protected. Where these timing limitations are not applied and migratory bird species are nesting, migratory birds remain vulnerable. Surface disturbing activities associated with portions of the Spruce 2 project will have GSG and raptor timing limitations applied, thereby providing protection to migratory birds until June 30. Whether migratory birds still receive protection until July 31 is dependent on whether an active raptor nest is located within 0.5 miles of the project area.

Heater treaters, and similar facilities with vertical open-topped stacks or pipes, can attract birds. Facilities without exclusionary devices pose a mortality risk. Once birds crawl into the stack, escape is difficult and the bird may become trapped (U.S. v. Apollo Energies Inc., 611 F.3d 679 (10th Cir. 2010); see also Colorado Oil and Gas Commission, Migratory Bird Policy, accessed February 13, 2012). To minimize these effects, the operator will equip all open-top pits, tanks, and pipes containing hydrocarbons with nets, screens, or other avian exclusion devices to prevent injury or death to migratory birds.

4.6.1.2.2. Cumulative Effects

The cumulative effects associated with alternative B are within the analysis parameters and impacts described in the PRB FEIS. For details on expected cumulative impacts, refer to the PRB FEIS, p. 4-235.

4.6.1.2.3. Mitigation Measures

GSG and raptor timing limitations on surface disturbing activities will also serve to mitigate impacts to nesting migratory birds. Raptor protections are put in place to avoid potential violations of the MBTA, making the guidance for seasonal timing relevant to the migratory bird issue as well. Specific conservation measures to protect migratory birds are not included in the current land use plan, as updated and amended. Although the PRB FEIS ROD addressed the potential impacts from oil and gas development to migratory birds, it did not specifically identify activities to help mitigate those impacts. The RMP is currently under revision, and a change in management for migratory birds is being considered among the alternatives. Until the revision is complete, the BFO will provide project level site-specific analysis of conservation measures implemented for migratory bird protection, and compliance with the MBTA.

BLM provided some level of protection for migratory bird nesting through timing limitations applied to CBNG plans of development for GSG and raptor nesting. Many CBNG projects (consisting of multiple wells) covered large areas that either encompassed GSG nesting habitat or raptor nests. Timing limitations applied as COAs for those projects were likely to also protect migratory birds during the nesting season by effectively limiting the development in a project area during grouse and raptor breeding seasons. Operators were likely to wait to construct facilities until limitations had been lifted for the entire area, in order to cut down on labor costs and difficulties from completing only small portions of the project at a time. With conventional oil projects, where less wells are proposed and development is more complicated, operators will most likely start construction as soon as possible, which could be during the migratory bird nesting season if the proposed area is not within 2 miles of a GSG lek or no active raptor nests are located. The shift in proposed projects from multi-well CBNG projects to single conventional

wells, and in turn reducing secondary protections to migratory birds, constitutes a "change in circumstances" (43 CFR 1610.5-6) that should be addressed at the project level until issues can be resolved in a land use plan.

Nesting in Brewer's sparrows (a BLM SSS) typically occurs mid-May to mid-July. Some young fledge in late July. Sage thrashers (BLM sensitive species) may lay a second clutch of eggs as late as mid-July. Lark sparrows in northern latitudes lay eggs from early May to mid-July (information on breeding habits available on the Birds of North America Online website: http://bna.birds.cornell.edu/bna). GSG timing limitations on surface disturbing activities will mitigate impacts to nesting migratory birds from March 15 to June 30. However, several species of birds, listed above, are likely to still have eggs or nestlings into July. BLM biologists have observed active Brewer's sparrow nests containing eggs during the last week of June. Only a percentage of known nests are active any given year, so the protections for migratory birds from June 30 to July 31 will depend on how many raptor and mountain plover nests are active. The least restrictive measures (in this case only applying GSG timing limitations) are inadequate to protect all nesting migratory birds that may inhabit the project area.

To reduce the likelihood of a "take" under the MBTA, pad construction (vegetation removal) should occur outside of the breeding season for the greatest quantity of BLM sensitive passerines (May 1- July 31) where suitable nesting habitat for sagebrush obligates is present. This restriction would apply to habitat removal, unless a pre-construction nest search (within approximately 10 days of construction planned May 1-July 31) is completed. If surveys will be conducted, the operator will coordinate with BLM biologists to determine protocol. The nest search will consist of in areas where vegetation will be removed or destroyed.

The BLM recommends the following well pads and associated infrastructure have timing limitations applied for habitat removal during the nesting season for sagebrush obligate passerines (May 1 to July 31): Iberlin Ranch Fed 074276-2FH, Iberlin Ranch Fed 084276-2FH, and Iberlin Ranch Fed 044176-1XFH .

Timing limitations for GSG (Iberlin Ranch Fed 084276-2FH well pads; March 15 to June 30), active raptor nests (Iberlin Ranch Fed 084276-2FH and Iberlin Ranch Fed 044176-1XFH well pads; Feb 1 to July 31), all begin prior to timing limitations for sagebrush obligates, and thus may provide additional protection where migratory bird nesting periods and habitats overlap.

The BLM also recommends that measures are taken to ensure that migratory birds are excluded from all facilities that pose a mortality risk, including, but not limited to, heater treaters, flare stacks, secondary containment, and standing water or chemicals where escape may be difficult or hydrocarbons or toxic substances are present.

4.6.1.2.4. Residual Effects

If restrictions on habitat removal, or clearance surveys, are not applied, the BLM would not be in conformance with the MBTA, the BLM-FWS MOU, or BLM IM No. 2013-005. If the restriction on habitat removal is applied, it is unlikely that active nests will be destroyed, as most nestlings will have fledged by August 1. Nests initiated after the first week in July may be destroyed by construction after August 1st. Migratory birds nesting adjacent to the well pad or road may be disturbed by construction and production activities. A timing limitation does nothing to mitigate loss and fragmentation of habitat. Suitability of the project area for migratory birds will be negatively affected due to habitat loss and fragmentation and proximity of human activities associated with oil and gas development.

4.6.2. Candidate Species

4.6.2.1. Greater Sage-Grouse (GSG)

4.6.2.1.1. Direct and Indirect Effects

Implementation of the proposed project will impact GSG habitat and individuals. Impacts to GSG are generally a result of loss and fragmentation of sagebrush habitats associated with roads and infrastructure. Research indicates that GSG hens also avoid nesting in developed areas. Impacts to GSG associated with energy development are discussed in detail in the 12-Month Findings for Petitions to List the Greater Sage-Grouse (*Centrocercus urophasianus*) as Threatened or Endangered (USFWS 2010) and chapters 15-21 of Greater Sage-grouse Ecology and Conservation of a Landscape Species and its Habitats (Knick and Connelly 2011).

The project area contains suitable nesting, brood-rearing, and winter habitat. Construction will cause fragmentation of sagebrush stands and result in the direct loss of approximately 20 acres of GSG habitat. Noise and human disturbance associated with roads, construction, drilling, and completion will be disruptive to GSG. Implementation of the project will adversely impact nesting habitat, both through direct loss and avoidance of the area by GSG due to fragmentation and anthropogenic activity. Disruptive activities (such as those associated with fracing) during the breeding/nesting season (March 15 – June 30) are anticipated. It is the policy of BLM WY to manage GSG habitats consistent with the provisions set forth by the State of Wyoming, and as described in Instruction Memorandum (IM) No. WY-2012-019, *Greater Sage-Grouse Habitat Management Policy on Wyoming Bureau of Land Management (BLM) Administered Public Lands Including the Federal Mineral Estate*. IM 2012-019 states that for areas outside of core and connectivity habitats, "Surface disturbing and/or disruptive activities are prohibited from March 15–June 30 to protect sage-grouse nesting and early brood rearing habitats within 2 miles of the lek or lek perimeter of any occupied lek located outside core or connectivity areas."

4.6.2.1.2. Cumulative Effects

The PRB FEIS (BLM 2003) states that "the synergistic effect of several impacts would likely result in a downward trend for the sage-grouse population, and may contribute to the array of cumulative effects that may lead to its federal listing. Local populations may be extirpated in areas of concentrated development, but viability across the Project Area [PRB] or the entire range of the species is not likely to be compromised (pg. 4-270)." Based on the impacts described in the PRB FEIS and the findings of more recent research, the proposed action may contribute to a decline in male attendance at the 8 leks that occur within 4 miles of the project area, and, potentially, extirpation of the local grouse population.

There are currently 788 wells (Wyoming Oil and Gas Conservation Commission [WOGCC]) in the cumulative impact assessment area, an area of 147 square miles, which is a density of approximately 5.3 wells per square mile. Currently, there are approximately 87 proposed wells (Automated Fluid Minerals Support System [AFMSS]) (including those from this project) within 4 miles of the eight leks. With the addition of the proposed wells, the well density within 4 miles of the leks increases to 5.9 wells per square mile, well over the 1 well per square mile recommendation by the State Wildlife Agencies' Ad Hoc Committee for Sage-Grouse and Oil and Gas Development.

In its Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats (2009), WGFD categorized levels of oil and gas development into thresholds that correspond to moderate, high, and extreme impacts to habitat effectiveness for various species of wildlife, based on well pad densities and acreages of disturbance. All 3 levels of impact result in a loss of habitat function by directly eliminating habitat; disrupting wildlife access to, or use of habitat; or causing avoidance and stress to wildlife. Extreme impacts mean those where the function of an important wildlife habitat is substantially impaired or lost. The Collins SW Lek is considered at moderate impact and was the only active lek within 4 miles in 2013. The Collins Lek is considered at a high impact. The other 6 leks within 4 miles are all at

an extreme impact. The proposed project is within 2 miles of the Cedar Canyon GSG Lek. This lek is already experiencing extreme impacts.

Declines in lek attendance associated with oil and gas development may be a result of a suite of factors including avoidance (Holloran et al. 2005, Holloran et al. 2007, Aldridge and Boyce 2007, Walker et al. 2007, Doherty et al. 2008, WGFD 2009), loss and fragmentation of habitat (Connelly et al. 2000, Braun et al. 2002, Connelly et al. 2004, WGFD 2004, Rowland et al. 2005, WGFD 2005, Naugle et al. 2011), reductions in habitat quality (Braun et al. 2002, WGFD 2003, Connelly et al. 2004, Holloran et al. 2005) and changes in disease mechanisms (Naugle et al. 2004, WGFD 2004, Walker et al. 2007, Cornish pers. comm.).

The Buffalo RMP (BLM 2001) and the PRB FEIS ROD (BLM 2003) included a 2-mile timing limitation on surface-disturbing activities around GSG leks. The 2-mile measure originated with the Western Association of Fish and Wildlife Agencies (WAFWA) (BLM 2004). Wyoming BLM adopted the 2-mile recommendation in 1990 (BLM 1990). The 2-mile recommendation was based on early research which indicated between 59% and 87% of GSG nests were located within 2 miles of a lek (BLM 2004). These studies were conducted in vast contiguous stands of sagebrush, such as those that occur in Idaho's Snake River plain.

Additional research across more of the GSG's range has since indicated that nesting may occur much farther than 2 miles from the breeding lek (BLM 2004). Holloran and Anderson (2005), in their Upper Green River Basin study area, reported that only 45% of their GSG hens nested within 1.9 miles of the capture lek. Moynahan and Lindberg (2004) found that only 36% of their GSG hens nested within 1.9 miles of the capture lek. Habitat conditions, and, thus, GSG biology, in the PRB area are more similar to Moynahan's north-central Montana study area than the Upper Green River area. Moynahan's study area occurred in mixed-grass prairie and sagebrush steppe, dominated by Wyoming big sagebrush (Moynahan et al. 2007). Recent research in the PRB suggests that impacts to leks from energy development are discernible out to a minimum of 4 miles, and that some leks in this radius have been extirpated as a direct result of energy development (Walker et al. 2007, Walker 2008, Naugle et al. 2011). BLM determined, based on these studies, that a 2-mile timing limitation is insufficient to reverse the population decline.

The 2012 population viability analysis for the NE Wyoming GSG found there remains a viable population of GSG in the PRB (Taylor et al. 2012). Threats from energy development and West Nile Virus (WNv) are impacting future viability (Taylor et al. 2012). The study indicated that effects from energy development, as measured by male lek attendance, are discernible out to a distance of 12.4 miles.

Studies document the additive impacts of energy development and WNv as a threat to GSG persistence in the PRB (Taylor et al. 2012, Garton et al. 2011). The cumulative and synergistic effects of CBNG development and WNv in the PRB area will continue to impact the local GSG population, causing further declines in lek attendance, and could result in local extirpation: "[f]indings reflect the status of a small remaining sage-grouse population that has already experienced an 82% decline within the expansive energy fields." (Taylor et al. 2012).

Current well densities reduce the effectiveness of PRB core areas (Taylor et al. 2012). Continued energy development around the core areas will reduce PRB core areas remaining value. WNv outbreaks combined with energy development reduce GSG populations and interact to exacerbate population declines. The effects of one WNv outbreak year could cut a population in half. Absent a WNv outbreak, or another stochastic event of similar magnitude, immediate extirpation is unlikely. Results suggest that if current oil and gas development rates continue, they may compromise future viability of NE Wyoming GSG, with an increased chance of extirpation with additional WNv outbreaks (Taylor et al. 2012).

A timing limitation does nothing to mitigate loss and fragmentation of habitat and changes in disease mechanisms. Rather than limiting mitigation to only timing restrictions, more effective mitigation strategies may include, at a minimum, burying power lines (Connelly et al. 2000b); minimizing road and well pad construction, vehicle traffic, and industrial noise (Lyon and Anderson 2003, Holloran 2005); and managing produced water to prevent the spread of mosquitoes with the potential to vector WNv in GSG habitat (Walker et al 2007). Walker et al. (2007) recommend maintaining extensive stands of sagebrush habitat over large areas (at least 1 mile in size) around leks to ensure GSG persistence. The size of such a no-development buffer would depend on the amount of suitable habitat around the lek and the population impact deemed acceptable. Connelly et al. (2000) recommended locating all energy-related facilities at least 2 miles from active leks.

Several guidance documents are available that recommend practices that would reduce impacts of development on GSG. These include Northeast Wyoming Sage-Grouse Conservation Plan (Northeast Wyoming Sage-grouse Working Group 2006), Sage-Grouse Habitat Management Guidelines for Wyoming (Bohne et al. 2007), Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats (WGFD 2009), Bureau of Land Management National Sage-Grouse Habitat Conservation Strategy (USDI 2004), Greater Sage-Grouse Comprehensive Conservation Strategy (Stiver et al. 2006), and BLM National Greater Sage-Grouse Land Use Planning Strategy (USDI 2011).

4.6.2.1.3. Mitigation Measures

Based on the summary of research describing the impacts of energy development on GSG, efforts to reduce habitat loss and fragmentation are likely to be the most effective in ensuring long-term lek persistence. In order to reduce the likelihood that noise, construction, and human disturbance impact nesting GSG, BLM will implement a timing limitation on all surface-disturbing activities within GSG habitat during the construction phase. The intent of this timing restriction is to decrease the likelihood that GSG will avoid these areas and increase habitat quality by reducing noise and human activities during the breeding season. The BLM will also implement a limitation on noise levels at the edge of occupied leks in the project area.

- Timing restrictions for surface disturbance will be applied to the Pump Station 1 and Iberlin Ranch Fed 084276-2FH, as well as road construction from the Spruce 2 Frac Pit to the Pump Station 1.

4.6.2.1.4. Residual Effects

A timing limitation restricting surface disturbance does not mitigate habitat loss, fragmentation or changes in disease mechanisms. Noise and human disturbance resulting from hydraulic fracturing, maintenance and production activities are likely to impact GSG nesting in the area for the life of the project. Suitability of the project area for GSG will be negatively affected due to habitat loss, fragmentation, and proximity of human activities associated with oil and gas development. The BLM made a commitment to support the management objectives set by the State of Wyoming, to maintain populations and habitats. In addition, the BFO identified the following objectives in the current RMP: maintain a biological diversity of animal species, support the WGFD population objectives, maintain or improve quality of wildlife habitat, and provide habitat for special status habitat species (BLM 2001).

The PRB FEIS predicted that the PRB oil and gas development would have significant impacts to the GSG population. The impact of the proposed development cumulatively contributes to the potential for local extirpations. Alternative B and the COAs applied are consistent with current BLM and Wyoming GSG conservation strategies and the anticipated effects are within the parameters of the PRB FEIS/ROD.

Current research does not identify specific components of energy development that measurably decrease impacts to GSG or their habitats. Even in areas where a variety of mitigation measures were applied, negative population impacts were still measurable when well density exceeded 1 well per square mile.

Management of energy development based on current core area configurations and associated lease stipulations, conditions of approval, and best management practices (BMPs), may not be sufficient to protect the population viability of PRB GSG.

4.6.3. Special Status (Sensitive) Species (SSS)

The PRB FEIS discusses impacts to sensitive species on pp. 4-257 to 4-265. BLM supports the policies set forth in sensitive species policy (BLM Manual 6840). BLM Manual 6840.22A states that "The BLM should obtain and use the best available information deemed necessary to evaluate the status of special status species in areas affected by land use plans or other proposed actions and to develop sound conservation practices. Implementation-level planning should consider all site-specific methods and procedures which are needed to bring the species and their habitats to the condition under which the provisions of the ESA are not necessary, current listings under special status species categories are no longer necessary, and future listings under special status species categories would not be necessary."

4.6.3.1. Ferruginous Hawk, Western Burrowing Owl, Mountain Plover, Black-tailed Prairie Dog

BLM anticipates no direct, indirect, cumulative effects to the above species from this project. Devon avoided impacts to black-tailed prairie dog towns. The PRB FEIS discussed impacts to special status species, pp. 4-257 to 4-273.

4.7. Cultural Resources

4.7.1. Direct and Indirect Effects

BLM policy states that a decision maker's first choice should be avoidance of historic properties (BLM Manual 8140.06(C)). If historic properties cannot be avoided, mitigation measures must be applied to resolve the adverse effect. Site 48JO134, the Bozeman Trail, is listed on the NRHP. The Bureau has previously determined that segments 48JO134-130, 48JO134-135, 48JO134-137, 48JO134-139, 48JO134-141 and 48JO134-143 of the Bozeman Trail within the proposed project contribute to the Bozeman Trail Multiple Property Group. BLM also previously determined that fee related CBM activity compromised the setting of all contributing portions of 48JO134 within the current APE. Modern facilities such as valve covers, CBNG wells, telemetry towers, access roads and other infrastructure are easily visible from all contributing segments of the trail. The proposal entails the upgrading of the existing crowned and ditched access road by widening it resulting in a maximum of 40 additional feet of disturbance to the existing grade. The access will also be straightened in two short segments. The widening will take place on the opposite side of all contributing segments of the Bozeman Trail. Although contributing segments are near (some within 25 feet) the proposed access upgrading, no earth moving activities will physically impact the Bozeman Trail. Temporary construction fencing will be required as a condition of approval in all areas where road upgrading will be within 100 feet of the Bozeman Trail in order to protect contributing segments.

Following the State Protocol Between the Wyoming BLM State Director and The Wyoming State Historic Preservation Officer, Section VI(A)(1), the BLM electronically notified the Wyoming State Historic Preservation Officer (SHPO) on May 30, 2013 and July 18, 2013 that the project will result in "no adverse effect" to historic properties. SHPO concurred with BLM's determinations on June 18 and July 26, 2013. If any cultural values (sites, features or artifacts) are observed during operation, they will be left intact and the Buffalo Field Manager notified. If human remains are noted, the procedures described in Appendix L of the PRB FEIS and ROD must be followed. Further discovery procedures are explained in Standard COA (General)(A)(1).

4.7.2. Cumulative Effects

Construction and development of oil and gas resources impacts cultural resources through ground disturbance, unauthorized collection, and visual intrusion of the setting of historic properties. This results

in fewer archaeological resources available for study of past human life-ways, changes in human behavior through time, and interpreting the past to the public. Additionally, these impacts may compromise the aspects of integrity that make a historic property eligible for the National Register of Historic Places. Recording and archiving basic information about archaeological sites and the potential for subsurface cultural materials in the proposed project area serve to partially mitigate potential cumulative effects to cultural resources.

Fee actions constructed in support of federal actions can result in impacts to historic properties. Construction of large plans of coalbed natural gas development on split estate often include associated infrastructure that is not permitted through BLM. Project applicants may connect wells draining fee minerals, or previously constructed pipelines on fee surface with a federal plan of development. BLM has no authority over such development which can impact historic properties. BLM has the authority to modify or deny approval of federal undertakings on private surface, but that authority is limited to the extent of the federal approval. Historic properties on private surface belong to the surface owner and they are not obligated to preserve or protect them. The BLM may go to great lengths to protect a site on private surface from a federal undertaking, but the same site can be legally impacted by the landowner at any time. The cumulative effect of numerous federal approvals can result in impacts to historic properties. Archeological inventories reveal the location of sites and although the BLM goes to great lengths to protect site location data, information can potentially get into the wrong hands. BLM authorizations that result in new access can inadvertently lead to impacts to sites from increased visitation by the public.

4.7.3. Mitigation Measures

If Operators observe any cultural values [sites, artifacts, human remains (Appendix L PRB FEIS and ROD)] during operation of this lease/permit/right-of-way, they will be left intact and the Buffalo Field Manager notified. Standard COA (General)(A)(1) further explains discovery procedures.

4.7.4. Residual Effects

During the construction phase, there will be numerous crews working across the project area using heavy construction equipment without the presence of archaeological monitors. Due to the extent of work and the surface disturbance caused by large vehicles, it is possible that unidentified cultural resources can be damaged by construction activities. The increased human presence associated with the construction phase can also lead to unauthorized collection of artifacts or vandalism of historic properties.

5. CONSULTATION/COORDINATION:

BLM consulted or coordinated with the following on this project:

Contact	Organization	Onsite Presence?
Mary Hopkins	Wyoming State Historic Preservation Officer	No

List of Preparers (BFO unless otherwise noted)

Position/Organization	Name	Position/Organization	Name
NRS/Team Lead	Eric Holborn	Archaeologist	G.L. “Buck” Damone III
Supr NRS	Casey Friese	Wildlife Biologist	Bill Ostheimer
Petroleum Engineer	Will Robbie	Geologist	Warren Garrett
LIE	Karen Klahsen	Grazing Management	NA
Soils	NA	Supr NRS	Bill Ostheimer
Hydrologist	NA	Assistant Field Manager	Chris Durham
Assistant Field Manager	Clark Bennett	NEPA Coordinator	John Kelley

6. References and Authorities

Agnew, W. D. 1983. Flora and Fauna Associated with Prairie Dog Ecosystems. Unpublished thesis. Colorado State University, Fort Collins. 47pp.

Agnew, W. D. 1988. Arthropod Consumption by Small Mammals on Prairie Dog Colonies and Adjacent Ungrazed Mixed-grass Prairie in Western South Dakota. Eighth Great Plains Wildlife Damage Control Workshop Proceedings. USDA Forest Service General Technical Report RM 154. pgs. 81-87.

Agnew, W., D. W. Uresk. and R. M. Mansen. 1986. Flora and Fauna Associated with Prairie Dog Colonies and Adjacent Ungrazed Mixed-grass Prairie in Western South Dakota. Jnl of Range Management 39, pp. 135-139

AHPIS, Animal and Plant Health Inspection Service. 2002. General information available online at http://www.aphis.usda.gov/lpa/issues/wnv/wnv.html.

Aldridge, C. L., and M. S. Boyce. 2007. Linking occurrence and fitness to persistence: a habitat-based approach for endangered greater sage-grouse. Ecological Applications 17:508-526.

Apa, A. D. 1985. Efficiency of Two Black-tailed Prairie Dog Rodenticides and Their Impacts on Non-target Bird Species. Unpublished thesis, South Dakota State University Brookings. 71pp.

Avian Power Line Interaction Committee (APLIC) 2006. R. Harness, contributing author to: Suggested Practices for Avian Protection on Power Lines: State of the Art in 2006. 207pp.

Bills, Thomas E. 2004. Powder River Basin Oil & Gas Project Semi-Annual Report: May 1, 2003 – October 31, 2003. BLM Buffalo Field Office. Buffalo, WY. 8pp.

Big Horn Environmental Consultants. 2008. Powder Valley Unit – Delta POD Wildlife Survey and Habitat Report. Sheridan, WY. 11pp.

Braun C. E. 1998. Sage-grouse declines in western North America: what are the problems? Proceedings of the Western Association of State Fish and Wildlife Agencies. 67:134–144.

Braun C. E., M. F. Baker, R. L. Eng, J. S. Gashwiler, and M. H. Schroeder. 1976. Conservation committee report on effects of alteration of sagebrush communities on the associated avifauna. Wilson Bulletin. 88:165–171.

Braun, C.E., O.O. Oedekoven, and C.L. Aldridge. 2002. Oil and Gas Development in Western North America: Effects on Sagebrush Steppe Avifauna with Particular Emphasis on Sage Grouse. In: Transactions of the 67th North American Wildlife and Natural Resources Conference. pp337-349.

Bureau of Land Management. 2004. Instruction Memorandum No. WY-2005-057: Statement of Policy Regarding Sage-Grouse Management Definitions, and Use of Protective Stipulations, and Conditions of Approval. Bureau of Land Management, Wyoming State Office. Cheyenne, WY.

Bureau of Land Management. 2008. Fact Sheet Greater Sage-Grouse Buffalo Field Office RMP Amendment. May 28, 2008.

Bureau of Land Management. 1990. Instruction Memorandum No. WY-90-564: Resource Management Plan Action and Wyoming BLM Standard Mitigation Guidelines for Surface Disturbing Activities. Bureau of Land Management, Wyoming State Office. Cheyenne, WY.

Campbell, Thomas and Tim Clark. 1981. Colony Characteristics and Vertebrate Associates of White-tailed and Black-tailed Prairie Dogs. American Midland Naturalist, Vol. 105, No. 2 (April 1981). pp. 269-276.

Canfield, J. E., L. J. Lyon, J. M. Hillis, and M. J. Thompson. 1999. Ungulates. Chapter 6 in Effects of Recreation on Rocky Mountain Wildlife: A Review for Montana, coordinated by G. Joslin and H. Youmans. Committee on Effects of Recreation on Wildlife, Montana Chapter of The Wildlife Society.

Clark, L., J. Hall, R. McLEan, M. Dunbar, K. Klenk, R. Bowen, and C. A, Smeraski. 2006. Susceptibility of greater sage-grouse to experimental infection with West Nile virus. Journal of Wildlife Diseases 42:14-22.

Clark, T. W., T. M. Campbell, D. G. Socha, and D. E. Casey. 1982. Prairie Dog Colony attributes and Associated Vertebrate Species. Great Basin Naturalist 42: 572-582.

Code of Federal Regulations (CFR)

1. 40 CFR All Parts and Sections inclusive Protection of Environment. Revised as of July 1, 2004.
2. 43 CFR All Parts and Sections inclusive - Public Lands: Interior. Revised as of October 1, 2006.

Confluence Consulting, Inc. 2004. Powder River Biological Survey and Implications for Coalbed Methane Development. Bozeman, MT. 179pp.

Connelly, J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000. Guidelines for management of sage grouse populations and habitats. Wildlife Society Bulletin 28:967-985.

Connelly, J. W., S. T. Knick, M. A. Schroeder, and S. J. Stiver. 2004. Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, Wyoming.

Cornish, Todd; Terry Creekmore; Walter Cook; and Elizabeth Williams. 2003. "West Nile Virus - Wildlife Mortality in Wyoming 2002-2003". In: The Wildlife Society Wyoming Chapter Program and Abstracts for the Annual Meeting at the Inn in Lander, WY November 18-21, 2003. Wildlife Society Wyoming Chapter. 17pp.

Cornish, Todd. Personal Communication. 2004. Wyoming State Veterinary Laboratory, University of Wyoming. Laramie, WY. (307) 742-6638. tcornish@uwyo.edu.

Dantzker, M. S., Deane, G. B. & Bradbury, J. W. 1999. Directional acoustic radiation in the strut display of male sage grouse Centrocercus urophasianus. Journal of Experimental Biology, 202, 2893–2909.

Danvir, Rick E. 2002. Sage Grouse Ecology and Management in Northern Utah Sagebrush-Steppe: A Deseret Land and Livestock Wildlife Research Report. Deseret Land and Livestock Ranch and the Utah Foundation for Quality Resource Management. Woodruff, UT.

Deisch, M. S., D. W. Uresk, and R. L. Linder. 1989. Effects of Two Prairie Dog Rodenticides on Ground Dwelling Invertebrates in Western South Dakota. Ninth Great Plains Wildlife Damage Control Workshop Proceedings. USDA Forest Service General Technical Report RM. Pgs 171-181.

Dobkin D. S. 1994. *Conservation and management of Neotropical migrant landbirds in the northern Rockies and Great Plains*. University of Idaho Press, Moscow, ID.

Doherty, K.E., D.E. Naugle, B.L. Walker, J.M. Graham. 2008. Greater sage-grouse winter habitat selection and energy development. Journal of Wildlife Management. In press.

Ebert, Jamies I., and Timothy A. Kohler. 1988. The Theoretical Basis of Archaeological Predictive Modeling and a Consideration of Appropriate Data-Collection Methods, in *Quantifying the Present and Predicting the Past: Theory, Method, and Application of Archaeological Predictive Modeling* edited by W. James Judge and Lynne Sebastian, pp 97-171. U.S. Department of the Interior, Bureau of Land Management Service Center, Denver, CO.

Eckerle, William. 2005. Experimental: Archaeological Burial Model for Powder River and Tongue River Hydrological Basins, Wyoming. In *Adaptive Management and Planning Models for Cultural Resource in Oil and Gas Fields in New Mexico and Wyoming*, by Eric Ingbar, Lynne Sebastian, Jeffrey Altschul, Mary Hopkins, William Eckerle, Peggy Robinson, Judson Finley, Stephen A. Hall, William E. Hayden, Chris M. Rohe, Tim Seaman, Sasha Taddie, and Scott Thompson, pp. 39-102. Prepared for the Department of Energy, National Energy Technology Laboratory by Gnomon, Inc. Electronic Document, http://www.gnomon.com/DOEPumpIII/FinalCombinedReport.pdf, accessed August and September 2010.

Fahrig, L., and J. Paloheimo. 1988. Determinations of local population size in patchy habitats. Theorectical Population Biology 34:194-213.

Fertig, W. 2000. *Status Review of the Ute Ladies Tresses (Spiranthes diluvialis) in Wyoming*. Wyoming Natural Diversity Database, Laramie, Wyoming.

Geist, V. 1978. Behavior. Big Game of North America; ecology and management. Stackpole Books, Harrisburg, Pennsylvania.

Gelbard J. L., and J. Belnap. 2003. Roads as conduits for exotic plant invasions in a semiarid landscape. Conservation Biology. 17:420–432.

Gibson, R. M. 1989. Field playback of male display attracts females in lek breeding Sage Grouse. Behavioral Ecology and Sociobiology 24: 439-443.

Gibson, R. M. and J. W. Bradbury. 1986. *Male and female mating strategies on sage grouse leks*. Pp. 379-398 in Ecological aspects of social evolution: birds and mammals (D. I. Rubenstein and R. W. Wrangham, eds.). Princeton Univ. Press, Princeton, New Jersey.

Grenier, M., B. Oakleaf, K. Taylor, and M. Hymas. 2004. *Inventory and Mapping of Black tailed Prairie Dogs in Wyoming – An Estimate of Acreage Completion Report*.

Grenier, M. 2003. An Evaluation of Black-footed Ferret Block Clearances in Wyoming: Completion Report. Wyoming Game and Fish Department. Lander, WY. 16pp

Haug, E. A. and L. W. Oliphant. 1985. Movements, Activity Patterns, and Habitat Use of Burrowing Owls in Saskatchewan. Journal of Wildlife Management. 54(1):27-35.

Hazlett, D.L. 1996. *The discovery of Spiranthes diluvialis along the Niobrara River in Wyoming and Nebraska*. Report prepared for the Bureau of Land Management Wyoming State Office.

Hazlett, D.L. 1997. *A 1997 search for Spiranthes diluvialis in southeastern Wyoming and western Nebraska*. Report prepared for the Bureau of Land Management Wyoming State Office.

Heidel, Bonnie. Botanist. Wyoming Natural Diversity Database. University of Wyoming. Laramie, WY.

Hiat, G.S. and D. Baker. 1981. Effects of oil/gas drilling on elk and mule deer winter distributions on Crooks Mountain, Wyoming. Wyoming Game and Fish Department.

Holloran, M. J. 2005. Greater sage-grouse (Centrocercus urophasianus) population response to natural gas field development in western Wyoming. Dissertation, University of Wyoming, Laramie.

Holloran, M. J, and S. H. Anderson. 2005. Spatial distribution of Greater Sage-Grouse nests in relatively contiguous sagebrush habitats. Condor 107:742-752.

Holloran, M J.; B. J. Heath; A. G. Lyon; S. J. Slater; J. L. Kuppiers; and S. H. Anderson. 2005. Greater sage-grouse nesting habitat selection and success in Wyoming. J. Wildl. Manage. 69(2):638-649.

Holloran, M. J., R. C. Kaiser, and W. A. Hubert. 2007. Population Response of yearling greater sage-grouse to the infrastructure of natural gas fields in southwestern Wyoming. Completion report. Wyoming Cooperative Fish and Wildlife Research Unit, Laramie, WY, USA. 34pp.

Hoogland, J. 1995. *The black-tailed prairie dog: Social life of a burrowing mammal*. Chicago University Press.

Hubert, W. A. 1993. *The Powder River: a relatively pristine stream on the Great Plains*. Pages 387-395 in L. W. Hesse, C. B. Stalnaker, N. G. Benson, and J. R. Zuboy, editors. Restoration planning for the rivers of the Mississippi River ecosystem. Biological Report 19, National Biological Survey, Washington, D.C.

Ingelfinger, F., and S. Anderson. 2004. Passerine response to roads associated with natural gas extraction in a sagebrush steppe habitat. Western North American Naturalist 64:385-395

Ingelfinger F. 2001. *The effects of natural gas development on sagebrush steppe passerines in Sublette County, Wyoming*. M.Sc. thesis, University of Wyoming, Laramie, WY.

Jalkotzy, M.G., P.I. Ross, and M.D. Nasserden. 1997. The Effects of Linear Developments on Wildlife: A Review of Selected Scientific Literature. Arc Wildlife Services Ltd., Calgary, Alberta, Canada.

Jellison, Bert. 2005. Sage-Grouse Restoration Project: Lake DeSmet Conservation District. Wyoming Game and Fish Department. Sheridan, WY.

Ken Kreckel. 2007. Direction Drilling: The Key to Smart Growth of Oil and Gas Development in the Rocky Mountain Region. The Wilderness Society, http://wilderness.org/files/Directional-Drilling.pdf .

Kelly Brian T. 2004. Letter to interested parties: Black-footed ferret clearance surveys. U.S. Fish and Wildlife Service (February 2, 2004). Cheyenne, WY. 4pp.

King, J. A. 1955. Social Behavior, Social Organization and Population Dynamics in a Black-tailed Prairie Dog Town in the Black Hills of South Dakota. Contr. Lab. Vert. Biol., University of Michigan. 67pp.

Klute, D. S., L.W. Ayers, M.T. Green, W.H. Howe, S.L. Jones, J.A. Shaffer, S.R. Sheffield, and T.S. Zimmerman. 2003. *Status Assessment and Conservation Plan for the Western Burrowing Owl in the United States*. U.S. Department of the Interior; Fish and Wildlife Service, Biological Technical Publication FWS/BTP-R6001-2003, Washington, D.C.

Knick, S. T., and J. T. Rotenberry. 1995. Landscape characteristics of fragmented shrubsteppe habitats and breeding passerine birds. Conservation Biology 9:1059-1071.

Knick S. T., D. S. Dobkin, J. T. Rotenberry, M. A. Schroeder, W. M. Vander Haegen, and C. van Riper III. 2003. Teetering on the edge or too late? Conservation and research issues for avifauna of sagebrush habitats. Condor. 105:611–634.

Knight R. L., and J. Y. Kawashima. 1993. Responses of raven and Red-tailed Hawk populations to linear right-of-ways. Journal of Wildlife Management. 57:266–271.

Knopf F.L. and J.R Rupert. 1995. Habits and habitats of Mountain Plovers in California. Condor 97:743-751.

Landry, R.E. 1979. *Growth and development of the Burrowing Owl*. M.S. thesis, California State University, Long Beach, CA.

Lowham, H.W. Streamflows in Wyoming WRIR 88-4045 U.S. Geological Survey 1988

Lustig, Thomas D., March. 2003. Where Would You Like the Holes Drilled into Your Crucial Winter Range? Transactions of the 67th North American Wildlife and Natural Resources Conference.

Marra PP, Griffing SM, McLean RG. West Nile virus and wildlife health. Emerg Infect Dis [serial online] 2003 Jul. Available from: URL: http://www.cdc.gov/ncidod/vol9no7/03-0277.htm.

McCraken, J. G., D. W. Uresk and R. M. Mansen. 1985. Burrowing Owl Foods in Conata Basin, South Dakota. Great Basin Naturalist 45: 287-290.

McDonald, D., N.M. Korfanta, and S.J. Lantz. 2004. *The Burrowing Owl (Athene cunicularia): a technical conservation assessment*. USDA Forest Service, Rocky Mountain Region.

Meffe, G.K. and C.R. Carroll. 1994. *Principles of Conservation Biology*. Sinauer Associates, Inc. Sunderland, MA.

Miller, B.K., G. Ceballos, and R.P. Reading. 1994. "The Prairie Dog and Biotic Diversity." Conservation Biology 8(3):677-81.

Miller, K.A. 2003. Peak-Flow Characteristics of Wyoming Streams, WRIR 03-4107 U.S. Geological Survey.

Moynahan, B. J. and M. S. Lindberg. 2004. *Nest Locations of Greater Sage-Grouse in Relation to Leks in North-Central Montana*. *Presented at* Montana Sage-Grouse Workshop, Montana Chapter of The Wildlife Society, Billings.

Moynahan, B. J.; M. S. Lindberg; J. J. Rotella; and J. W. Thomas. 2005. Factors Affecting Nest Survival of Greater Sage-Grouse in Northcentral Montana. J. Wildl. Manage.

Moynahan, B. J., M. S. Lindberg, J. J. Rotella, and J. W. Thomas. 2007. Factors affecting nest survival of greater sage-grouse in north-central Montana. Journal of Wildlife Management 71:1773-1783.

Naugle, D. E. K. E. Doherty, B. L. Walker, M. J. Holloran, and H. E. Copeland. 2011. Energy Development and Greater Sage-Grouse. Pp. 489-529 in Greater Sage-Grouse: ecology and conservation of a landscape species and its habitats, S. T. Knick, J. W. Connelly, C. E. Braun (eds.) Studies in Avian Biology, Number 38, University of California Press, Berkley.

Naugle, D. E.; C. L. Aldridge; B. L. Walker; T. E. Cornish; B. J. Moynahan; M. J. Holloran; K. Brown; G. D. Johnson; E. T. Schmidtmann; R. T. Mayer; C. Y. Kato; M. R. Matchett; T. J. Christiansen; W. E. Cook; T. Creekmore; R. D. Falise; E. T. Rinkes; and M. S. Boyce. 2004. West Nile virus: Pending Crisis of Greater Sage-grouse. Ecology Letters. 7:704-713.

Naugle, David E.; Brett L. Walker; and Kevin E. Doherty. 2006. Sage Grouse Population Response to Coal-bed Natural Gas Development in the Powder River Basin: Interim Progress Report on Region-wide Lek Analyses. May 26, 2006. University of Montana. Missoula, MT. 10pp

Nicholoff, S.H., compiler. 2003. Wyoming Bird Conservation Plan, Version 2.0. Wyoming Partners in Flight. Wyoming Game and Fish Department, Lander.

North Dakota Industrial Commission Oil and Gas Research Program. 2011. Investigation of Methodologies to Control Dust on County Roads in Western North Dakota. Grant Applicants: Dunn and Mckenzie County.

Noss, R. F. and A. Cooperrider. 1994. *Saving Nature's Legacy: Protecting and Restoring Biodiversity*. Defenders of Wildlife and Island Press, Washington, D. C.

NRCS Web Soil Survey. n.d. Electronic document, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx
Oakleaf, Bob. January 13, 1988. Letter to BFAT: Preliminary BFF Reintroduction Site Analysis, Meeteetse Management Plan Assignments. Wyoming Game and Fish Department. Lander, WY. 10pp.

Olendorff, R.R. 1993. Status, Biology, and Management of Ferruginous Hawks: A review. Raptor Res. and Tech. Asst. Cen., Spec. Rep. USDI, BLM, Biose, ID.

Olenick, B. E. 1990. *Breeding biology of burrowing owls using artificial nest burrows in southeastern Idaho*. Thesis, Idaho State University, Pocatello, Idaho, USA.

Paige, C., and S. A. Ritter. 1999. *Birds in a sagebrush sea: managing sagebrush habitats for bird communities*. Partners in Western Flight working group, Boise, ID.

Patterson, C. T. and S. H. Anderson. 1985. Distributions of Eagles and a Survey for Habitat Characteristics of Communal Roosts of Bald Eagles (Haliaeetus leucocephalus) Wintering in Northeastern Wyoming. Wyoming Cooperative Fishery and Wildlife Research Unit. University of Wyoming. Laramie, WY.

Pendery, Bruce M. 2010, BLM's Retained Rights: How Requiring Environmental Protection Fulfills Oil and Gas Lease Obligations, 40 Environmental Law, 599-685.

Porneluzi, P, J. C. Bednarz, L. J. Goodrich, N. Zawada, and J. Hoover. 1993. Reproductive performance of territorial Ovenbirds occupying forest fragments and a contiguous forest in Pennsylvania. Conservation Biology 7:618-622.

Primack, R.B. 1993. Essentials of conservation biology. Sinauer Associates, Sunderland, Massachusetts, USA.

Reading, R. P., S. R. Beissinger, J. J. Grensten, and T. W. Clark. 1989. Attributes of Black-tailed Prairie Dog Colonies in North Central Montana with Management Recommendations for the Conservation of Biodiversity. Attributes of Black-tailed Prairie Dog Colonies in North Central Montana with Management Recommendations for the Conservation of Biodiversity. pgs 13-28.

Reading, R., and Randy Matchet. 1997. Attributes of Black-tailed Prairie Dog Colonies in Northcentral Montana. Journal of Wildlife Management 61(3): 664-673.

Robinson, S. K. 1992. *Population dynamics of breeding birds in a fragmented Illinois landscape*. Pages 408-418 in J. Hagan and D. W. Johnston, editors. Ecology and conservation of neotropical migrant land birds. Smithsonian Institution press, Washington, D. C.

Romin, Laura A., and Muck, James A. May 1999. Utah Field Office Guidelines For Raptor Protection From Human And Land Use Disturbances. U.S. Fish and Wildlife Service, Salt Lake City, Utah

Rotenberry J. T., and J. A. Wiens. 1980a. Habitat structure, patchiness, and avian communities in North American steppe vegetation: a multivariate analysis. Ecology. 61:1228–1250.

Rowland, M. M., M. Leu, , S. P. Finn, S. Hanser, L. H. Suring, J. M. Boyd, C. W. Meinke, S. T. Knick, and M. J. Wisdom. 2005. Assessment of threats to sagebrush habitats and associated species of concern in the Wyoming Basins. Version 1.1, June 2005, unpublished report on file at USGS Biological Resources Discipline, Snake River Field Station, 970 Lusk St., Boise, ID 83706.
Rowland, M. M., M. Leu, , S. P. Finn, S. Hanser, L. H. Suring, J. M. Boyd, C. W. Meinke, S. T. Knick, and M. J. Wisdom. 2005. Assessment of threats to sagebrush habitats and associated species of concern in the Wyoming Basins. Version 1.1, June 2005, unpublished report on file at USGS Biological Resources Discipline, Snake River Field Station, 970 Lusk St., Boise, ID 83706.
Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey, and J.R. Squires. 1999. The Scientific Basis for Lynx Conservation: Qualified Insights. Ch16. USDA Forest Service Technical Report RMRS-GTR-30.

Saab, V., and T. Rich. 1997. *Large-scale conservation assessment for neotropical migratory landbirds in the Interior Columbia River Basin*. USDA Forest Service General Technical Report PNW-GTR-399, Portland, Oregon, USA.

Smith D.G., and J.R. Murphy. 1978. Biology of ferruginous hawk in central Utah. Sociobiology 3:79-95.

State wildlife agencies' ad hoc committee for sage-grouse and oil and gas development. 2008. Using the best available science to coordinate conservation actions that benefit greater sage-grouse across states affected by oil and gas development in Management Zones I-II (Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming). Unpublished report. Colorado Division of Wildlife, Denver; Montana Fish, Wildlife and Parks, Helena; North Dakota Game and Fish Department, Bismarck; Utah Division of Wildlife Resources, Salt Lake City; Wyoming Game and Fish Department, Cheyenne.

Steenhof K., M. N. Kochert, and J. A. Roppe. 1993. Nesting by raptors and Common Ravens on electrical transmission line towers. Journal of Wildlife Management. 57:272–281.

Stinson, D. W., D. W. Hays, and M. A. Schroeder. 2004. Washington State Recovery Plan for the Sage-grouse. Washington Department of Fish and Wildlife, Olympia, Washington. 109 pages.

Temple S. A. 1986. Predicting impacts of habitat fragmentation on forest birds: A comparison of two models. Pages 301-304 in Wildlife 2000 (J. Verner, C. J. Ralph, and M. L. Morrison, Eds.). Univ. Wisconsin Press, Madison.

Temple S.A., and J. R. Cary. 1988. Modeling dynamics of habitat-interior bird populations in fragmented landscapes Conserv. Biol.2 :340-347.

Temple, S.A., and B.A. Wilcox. 1986. Introduction: Predicting effects of habitat patchiness and fragmentation. In *Wildlife 2000: Modeling Habitat Relationships of Terrestrial Vertebrates*, ed. J. Verner, M.L. Morrison, and C.J. Ralph, 261-62. Madison: University of Wisconsin Press.

The National Environmental Policy Act of 1969 (NEPA), as amended (Pub. L. 91-90, 42 U.S.C. 4321 et seq.).

Urban, D. L., and H. H. Shugart, Jr. 1984. Avian demography in mosaic landscapes: modeling paradigm and preliminary results. Pages 273-280 in J. Verner, M. L. Morrison, and C. J. Ralph editors. Wildlife 2000: Modeling habitat relationships of terrestrial vertebrates. University of Wisconsin Press, Madison.

U.S. National Academy of Sciences, 2012. Induced Seismicity Potential in Energy Technologies. Washington, D.C.

U.S. Department of the Interior, Bureau of Land Management and Office of the Solicitor (editors). 2001. The Federal Land Policy and Management Act, as amended. Public Law 94-579.

U.S. Department of the Interior 2009, Bureau of Land Management, Instruction Memorandum 2009-078. Processing Oil and Gas Applications for Permit to Drill for Directional Drilling into Federal Mineral Estate from Multiple-Well Pads on Non-Federal Surface and Mineral Estate Locations.

U.S. Department of the Interior 1985, Bureau of Land Management, Buffalo Field Office. Buffalo Resource Management Plan Final Environmental Impact Statement, Record of Decision; see also Approved Resource Management Plan for Public Lands Administered by the Bureau of Land Management Buffalo Field Office 2001; and see: Powder River Oil and Gas Project Environmental Impact Statement and Resource Management Plan Amendment. 2003.

U.S. Department of the Interior 2009, Bureau of Land Management, High Plains District, Update of Task 3A Report for the Powder River Basin Coal Review Cumulative Air Quality Effects for 2020, (AECOM).

U.S. Department of the Interior 2011, Bureau of Land Management, Casper Field Office, Environmental Assessment of Samson Resources Company's Proposed Field Development Program in and adjacent to the Hornbuckle Field, Converse County, Wyoming, WY-060-EA11-181.

U.S. Department of the Interior 2011, Bureau of Land Management. State Director Review, SDR WY-2011-010.

U.S. Department of the Interior 2012, Bureau of Land Management, Buffalo Field Office, Viability Analysis for Conservation of Sage-grouse Populations, R. L. Taylor, D. E. Naugle, and L. S. Mills, Univ. of Montana.

U.S. Department of the Interior 2007, US Fish and Wildlife Service. Reinitiation of Formal Consultation for Powder River Oil and Gas Project. March 23, 2007

U.S. Department of the Interior, Fish and Wildlife Service. 2002. Final Biological and Conference Opinion for the Powder River Oil and Gas Project, Campbell, Converse, Johnson, and Sheridan Counties (WY6633). December 17, 2002. Cheyenne, WY. 58pp.

U.S. Department of the Interior, Fish and Wildlife Service. *Report Mountain Plover (Charadrius Montanus) Biological Evaluation*. March 9, 2007.

U.S. Department of the Interior, Fish and Wildlife Service. 2010. Endangered and Threatened Wildlife and Plants; 12-Month Findings for Petitions to List the Greater Sage-Grouse (*Centrocercus urophasianus*) as Threatened or Endangered. 50 CFR Part 17.

U.S. Department of the Interior, Fish and Wildlife Service. 1989. Black-footed ferret Survey Guidelines for Compliance with the Endangered Species Act. Denver, CO and Albuquerque, NM.

U.S. Department of the Interior, Geological Service. 1996. Occurrences of Erionite in Sedimentary Rocks of the Western United States, R.A. Shepherd, Report 96-018.

U.S. Department of the Interior, Geological Survey. 2007. Organic Compounds in Produced Waters from Coalbed Natural Gas Wells in the Powder River Basin, Wyoming. Applied Geochemistry 22, 2240–2256.

U.S. Department of the Interior, Geological Survey. 2010. Assessment of Potential Effects of Water Produced from Coalbed Methane Natural Gas Development on Macroinvertebrate and Algal Communities in the Powder River and Tongue River, Wyoming and Montana.

U.S. Environmental Protection Agency. 2004. Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs Study, EPA 816-R-04-003, http://water.epa.gov/type/groundwater/uic/upload/completestudy.zip .

Vander Haegen, W. M., F. C. Dobler, and D. J. Pierce. 2000. Shrubsteppe bird response to habitat and landscape variables in eastern Washington, USA. Conservation Biology 14:1145-1160.

Walker, B. L., and D. E. Naugle. 2011.West Nile virus ecology in sagebrush habitats and impacts on greater sage-grouse populations. Pages 127-142 in Greater sage-grouse: ecology and conservation of a landscape species and its habitats, S. T. Knick, J. W. Connelly, C. E. Braun (eds). Studies in Avian Biology, Number 38, University of California Press, Berkley.

Walker, B. L., D. E. Naugle, K. E. Doherty, and T. E. Cornish. 2007. West Nile virus and greater sage-grouse; estimating infection rate in a wild bird population. Avian Diseases 51:691-696.

Walker B, Naugle D, Rinkes T. 2003. The Response of Sage Grouse to Coal-bed Methane Development and West Nile virus in the Powder River Basin: Is There a Link ? Page 6 in: Program and Abstracts for the Annual Wildlife Society Meeting, Wyoming Chapter.

Walker, B.L., D. E. Naugle, and K.E. Doherty. 2007. Greater sage-grouse population response to energy development and habitat loss. Journal of Wildlife Management 71:2644-2654.

WDEQ, June 14, 2004. Compliance Monitoring for Ground Water Protection Beneath Unlined Coalbed Methane Produced Water Impoundments

Windingstad, R. M., F. X. Kartch, R. K. Stroud, and M. R. Smith. 1987. Salt toxicosis in waterfowl in North Dakota. Jour. Wildlife Diseases 23(3):443-446.

Wyoming Game and Fish Department (WGFD). 2004. Minimum Recommendations for Development of Oil and Gas Resources within Crucial and Important Wildlife Habitats on BLM Lands. WGFD. Cheyenne, WY

WGFD. 2003. Wyoming Greater Sage-Grouse Conservation Plan. WGFD. Cheyenne, WY

WGFD. 2004. Sheridan Region Wyoming Game and Fish Department: Annual Sage-Grouse Completion Report for 2004. Wyoming Game and Fish Department. Gillette, WY.

WGFD. 2005. Northeast Wyoming Local Working Group Area: Annual Sage-Grouse Completion Report for 2005. Wyoming Game and Fish Department. Buffalo, WY. 42pp.

WGFD. 2008. Hunting and Sage-Grouse: A Technical Review of Harvest Management On a Species of Concern in Wyoming. Wyoming Game and Fish Department. Green River, WY. 21pp.

WGFD. 2009. Minimum Recommendations for Development of Oil and Gas Resources within Crucial and Important Wildlife Habitats on BLM Lands. WGFD. Cheyenne, WY.

White, C.M. and T.L. Thurow**.** 1985. Reproduction of Ferruginous Hawks exposed to controlled disturbance. Condor. 87:14-22.

Zou, L., S. N. Miller, and E. T. Schmidtmann. 2006. Mosquito larval habitat mapping using remote sensing and GIS: implications of coalbed methane development and West Nile virus. Journal of Medical Entomology 43:1034-1041.

Appendix A. Table A.1 Summary of Sensitive Species Habitat and Project Effects Associated with Alternative B.

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
Amphibians				
Northern leopard frog (*Rana pipiens*)	Beaver ponds and cattail marshes from plains to montane zones.	NS	NI	Habitat is not present.
Columbia spotted frog (*R*anus pretiosa)	Ponds, sloughs, small streams, and cattails in foothills and montane zones. Confined to headwaters of the S Tongue River & tributaries.	NP	NI	The project area is outside the species' range, and the species is not expected to occur .
Fish				
Yellowstone cutthroat trout (*Oncoryhynchus clarki bouvieri*)	Cold-water rivers, creeks, beaver ponds, and large lakes in the Upper Tongue sub-watershed	NP	NI	The project area is outside the species' range, and the species is not expected to occur.
Birds				
Baird's sparrow (*Ammodramus bairdii*)	Shortgrass prairie and basin-prairie shrubland habitats; plowed and stubble fields; grazed pastures; dry lakebeds; and other sparse, bare, dry ground.	NS	MIIH	Habitat is not present.
Bald eagle (*Haliaeetus leucocephalus*)	Mature forest cover often within one mile of large water body with reliable prey source nearby.	K	MIIH	Bald eagles are not likely to use the few mature trees in the project area for nesting or winter roosting. Surface disturbing and maintenance activities may impact foraging eagles and the species may avoid the area.
Brewer's sparrow (*Spizella breweri*)	Sagebrush shrubland	S	MIIH	Nesting and foraging habitat may be impacted by dust, noise, human activities, & direct loss. May avoid area.
Ferruginous hawk (*Buteo regalis*)	Basin-prairie shrub, grasslands, rock outcrops	K	MIIH	Nesting and foraging habitat may be impacted by dust, noise, human activities, & direct loss. May avoid area.
Loggerhead shrike (*Lanius ludovicianus*)	Basin-prairie shrub, mountain-foothill shrub	S	MIIH	Nesting and foraging habitat may be impacted by dust, noise, human activities, & direct loss. May avoid area.
Long-billed curlew (*Numenius americanus*)	Grasslands, plains, foothills, wet meadows	S	MIIH	Nesting and foraging habitat may be impacted by dust, noise, human activities, and direct loss. My avoid area.
Mountain Plover	Short-grass prairie with slopes < 5%	S	MIIH	Nesting and foraging habitat may be impacted by dust, noise, human activities, & direct loss. May avoid area.
Northern goshawk (*Accipiter gentilis*)	Conifer and deciduous forests	NP	NI	Habitat not present.
Peregrine falcon (*Falco peregrinus*)	Cliffs	NP	NI	Habitat not present.
Sage sparrow (*Amphispiza billneata*)	Basin-prairie shrub, mountain-foothill shrub	S	MIIH	Nesting and foraging habitat may be impacted by dust, noise, human activities, & direct loss. May avoid area.
Sage thrasher (*Oreoscoptes montanus*)	Basin-prairie shrub, mountain-foothill shrub	S	MIIH	Nesting & foraging habitat may be impacted by dust, noise, human activities, & direct loss. May avoid area.
Trumpeter swan (*Cygnus buccinator*)	Lakes, ponds, rivers	NP	NI	Habitat not present.

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
Western Burrowing owl (*Athene cunicularia*)	Grasslands, basin-prairie shrub	S	MIIH	Nesting & foraging habitat may be impacted by dust, noise, human activities, & direct loss. May avoid area.
White-faced ibis (*Plegadis chihi*)	Marshes, wet meadows	NP	NI	Habitat not present.
Yellow-billed cuckoo (*Coccyzus americanus*)	Open woodlands, streamside willow and alder groves	NP	NI	Habitat not present.
Mammals				
Black-tailed prairie dog (*Cynomys ludovicianus*)	Prairie habitats with deep, firm soils and slopes less than 10 degrees.	K	MIIH	Prairie dogs may be negatively impacted by dust and noise associated with the development.
Fringed myotis (*Myotis thysanodes*)	Conifer forests, woodland chaparral, caves and mines	NP	NI	Habitat not present.
Long-eared myotis (*Myotis evotis*)	Conifer and deciduous forest, caves and mines	NP	NI	Habitat not present.
Swift fox (*Vulpes velox*)	Grasslands	S	MIIH	Denning & foraging habitat may be impacted by dust, noise, human activities, & direct loss. May avoid area.
Townsend's big-eared bat (*Corynorhinus townsendii*)	Caves and mines.	NP	NI	Habitat not present.
Plants				
Limber Pine (*Pinus flexilis*)	Mountains, associated with high elevation conifer species	NP	NI	Habitat not present.
Porter's sagebrush (*Artemisia porteri*)	Sparsely vegetated badlands of ashy or tufaceous mudstone and clay slopes 5300-6500 ft.	NP	NI	Habitat not present.
William's wafer parsnip (*Cymopterus williamsii*)	Open ridgetops and upper slopes with exposed limestone outcrops or rockslides, 6000-8300 ft.	NP	NI	Project area outside of species' range.

Presence

K - Known, documented observation within project area.
S - Habitat suitable and species suspected, to occur within the project area.
NS - Habitat suitable but species is not suspected to occur within the project area.
NP - Habitat not present and species unlikely to occur within the project area.

Project Effects

NI - No Impact.
MIIH - May Impact Individuals or Habitat, but will not likely contribute to a trend towards Federal listing or a loss of viability to the population or species.
WIPV - Will Impact Individuals or Habitat with a consequence that the action may contribute to a trend towards Federal listing or cause a loss of viability to the population or species.
BI -Beneficial Impact