DECISION RECORD
Peak Powder River Resources, LLC, VanBuggenum #s 1-2H, 2-2H, 1-11H, & Gilbertz 1-13H
Environmental Assessment (EA), WY-070-EA14-203
Bureau of Land Management, Buffalo Field Office, Wyoming

DECISION. The BLM approves Peak Powder River Resources, LLC's (Peak's) VanBuggenum 1-2H gas and oil well application for permit to drill (APD) described in Alternative B of the environmental assessment (EA), WY-070-EA14-203, incorporated here by reference. This approval includes the well's support facilities. BLM defers making a decision on 3 Peak APDs: VanBuggenum 2-2H, VanBuggenum 1-11H, and Gilbertz 1-13H for the reasons cited in the EA and below.

Compliance. This decision complies with or supports:

- 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); including the Onshore Oil and Gas Orders.
- National Environmental Policy Act of 1969 (NEPA) (42 USC 4321).
- National Historic Preservation Act of 1966 (NHPA) (16 USC 470).
- Buffalo and Powder River Basin Final Environmental Impact Statements (FEISs), 1985, 2003, 2011.
- Buffalo Resource Management Plan (RMP) 1985 and Amendments.

Consultation.

- BLM Washington Office Instruction Memorandum No. 2009-078, Processing Oil and Gas Application for Permit to Drill for Directional Drilling into Federal Mineral Estate from Multiple-Well Pads on Non-Federal Surface and Mineral Locations, 2009.
- Wyoming BLM State Director Review, SDR No. WY-2011-010, EOG Resources, Inc. v. Pinedale Field Office, 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.

Approvals. BLM approves 1 APD and support facilities:

#	Well Name & #	Twp	Rng	Sec	Qtr	Lease #
1	VanBuggenum 1-2H	44	75	35	SESW	WYW160587(LL) WYW160790(LL)

Deferrals. BLM defers the following 3 APDs and associated infrastructure:

#	Well Name & #	Twp	Rng	Sec	Qtr	Lease #
1	VanBuggenum 2-2H	43N	75W	11	NENE	WYW138135(SHL),WYW160790(LL)
2	VanBuggenum 1-11H	43N	75W	11	SESE	WYW138135(SHL,LL,BHL)
3	Gilbertz 1-13H	43N	75W	13	SESE	WYW142978(SHL),WYW137915(LL, BHL)

BHL-Bottom Hole Lease; LL-Lateral Bore Lease; SHL-Surface Hole Lease

Limitations. See the conditions of approval (COAs).

Deferral. BLM defers its decision on 3 APDs based on the findings of the Cultural Resources Inventory. The proposed VanBuggenum 2-2H, VanBuggenum 1-11H, and Gilbertz 1-13H wells have the potential to adversely impact the visual setting of the Pumpkin Buttes Traditional Cultural Property (TCP). Peak provided the BLM with visual contrast rating analysis (VCR) for the VanBuggenum 2-2H and VanBuggenum 1-11H APDs showing that the proposals, as submitted, will adversely impact the setting of the TCP. Peak was unable to provide the BLM with a VCR for the Gilbertz 1-13H APD. The BLM will conduct additional analysis to determine if changes to the proposal designs will allow the projects to

proceed. The BLM will begin VCR analysis as soon as prior scheduling commitments and weather conditions allow. BLM must also consult with the Wyoming State Historic Preservation Officer (WYSHPO) and interested tribes to determine if the setting of the TCP is intact in the project area and if it is, what steps may be necessary to resolve any potential adverse effects. The BLM has not completed the NEPA analysis for the 3 deferred APDs. Our estimated timeframe to complete our analysis and make a decision on the 3 APDs will be within 30 days after we complete the necessary VCR analysis - which may receive expansion should Peak offer proposals, as appropriate, to change any project designs.

THE FINDING OF NO SIGNIFICANT IMPACT (FONSI). Analysis of Alternative B of the EA, WY-070-EA14-203, and the FONSI (incorporated here by reference) found Peak's proposal for VanBuggenum 1-2H will have no significant impacts on the human environment, beyond those described in the PRB FEIS. There is no requirement for an EIS.

COMMENT OR NEW INFORMATION SUMMARY. BLM publically posted the APDs for 30 days, received no comments, and then internally scoped them. Since receipt of these APDs BLM received a policy clarification that updated bonding and its review.

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

1. BLM and Peak included mitigation measures 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 GSG extirpation; yet its effect is acceptable because it is outside priority habitats and is within the parameters of the PRB FEIS/ROD and current BLM and Wyoming GSG conservation strategies. There are no conflicts anticipated or demonstrated with current uses in the area. This decision approving this APD complies with the Energy Policy Act of 2005, Section 390, 43 CFR 1610.5, 40 CFR 1508.4, and 43 CFR 46.215.
3. To reduce the likelihood of a "take" under the Migratory Bird Treaty Act, BLM sensitive species nesting habitat removal will occur outside of the breeding season or be cleared by survey.
4. BLM adopts the analysis and condition of approval for burrowing owl conservation from the similarly situated sagebrush and short grass prairie found in the PRB's Thunder Basin National Grassland Land and RMP, 2002, 2006, pp. 1-13 to 1-22; the supporting FEIS, 2002, and its Records of Decision, 2002, p. D-15, 2006. This is the least restrictive COA for burrowing owl conservation benefitting the owl and this project.
5. This decision applies the mitigation found in the appendices of, *BLM and Wyoming State Historical Preservation Office Programmatic Agreement (PA) for the Pumpkin Buttes Traditional Cultural Property from Anticipated Federal Minerals Development in Campbell County, Wyoming,* to include Appendices A-G. The following references, in addition to the PA, also support this decision: Buffalo RMP Record of Decision 2003 (pp. 8-9, 18), 43 CFR 1610.3-2, National Historic Preservation Act of 1966, and the analysis provided in the EA. This rationale incorporates by reference the traditional cultural property analysis and decisions found in WY State Director Review (SDR)-2010-030, pp. 25-28, and 31-33.
6. Peak will conduct operations to minimize adverse effects to surface and subsurface resources, prevent unnecessary surface disturbance, and conform to currently available technology and practice.
7. The selected alternative will help meet the nation's energy needs, and help stimulate local economies by maintaining workforce stability.
8. The operator 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.

9. The operator certified it has a surface access agreement.
10. The project is clearly lacking in wilderness characteristics as it lacks federal surface.
11. These APDs are pursuant to the Mineral Leasing Act for developing oil or gas and do not satisfy the categorical exclusion directive of the Energy Policy Act of 2005, Section 390 because the proposed drilling is at a site where drilling occurred more than 5 years prior.

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: __//s// Duane W. Spencer_____ Date: __5/8/14_____

FINDING OF NO SIGNIFICANT IMPACT
Peak Powder River Resources, LLC, VanBuggenum #s 1-2H, 2-2H, 1-11H, & Gilbertz 1-13H
Environmental Assessment (EA), WY-070-EA14-203
Bureau of Land Management, Buffalo Field Office, Wyoming

FINDING OF NO SIGNIFICANT IMPACT (FONSI). Based on the information in the EA, WY-070-EA14-203, which BLM incorporates here by reference; I find that: (1) the implementation of Alternative B (approving 1 application for permit to drill (APD) and deferring my decision on 3 APDs) 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, 2011 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 (as defined above) 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, 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 have minor controversy, are not highly uncertain, or do not involve unique or proven 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 (1 APD approval and 3 deferrals). The project area is clearly lacking in wilderness characteristics as it lacks federally owned surface. 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: _____//s// Duane W. Spencer_____ Date: ____5/8/14_____

ENVIRONMENTAL ASSESSMENT (EA), WY-070-EA14-203
Peak Powder River Resources, LLC's Applications for Permit to Drill (APDs)
VanBuggenum 1-2H, VanBuggenum 2-2H, VanBuggenum 1-11H and Gilbertz 1-13H
Bureau of Land Management, Buffalo Field Office, Wyoming

1. INTRODUCTION

BLM provides an EA for Peak Powder River Resources, LLC's (Peak) 4 conventional oil and gas well applications for permit to drill (APDs), VanBuggenum 1-2H, VanBuggenum 2-2H, VanBuggenum 1-11H, and Gilbertz 1-13H. BLM uses standard split jurisdiction of federal lands: with fee surface over federal minerals at the VanBuggenum 2-2H, VanBuggenum 1-11H, and Gilbertz 1-13H well locations. BLM has reduced jurisdiction over the VanBuggenum 1-2H where the location is on fee surface over fee minerals, then; laterally drain federal minerals. This site-specific analysis tiers into and incorporates by reference 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, 2011 and the PRB FEIS Record of Decision (ROD) per 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. 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 the proposed drilling may be within the Pumpkin Buttes Traditional Cultural Property (PB TCP) setting.

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 APD: the site-specific analysis, and mitigation. Fourth is the monitoring and reclamation of wells and their features. (Pendery 2010)

1.1. Background

Peak submitted the VanBuggenum 1-2H, VanBuggenum 2-2H, VanBuggenum 1-11H, and Gilbertz 1-13H as individual APDs to the BFO to produce oil and natural gas from federally managed fluid mineral formations, over privately owned lands with rolling hills, broad bottom drainages, and some steep slopes.

- March 6-8, 2013: BLM received and posted the VanBuggenum 1-2H, VanBuggenum 2-2H, VanBuggenum 1-11H, Gilbertz 1-13H NOS notices of staking (NOSs).
- April 17, 2013: BFO assigned the VanBuggenum 1-2H, VanBuggenum 2-2H, VanBuggenum 1-11H and Gilbertz 1-13H NOSs.
- June 12, 2013: BLM conducted onsite inspections to evaluate the proposals and modify them as necessary to alleviate environmental impacts.
- September 19, 2013: Peak submitted the 4 APDs to the BFO.
- December 5-13, 2013: BLM sent Peak the post-onsite deficiency letters identifying Onshore Oil and Gas Order No. 1 deficiencies for the 4 APDs.
- January 28 and 29, 2014: Peak submitted information and revisions to address the APD deficiencies.
- March 18, 2014: BLM requested additional information from Peak to satisfy unresolved Onshore Oil and Gas Order No. 1 deficiencies.
- March 19, 2014: Peak submitted information to address the APD deficiencies.
- March 21, 2014: BLM sent Peak a 30-day letter for the VanBuggenum 2-2H, VanBuggenum 1-11H, and Gilbertz 1-13H APDs as Notice of Deferral pursuant to Onshore Oil and Gas Order, No. 1, Section III.E.2.c.

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 Resource Management Plan's (RMP) goals, objectives, and management actions with allowing the exercise of the operator's conditional lease rights to develop fluid minerals on federal leases. BLM incorporates by reference here, the APD information (40 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. BLM Washington Office Instruction Memorandum (IM) No. 2009-078 established policy and procedures for processing APDs for horizontal drilling into federal mineral estate from multiple well pads on non-federal locations. Drilling and producing the wells is a federal action. Construction, operation, and reclamation of infrastructure on non-federal land are not federal actions. Drilling and producing mitigation is in the Conditions of Approval for Conventional Application for Permit to Drill.

It is the BLM's responsibility and obligation to analyze the full effects of the federal action, and identify mitigation measures, regardless of the BLM's authority to enforce the mitigation. The BLM needs to identify mitigation measures that would reduce or eliminate the effects of a non-federal action when it is a connected action to the BLM proposed action (see the BLM NEPA Handbook, Section 6.8.2.1.1, Connected Non-federal Actions). Identifying mitigation outside of the BLM's jurisdiction alerts other agencies and landowners that can implement the mitigation. The probability of the other agencies implementing the mitigation measures is likely to occur, although these agencies may vary specific parameters recommended by the BLM.

1.4. Scoping and Issues

BLM posted the proposed APDs for 30 days and will timely publish the EA, any finding, and decision on the BFO website. 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 recent fluid mineral EAs that BLM externally scoped. External scoping of the horizontal drilling in Crazy Cat East EA, WY-070-EA13-028, 2013, in the PRB area received 3 comments, revealing no new issues. The BFO interdisciplinary 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 proposal is clearly lacking wilderness characteristics as it lacks federal surface. 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	Water quality	Soils & Vegetation	Transportation
Wildlife: raptors, migratory birds, special status species		Cultural: National Register eligible sites	

2. PROPOSED PROJECT AND ALTERNATIVES

2.1. Alternative A – No Action

The no action alternative would deny these APDs requiring the operator to resubmit APDs 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; see Table 3.1.

2.2. Alternative B Proposed Action (Proposal)

Overview. Company proposes drilling and developing 4 horizontal oil wells into federal mineral estate from 4 new proposed well pad locations. The proposed wells are 18 miles west of Wright, Campbell County, Wyoming. The primary objective is to drill 4 horizontal wells to the Shannon formation at 9,807-9,936 feet total vertical distance. The surface hole locations are in Table 2.1. See Figure 2.1 below.

Table 2.1. Well Name/#/Lease/Location:

#	Well Name & No.	Twn	Rng	Sec	Qtr
1	VanBuggenum 1-2H	44N	75W	35	SESW
2	VanBuggenum 2-2H	43N	75W	11	NENE
3	VanBuggenum 1-11H	43N	75W	11	SESE
4	Gilbertz 1-13H	43N	75W	13	SESE

Table 2.2. Wells & Leases – Surface Hole (SHL), Lateral (LL), & Bottom Hole Leases (BHL)

#	Well Name & No.	SHL	LL	BHL
1	VanBuggenum 1-2H	Non-Federal	WYW160587 WYW160790	Non-Federal
2	VanBuggenum 2-2H	WYW138135	WYW160790	Non-federal
3	VanBuggenum 1-11H	WYW138135	WYW138135	WYW138135
4	Gilbertz 1-13H	WYW142978	WYW137915	WYW137915

Drilling, Construction and Production Design Features Include:

- A road network consisting of 2.6 miles of proposed crown and ditch road 30 feet wide across the ditches.
- 3.1 miles of overhead power line network and 4 individual power meters.
- Construction of a temporary water storage tank 150 feet in diameter and 12 feet high (41,000 bbls capacity) for drilling, completion and hydraulic stimulation of the well.
- Hydraulic stimulation using 12-20, 500 barrel (bbl) hydraulic fracturing (HF) tanks on location for:
  - storage vessels to heat HF water,
  - store and mixing of HF chemicals prior to pumping down hole
  - Storage of HF flow back fluids for disposal at an authorized off site facility.
- Potential production facilities including 2 pumping units (1 for each well), a 4 tank battery, and 2 heater treater and separator units on the well pad and placed on the cut portion of the well location.
- All engines will be equipped with an adequate muffler system, decibel level not to exceed 50 decibels at sensitive receptors (e.g. raptor nests, GSG nesting habitat)
  - An on-location drilling mud system comprised of a closed loop mud system using 4, 500bbl HF tanks and 1, 6,600 square foot, lined cutting pit 10 deep.
- There will be no pits at the producing oil well location.

Drilling and Completion Water Sources and Amounts

For a detailed description of design features and construction practices associated with the proposed project, refer to the surface use plan of operations (SUPO) and drilling plan included with the APDs. Also see each APD for maps showing the proposed well location and associated facilities described above.

Peak estimates that during the drilling phase of each individual well it may use up to 41,000 barrels of water for drilling and completion. Peak estimates a 4-6 week period per well. The average daily truck traffic (ADT) for mobilizing the rig to and from the location requires about 30 semi-trucks and 15 small

trucks per day for 5 days. During drilling operations approximately 15 large trucks (water haulers, cement trucks, etc.) and 10 personal pickup trucks per day for 2-4 weeks. During the well completion process (a 1-3 week period per well) the ADT increases to 6 large trucks and 6 personal pickup trucks per day. Finally, during the production phase the ADT will decrease to 1-2 semi-trucks and 1 pickup truck per day. BLM incorporated and analyzed the implementation of committed mitigation measures in the SUPO and drilling plan, in addition to the COAs in the PRB FEIS ROD, as well as changes made at the onsite.

Table 2.3. Anticipated Drilling and Completion Sequence and Timing (per well)

Drilling and Completion Step	Approximate Duration
Build location (roads, pad, and other initial infrastructure)	~30 days
Mob rig	5 days[1]
Drilling (24/7)	14-30 days[2]
Schedule/logistics for completion	~30 days
Completion (setup, completion, demobilization)	7-21 days

[1] Depending on distance and need to add supplemental drilling equipment, such as skidding plates.
[2] By comparison, approximately 2 days are required to drill a CBNG well. Source: ICF 2012

Additionally, the operator, in their APDs, committed to:

- Comply with the approved APDs, 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 measures to alleviate resource impacts in their submitted surface use and drilling plans.
- Certify it has a surface access agreement with the landowners.

Table 2.4. Disturbance Summary

Facility	Number or Miles	Disturbance	Interim Disturbance
Engineered Well Pads	4		
VanBuggenum 1-2H,	-	6.61 acres	2.71 acres
VanBuggenum 2-2H,	-	5.40 acres	2.56 acres
VanBuggenum 1-11H	-	6.10 acres	2.57 acres
Gilbertz 1-13H	-	8.06 acres	2.93 acres
Proposed Improved Roads Without Utility Corridor	2.6 miles	15.75 acres	9.46 acres
Proposed Overhead Powerline	3.09 miles	20.56 acres	20.56 acres
Total Surface Disturbance		**62.48 acres**	**40.79 acres**

The reasonably foreseeable activity in a 4 mile radius (an area of 49,450 acres) of the 4 proposed well locations allows for 620 CBNG wells on 80 acre spacing and 155 conventional oil wells on 320 acres spacing. There are currently 515 existing oil and gas wells. This includes 302 CBNG wells on 80 acre spacing and 213 conventional oil wells on 320 acres spacing. There are applications for 49 addition oil and gas wells (WOGCC, March 2014).

Off Well Pad

Peak will use 2.8 miles of existing crown and ditched access road for its operations. Produced water will be trucked to reinjection and disposal facilities until the new pipeline is constructed. See p. 9 of the SUPOs for specific details on Peak's plans for produced water. Filling the water storage tanks on location will be done prior drilling and/or completion operations and may take up to 2 weeks. There are existing gas-gathering facilities in the vicinity of the 4 wells. Peak did not include plans for gas pipelines with the APDs and it is anticipated that those will be submitted under sundry notice at a later date. Peak requires an additional 28,400 feet of 3rd party electrical power installation from the 16,312 feet of existing

overhead powerlines to the proposed wells. The electric run to the wells will be overhead powerlines to the edge of the pad and buried power run to the pumping unit electric motor and other electrically powered devices on site to power the well. Peak will propose any alternation to the power route via sundry or right-of-way application and BLM will analyze such proposal in a separate NEPA analysis. Peak does not anticipate requiring the use of generators for this project during initial well production.

2.3. Conformance to 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, supporting FEISs, 1985, 2003 (2011), and laws including the Clean Air Act, 42 USC 7401-7671q (2006), the Clean Water Act, 33 USC 1251 et seq. (1972), etc.

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 coalbed natural gas (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); see Table 3.1. There are 515 producing oil and gas wells within 4-miles of project area, Wyoming Oil and Gas Conservation Commission (WOGCC, March 18, 2014). 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. (See Table 2.4 for an approximation of the disturbance in the current situation.) 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 have applications for 49 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.

Project Area Description

The proposed wells, access roads and associated infrastructure would be developed within an area of approximately 3,048 acres. Elevations range from 5,305 to 5,363 feet above sea level. Topography ranges from gentle to moderately rugged with steep slopes and deeply incised draws. Much of the project area consists of rolling hills and broad bottom drainages giving way to dissected uplands with steep down-cut channel. This topography was created predominately by summer thunderstorms and spring runoff in ephemeral drainages with steep gradients and fine sediment substrate, which lead to the Powder River. The project area is drained west to east by Fourmile Creek and All Night Creek. These intermittent streams are tributaries of Belle Fourche River. Stream banks are vegetated with tree and shrub species consisting of widely scattered cottonwood trees, patches of greasewood, and dense sagebrush. The overall project area is considered rangeland. Livestock grazing (sheep and cattle) and mineral development are the predominant land uses in the area. (GMEC 2013) Wyoming State Highway 50 lies 2.3-2.6 miles east of the 3 VanBuggenum wells. The Gilbertz 1-13H well is just over 1 mile west of the highway and is in clear line of sight.

Table 3.1. Adjacent Project NEPA Analyses Incorporated Here by Reference by Decision Date

#	POD / Well Name	NEPA Document #	# / Type Wells	Decision Date
1	Iberlin 1-9H and Iberlin 1-9TH wells	WY-070-EA13-224	2 Oil	8/16/2013
2	Barlow Ranch Federal 074974-3NH well	WY-070-EA12-173	1 Oil	8/10/2012
3	Hornbuckle well	WY-060-EA11-181	96 Oil	8/30/2011
4	Crazy Cat East EA	WY-070-EA13-028	36 Oil	3/5/2013
5	Mufasa Fed 11-31H well	WY-070-EA12-062	1 Oil	4/20/2012
6	Lance Sahara POD	WY-070-EA13-072	5 Oil	3/5/2013

Development potential exists for salable minerals, including sand and gravel deposits and clinker (USDI BLM 2009). Salable minerals are mined from surface deposits and outcrops. Alluvial and colluvial deposits consist of gradational and dissected alluvial fans (USDI BLM 2009). The underlying bedrock within the project area consists entirely of the Wasatch Formation. Within the vicinity of the project area, the Wasatch Formation is primarily variegated mudstone with sandstone and conglomeratic lenses (Love and Christiansen 1985). The Wasatch Formation is underlain by the Fort Union Formation, which is further subdivided into three different members. The upper member of the Fort Union Formation, the Tongue River Member, is known to contain thick, continuous coal beds, including the Anderson-Wyodak coal zone (Bartos and Ogle 2002). The Big George coal seam is considered a deeper equivalent to the Anderson-Wyodak coal zone within the Fort Union Formation (Bartos and Ogle 2002).

3.1. Air Quality

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 Environmental Protection Agency (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 2011-2014 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. The Wyoming Air Resource Monitoring System (WARMS) also measures meteorological parameters from 9 sites in the State, and particulate concentrations from 5 of those sites, monitors speciated aerosol (3 locations), and evapotranspiration rates (1 location). The sites monitoring air quality for the Powder River Basin are at Sheridan, South Coal Reservoir, Buffalo, Fortification Creek, and Newcastle. The northeast Wyoming visibility study is ongoing by the Wyoming Department of Environmental Quality (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. Adgate, et al. advanced a hypothesis that air and water quality effects from HF may negatively impact human health but concluded that “major uncertainties” and a “paucity of baseline data” after the drilling of 153,260 wells since 2004. They called for more research funding.

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, Ecological Sites, and Vegetation

Information on major land resource areas and soil types was obtained from Natural Resources Conservation Service (NRCS) information, including the Land Resource Regions and Major Land Resource Areas of the United States (U.S.), the Caribbean, and the Pacific Basin, U.S. Department of Agriculture (USDA) Handbook 296 (USDA 2006) and the Soil Survey Geographic Database (SSURGO). Soil baseline characterization for the project area is based on SSURGO database review and analyses. SSURGO is the most detailed level of soil mapping done by the USDA NRCS. Soils in the project area were identified from the South Campbell County Survey Area, Wyoming (WY605). The NRCS performed the survey using National Cooperative Soil Survey standards.

The BLM uses SSURGO soil survey information to predict soil behavior, limitations, and suitability for a given action. The BLM's long term goal for soil resource management is to maintain, improve, or restore soil health and productivity, and to prevent or minimize soil erosion and compaction. Soil management objectives are to ensure that adequate soil protection is consistent with the resource capabilities. The project is in the Southern Part of the Northern Rolling High Plains Major Land Resource Area (MLRA). This area is in the Missouri Plateau, Unglaciated Section of the Great Plains Province of the Interior Plains. It is an area of old plateaus and terraces that are deeply eroded. Typically, local relief is about 150 to 250 feet. Slopes generally are gently rolling to steep, with wide belts of steeply sloping badlands bordering a few of the larger river valleys. Terraces are common along most of the major river systems in the area. In places, flat-topped, steep-sided buttes rise sharply above the plains.

The dominant soil orders in this MLRA are Aridisols and Entisols. Aridisols are well developed soils that have a very low concentration of organic matter and form in an arid or semi-arid climate. In contrast, Entisols are recent soils that lack soil development because erosion or deposition rates occur faster than the rate of soil development. Area 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. Soils differ with topographic location, slope, and elevation. Soil depths vary from deep in the draw and creek bottoms to shallow in the uplands with very shallow soils on steeper slopes and ridges. Topsoil depths salvageable for reclamation range from 0 inches on miscellaneous areas (such as badlands) to 2 inches on ridges and side slopes to in excess of 6 inches in bottomlands. Slopes vary with steep slopes occurring along drainages. The primary soil limitations in the area are depth to bedrock, low organic matter content, low water holding capacity, and high water erosion potential.

The project area has a total of 13 soil map units. A map unit consists of the named soils or miscellaneous areas that are dominant or co-dominant in extent. Map units may also contain large areas of similar soils or miscellaneous areas not as extensive as the named components, and minor inclusions (dissimilar soils or miscellaneous areas that are minor in extent). The soil series is the most specific category of the national soil classification system, used to designate soil map units. Soil series describe soils having similar chemistry, physical properties, and perform similarly for land uses. Dominant soil map units in the area are in Table 3.2. Soil map units representing 1% or greater are identified. Additional soil information is in the Ecological site descriptions. Ecological site descriptions are soil and vegetation community descriptions compiled by the NRCS for the purpose of resource identification providing management and reclamation recommendations (provided below).

Table 3.2. Map Unit Symbol (MUS) / Dominant Soils Affected by the Proposals

MUS	Map Unit Name	Acres[1]	Project Area
221	Turnercrest-Keeline-Taluce fine sandy loams, 6 to 30% slopes	150.38	12%

MUS	Map Unit Name	Acres[1]	Project Area
236	Vonalee-Terro fine sandy loams, 2 to 10% slopes	22.31	2%
170	Keeline-Tullock loamy sands, 6 to 30% slopes	187.84	16%
158 157	Hiland-Bowbac fine sandy loams, 6 to 15% slopes Hiland-Bowbac fine sandy loams, 0 to 6% slopes	160.50	13%
121 126 127	Cushman-Cambria loams, 0 to 6% slopes Cushman-Theedle loams, 0 to 6% slopes Cushman-Theedle loams, 6 to 15% slopes	56.39	5%
146 148	Forkwood-Cushman loams, o to 6% slopes Forkwood-Ulm loams, 0 to 6% slopes	428.17	36%
214	Theedle-Kishona loams, 0 to 6% slopes	93.30	8%
217	Theedle-Shingle loams, 3 to 30% slopes	27.54	2%
233	Ustic Torriorthents, gullied	85.11	7%

Total=1211.54

Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to a taxonomic class other than those of the major soils. Minor components may have properties and behavioral characteristics divergent enough to affect use or to require different management. Areas of minor components were identified during the onsite investigations especially where the soil pattern was so complex that it was impractical to identify all the soils and miscellaneous areas on the landscape.

The map units that make up the majority of the project area (95%) also hold the soil with least limiting chemical and physical soil properties. The well pads and most of the access roads fall over map unit Forkwood-Cushman loams, 6 to 15% slopes (89%) with Forkwood-Ulm loams, 0 to 6% slopes having complimentary properties. The dominant components of the Forkwood-Cushman loams have a fair rating as a source of topsoil or reclamation material. Topsoil depth ranges from 0 to 23 inches with low organic content of 0 to 2%. The soil has a slightly sodic horizon within 30 inches of the surface. The subsoil below 30 inches in depth is the component is of greatest concern due to the lack of organic matter, high EC, high SAR with high erosion potential. Approximately 80% (up to 41,060 cubic yards) of the material excavated to construct the well pad will be material from the *Cr*[1] soil horizon. In its current undisturbed state, the sterile *Cr* material is isolated from the surface by 30 to 60 inches of overlying soil horizons. However the map units in the project area are all poorly rated as construction material sources due to high clay content and/or low soil strength - a common trait of PRB soils. See the NRCS Soil Survey WY605 – Campbell County (SSURGO) data for more detailed soil information. Ecological Site interpretations include additional site-specific soil information.

3.3. Soils Susceptible to Erosion

Productivity loss is likely to occur on most disturbed soils if erosion is not mitigated. The development of a favorable rooting zone by the weathering of parent rock is much slower than development of the surface horizon. One estimate of this renewal rate is 0.5 tons per acre per year for unconsolidated parent materials and much less for consolidated materials. Loss of organic matter, resulting from erosion and tillage, is one of the primary causes for reduction in production yields. As organic matter decreases, soil aggregate

1 - Soil horizons differ in physical properties such as color, texture, structure, and thickness, and other properties such as chemical and mineral content, consistency, and reactions require special laboratory tests. All properties are used to define types of soil horizons. Soil scientists use the capital letters A**,** B, C**,** Cr and R to identify the soil horizons. Most soils have 3 major horizons -- the surface horizon (A), the subsoil (B**),** and the substratum (C or Cr**).** Hard bedrock, which is not soil, uses the letter R (NRCS 2010).

stability, soil moisture holding capacity, and cation exchange capacity decline (USDA 1998). The NRSC (2010) soil interpretations indicate that some soils in the project area are highly susceptibility to water and wind erosion. This includes the Keeline-Tullock loamy sands, 6 to 30% slopes and Ustic Torriorthents, gullied. Even though most soils in the project area are not highly susceptible to erosion in the undisturbed state, the sub-soils that will be exposed from construction are. Drastically disturbed site such as well pads create an environment that is highly susceptibility to water and wind erosion.

3.4. Reclamation Suitability (Source Material)

The 2 map units that are made up of the soils with most limiting chemical and physical soil properties make up about 23% of the project area and include the Keeline-Tullock loamy sands, 6 to 30% slopes and Ustic Torriorthents, gullied. The dominant components of the Keeline-Tullock loamy sands, 6 to 30% slopes have a poor rating as a source of topsoil or reclamation material. Ustic Torriorthents, gullied is not rated as soil at all. Theedle-Shingle loams, 3 to 30% slopes, have similar limiting soil properties and poor to fair rating as a source of topsoil.

3.5. Ecological Site and Vegetation

The 4 well locations are in the Campbell County South (605) soil Survey Area. Ecological site descriptions provide site and vegetation information needed for resource identification, management, and reclamation recommendations. To determine the appropriate ecological sites for the proposal area, BLM analyzed data from on-site field reconnaissance and from NRCS published soil survey information. A summary of the proposal's Ecological sites and their corresponding map units are in Table 3.3. The onsite inspection confirmed the Sandy-Loamy Ecosite composition with a vegetative community dominated by western wheat grass, sandberg bluegrass, prairie junegrass, needleandthread, blue gramma threadleaf sedge, cheatgrass with a health big sagebrush component. Sagebrush canopy cover ranges from 0-5% with an average height of 14-18 inches. The minor species present include showy peavine, green needlegrass, goatsbeard, plains prickly pear and scarlet globemallow.

Table 3.3. Ecological Sites and Soils Map Unit Symbols (MUS) within the Project Area

MUS	Ecological Site	Acres	Project Area
121	Loamy (10-14NP)	605	50%
126			
127			
146			
148			
214			
217			
157	Sandy (10-14NP)	521	43%
158			
170			
221			
236			
233	Not Rated - Ustic Torriorthents, gullied	85	7%

3.6. Water Resources

WDEQ regulates Wyoming's water quality with EPA oversight. Peak will truck water to the location for drilling and HF operations. Peak is proposing 3 options to obtain drilling and HF water: 1) Snow Fence Stock Reservoir, 2) Spomer 43-18-4374 CBNG well, and 3) Harden #1 stock water well. Refer to the wells specific SUPO (p. 7) and project map D for locations of the water sources and transportation routes. Peak did not disclose the volume to of water needed for drilling and well completion but water will be stored on location in a 41,000 barrel temporary tank. During the initial phase of well production the

produced oil and water will be stored in tanks and then periodically transported by truck off location. The operator did not disclose the disposal methods but p. 9 of the SUPO states that drilling fluids will be taken to either an approved Class II disposal wells or/and an evaporation facility, the Holler1-11.

3.6.1. Groundwater

The area's historical use of groundwater was for stock or domestic water. There are 47 oil and gas wells and 1 water injection well (WIW) in a 1-mile radius of the 4 proposed wells. A search of the WSEO Ground Water Rights Database showed 7 registered stock and domestic water wells and 2 BLM ground water monitor wells within 1 mile of the proposed wells with depths from 120 to 872 feet. The Fox Hills, the deepest penetrated fresh water zone in the PRB, ranges in depth from 7,212 to 7,312 feet at the 4 well locations. Refer to the PRB FEIS for additional information on groundwater, pp. 3-1 to 3-36. The 2004 EPA study found it unlikely that HF CBNG wells would contaminate ground water. The EPA has an expansive, on-going study looking at more aspects of HF and has yet to issue findings. A 2011-2012 Geological Survey study found no groundwater effects from thousands of deep HF oil and gas wells. Adgate, 2014, Warner 2012, and news sources reveal a minor controversy over a state's non-disclosure of proprietary HF fluids while release decisions receive administrative and court reviews.

3.6.2. Surface Water

The project area is in the Fourmile and All Night Creek drainages - tributaries to the Belle Fourche River. Most of the area drainages are ephemeral (flowing only in response to a precipitation event or snow melt) to intermittent (flowing only at certain times of the year when it receives water from alluvial groundwater, springs, or other surface source). The channels are primarily well vegetated grassy swales, without defined bed and bank. See the PRB FEIS for a surface water quality discussion, pp. 3-48 to 3-49.

3.7. Minerals – Locatable, Leasable, Salable

There are a total of 11 individual mining claims within the proposal's 4 wells. Although mining claimants are not required to list the minerals they are locating their claims for, given the number of uranium projects in this area, these mining claims were likely for uranium. There are also 3 existing monitor wells in the project area to test water quality and hydrology for potential solution uranium mining.

3.8. Wetlands/Riparian

Fourmile and All Night Creeks are included in the National Wetlands Index listed as freshwater emergent wetlands. The 4 proposed well pads and access road are do not impact these stream channels, however, there is the potential that gas and/or oil pipelines constructed by '3d party' operators could directly impact wetlands. Other ephemeral drainages, which flow into intermittently, dissect the area. The ephemeral drainages have gentle slope with well vegetated bottoms with numerous small head-cut features.

3.9. Invasive or Noxious Species

BLM discovered black henbane, a state-listed noxious weed, persists in the project area by a search of inventory maps and/or databases. Neither black henbane nor other state-listed noxious weeds were observed during subsequent field investigation. Gelbhard, 2003 and Duniway 2010, showed that surface disturbances increase the proliferation of invasive or noxious species out to 0.5 miles or more from the disturbance while correspondingly compromising native communities in the same footprint. Cheatgrass (*Bromus tectorum*) and to a lesser extent, Japanese brome (*B. japonicus*) exist in the affected environment. These species are found in high densities and numerous locations throughout NE Wyoming. Balch, 2013, linked the proliferation of cheatgrass in semi-arid environments to the increased frequency and severity of wildfire.

3.10. Fish and Wildlife

The PRB FEIS identified wildlife species occurring in the PRB, pp. 3-113 to 3-206. Peak employed Grouse Mountain Environmental Consultants (GMEC) to complete wildlife surveys and habitat

assessment within 0.5 miles of the project area. Likewise, the BLM wildlife biologists performed a habitat assessment in the project area during the onsite field visits. The 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, Wyoming Game and Fish Department (WGFD) datasets, and the Wyoming Natural Diversity Database (WYNDD) to evaluate the affected environment for wildlife species that may occur in the project area. The rangeland at the well locations and the immediate area has been intensively grazed leaving the area with sage brush cover that ranges from sparse with standing vegetation to dense in small patches with good understory. In general, the area habitat is rolling hills of grassland with a healthy sage brush component.

3.10.1. Big Game

The big game species occurring in the project area are mule deer, pronghorn, and white-tailed deer. Yearlong use is when a population of animals makes general use of suitable documented habitat sites in the range on a year-round basis. Animals may leave the area under severe conditions. Winter-yearlong use is when a population or a portion of a population of animals makes general use of the documented suitable habitat sites in this range on a year-round basis, but during the winter months there is a significant influx of additional animals into the area from other seasonal ranges. The project is in the range of the Pumpkin Buttes mule deer and pronghorn herds. The mule deer herd was 13% below the population objective in 2010 (WGFD 2011a). The herd declined 21.6% since 2006 falling below population objectives for the past 2 years. The white-tailed deer herd on the other hand was 100% above objective and has been above objectives for the past 10 years. The pronghorn herd was 46% above population objectives and has been for the past 12 years. The PRB FEIS discussed the affected environment for pronghorn, mule deer, and white-tailed deer on pp. 3-117 to 3-122, pp. 3-127 to 3-132, and 3-122 to 3-127 respectively.

3.10.2. Raptors

The PRB FEIS discussed the affected environment for raptors, pp. 3-141 to 3-148. There 2 are raptor nests within 0.5 miles of the proposed well site. GMEC completed 3 surveys between April 15 and June 10, 2013 to search for undocumented raptor nests with special attention given to rock outcrops, cliffs, ridges knolls and other likely areas. Neither of the 2 nests were located by GMEC during their surveys and were reported as gone. No new nests were located and known nest locations within 1 mile of the well location were noted to be gone. Raptor nesting habitat is present thought out the area an unidentified raptors in flight were noted by the BLM during the onsite inspection.

3.10.3. Migratory Birds

The PRB FEIS discussed the affected environment for migratory birds, pp. 3-150 to 3-153. Migratory birds migrate for breeding and foraging at some point in the year. The BLM-Fish and Wildlife Service (FWS) Memorandum of Understanding (MOU) (2010) promotes migratory birds' conservation, per Executive Order 13186 (Federal Register V. 66, No. 11). BLM includes migratory birds in every NEPA analysis of actions having potential to affect migratory bird species of concern to fulfill obligations under the Migratory Bird Treaty Act (MBTA). BLM encourages voluntary design features and conservation measures agreeing with those in the programmatic mitigation in Appendix A of the PRB ROD.

Habitats occurring near the proposed wells include sage-brush steppe grasslands, mixed grass prairie, and mature deciduous trees. Many species that are of high management concern use these areas for 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 FWS's Birds of Conservation Concern (BCC 2008) report identifies species of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act. Species in this list that have the potential to occur in the project area are: Brewer's sparrow, sage

thrasher, loggerhead shrike, short-eared owl, and grasshopper sparrow. Of these, 3 species are identified on the BLM Wyoming Sensitive Species list.
The WGFD Wyoming Bird Conservation Plan (Nicholoff 2003) identified 3 groups of Wyoming's high-priority bird species: Level I – those that clearly need conservation action, Level II – species where the focus should be on monitoring, rather than active conservation, and Level III – species that are not of high priority but are of local interest. Species likely occurring in the project area are in Table 3.5.

Table 3.5. Migratory Birds Occurring in Shrub-Steppe Habitat in NE Wyoming (Nicholoff 2003)

Level	Species	WY BLM Sensitive	Species	WY BLM Sensitive
Level I	Ferruginous hawk	Yes	Sage sparrow	Yes
	Brewer's sparrow	Yes		
Level II	Lark bunting	No	Sage thrasher	Yes
	Lark sparrow	No	Vesper sparrow	No
	Loggerhead shrike	Yes		

Several migratory species are also BLM special status (sensitive) species (SSS). Those known or suspected of occurring in the project area include Baird's sparrow, Brewer's sparrow, ferruginous hawk, loggerhead shrike, long-billed curlew, sage sparrow and sage thrasher.

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

Project effects will not impact threatened, endangered, candidate, and proposed species occurring in the area beyond the level analyzed in the PRB FEIS. A discussion of the affected environment is in the PRB FEIS, pp. 3-174 to 3-179. A description of habitat and presence for threatened and endangered species is in Table 4.3, in Section 4.9.5 below. Ute ladies'-tresses (ULT) habitat is not present in the project area and the species is not expected to occur.

3.10.4.1. Ute Ladies'-Tresses Orchid (ULT)

The project area was surveyed in 2013 for ULT as a listed species under the Endangered Species Act (ESA). Suitable habitat or individuals was not present (GMEC 2013). Soil types were primarily loamy with moderately high clay content. However, suitable ULT habitat has been modeled and mapped in the project area at the NENE, NENW and NWNE Section 1, T43N/R75W. No populations of the ULT are present in Campbell County. The closest known population is near Wind Creek in Converse County, 16 miles southwest. The nearest known suitable habitat for ULT is 4 miles to the southeast.

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

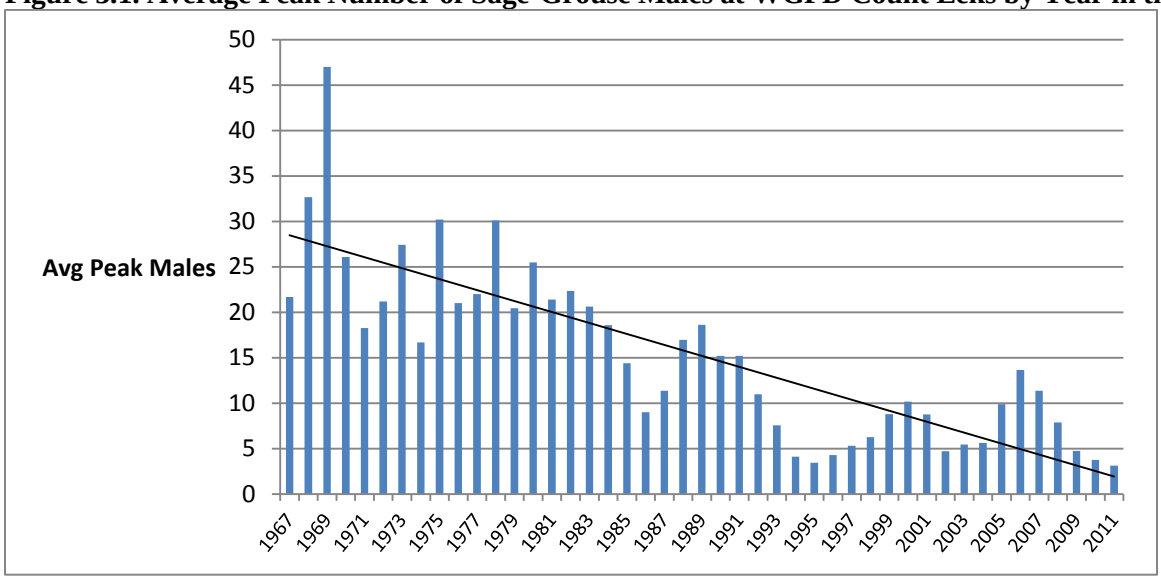
The PRB FEIS has a detailed discussion on GSG ecology and habitat, pp. 3-194 to 3-199. Subsequently the FWS determined the GSG warrants federal listing as threatened across its range, but precluded listing due to other higher priority listing actions, 75 Fed. Reg. 13910 to 14014, Mar. 23, 2010; 75 Fed. Reg. 69222 to 69294, Nov. 10, 2010. GSG are a WY BLM special status (sensitive) species (SSS) and a WGFD species of greatest conservation need because of population decline and ongoing habitat loss. The 2012 population viability analysis for the Northeast Wyoming GSG found there remains a viable population of GSG in the PRB (Taylor et al. 2012). However, threats from energy development and West Nile virus (WNv) are impacting future viability (Taylor et al. 2012). The BLM IM WY-2012-019 establishes interim management policies for proposed activities on BLM-administered lands, including federal mineral estate, until RMP updates are complete.

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 show there are 10 GSG leks within 4 miles of the project area. 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 GSG population in northeast Wyoming is exhibiting a steady long term downward trend, as measured by lek attendance (WGFD 2011b). Figure 3.1 illustrates a 10-year cycle of periodic highs and lows. Each subsequent population peak is lower than the previous peak. Research suggests that the declines since 2001 are a result, in part, of energy development (FWS 2010, Taylor et. al. 2012). Impacts from oil and gas development are most discernible at the spatial scale of 20 km (12.4 mi) (Taylor et al. 2012). These findings echo results from previous studies conducted in the basin, where biologists observed basin-wide population declines (Walker et al. 2007). There are 31 documented leks within 12.4 miles of the 4 new well sites, none of which are in GSG priority habitat. Currently there are 6,764 wells (2,892 are abandoned) within 12.4 miles of the 31 leks, an area of 1,347 square miles.

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



Site Specific Habitat

The project area is approximately 1.8 miles from the nearest GSG lek, Mud Spring Creek, and 18 miles from GSG priority habitat, as identified in EO 2011-5, Greater Sage-grouse Core Area Protection. GSG habitat models indicate that the project area may contain high quality GSG nesting habitat (Walker et al. 2007). The BLM confirmed suitable nesting and brood rearing habitat exists throughout the area surrounding the 4 new well sites and access roads in excess of the model's prediction. Suitable habitat exists within 2 miles of the proposals. Sagebrush stands north and west of the project area consist of 10-12% canopy cover with an average height of 14-16 inches. Sagebrush to the east and south consist of 5-8% canopy cover with an average height of 12-14 inches (GMEC 2013). During the onsite inspection, the BLM observed GSG droppings consistent with brooding GSG at the Gilbertz 1-13H location.

3.10.6. Special Status (Sensitive) Species (SSS)

Sensitive species are discussed in the PRB FEIS pp. 3-189 to 3-201. Wyoming BLM manages habitats for Sensitive Species and Species of Concern to preclude listings as threatened or endangered species. The

authority for the sensitive species policy and guidance comes from the Endangered Species Act (ESA) of 1973, as amended; the FLPMA of 1976; the U.S. Department of the Interior (USDI) Manual 235.1.1A, and BLM Manual 6840. The policy goals are to:

- Maintain vulnerable species and habitat components in functional BLM ecosystems
- Ensure sensitive species are considered in land management decisions
- Prevent a need for species listing under the ESA
- Prioritize needed conservation work with an emphasis on habitat

Only potentially affected species are discussed below. Evaluations of all Wyoming BLM-Sensitive Species are in Appendix B of this EA, Table B.1. For the species listed below, where habitat is present but there were no recorded observations, surveys specifically targeting these species were not conducted unless otherwise stated. Some may be present, but are unrecorded, and others likely are not present.

3.10.6.1. Black-tailed Prairie Dog

The PRB FEIS discussed the affected environment for black-tailed prairie dogs, p. 3-179. The black-tailed prairie dog was on the list of candidate species for federal listing in 2000 (USFWS 2000). It was removed from the list in 2004. Comparisons with 1994 aerial imagery indicated that black-tailed prairie dog acreage remained stable from 1994 to 2001, but aerial surveys in 2003 indicated that approximately 47% of the prairie dog acreage was impacted by Sylvatic plague and/or control efforts (Grenier et al. 2004). Due to human-caused factors, black-tailed prairie dog populations are now highly fragmented and isolated (Miller et al. 1994). Most colonies are small and subject to potential extirpation due to inbreeding, population fluctuations, and other problems that affect long term population viability, such as landowner poisoning and disease (Primack 1993, Meffe and Carroll 1994, Noss and Cooperrider 1994). Records show the nearest known black-tailed prairie dog colony lies approximately 2.9 miles southwest of the project area. GMEC did not observe any prairie dog colonies during surveys.

3.10.6.2. Bald Eagle

The PRB FEIS discussed the affected environment for bald eagles, p. 3-175. The bald eagle was a threatened species when BLM approved the PRB FEIS. FWS removed the bald eagle from the ESA in 2007. The bald eagle has protection under the Bald and Golden Eagle Protection and the Migratory Bird Treaty Acts. Mature cottonwoods along Fourmile and All Night Creeks are sparse and insufficient to support the construction of a large bald eagle nest or substrate that could support roosting eagles within 1 mile of the project. GMEC did not did not survey for roosting bald eagles within 1 mile of the project area during winter roost surveys (GMEC 2013). Surveys dating back to 2005 did report roosting bald eagle in the vicinity of the project area - the nearest being over a mile away, in December 2009.

3.10.6.3. 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 Powder River Basin, this hawk inhabits grasslands and sage shrublands in the PRB. They typically nest on the ground, increasing its exposure to ground predators. Suitable foraging habitat and nesting sites for the ferruginous hawk are present throughout the project area.

3.10.6.4. Western Burrowing Owl

The affected environment for the Western burrowing owl (burrowing owl) is discussed in the PRB FEIS on p. 3-186. Current population estimates for the U.S. are not well known but trend data suggest declines throughout the burrowing owls' North American range (McDonald et al. 2004). Primary threats are habitat loss and fragmentation, mostly due to intensive agricultural and urban development and habitat degradation, due to declines in populations of colonial burrowing mammals (Klute et al. 2003).Historic survey information at the BFO indicates there are no burrowing owl nests within 0.25 mile of the project

area. The lack of an active prairie dog colony within the vicinity of the project area negates the presence suitable western burrowing owl habitat in the project area as documented.

3.10.6.5. Mountain Plover

The PRB FEIS discussed the affected environment for mountain plover on pp. 3-177 to 3-178. FWS proposed the mountain plover as a threatened species under the ESA when the PRB EIS was written. FWS withdrew the proposal. On May 12, 2011, after a review of the scientific and commercial information, the FWS, found mountain plover not warranted for listing, citing threats to its habitat as less significant than previously thought. Suitable habitat for mountain plover in the project area is limited and they typically seek out large prairie dog colonies (10 or more acres). Surveys for nesting mountain plovers were conducted by GMEC in 2013 following the FWS guidelines for mountain plover surveys (FWS 2002a). Surveys were conducted and extended buffer of 0.25 mile from proposed construction areas. No suitable mountain plover habitat, individuals or nests were observed during the surveys.

3.10.6.6. 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, and the species is suspected to occur.

3.10.6.7. Northern Leopard Frog

The affected environment for northern leopard frog is discussed in the PRB FEIS on p. 3-181. Suitable habitat is present along Fourmile and All Night Creeks and tributaries as well as the 2 stock reservoirs and within the wetland and riparian areas of the project area. There are no recorded observations of northern leopard frogs in the project area, but it is suspected to be present.

3.11. 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 found in BFO, refer to the *Draft Cultural Class I Regional Overview, Buffalo Field Office* (BLM, 2010). A Class III (intensive) cultural resource inventory (BFO project no. 70130096) was performed to locate historic properties which may be impacted by the proposal. The Pumpkin Buttes (PB) (48CA268) are a series of 4 prominent buttes which are eligible for the National Register of Historic Places. The BLM (in consultation with 15 tribes and the Wyoming State Historic Preservation Office (SHPO) also determined PB is a Traditional Cultural Property (TCP). A TCP is a historic property that is directly associated with cultural practices or beliefs of a community that are rooted in that community's history and are important in maintaining their continuing cultural identity. The BLM established a boundary for the PBTCP in consultation with the tribes and SHPO. The site boundary is based on topographic lines, varying in elevation from butte to butte. In 2009, the Buffalo BLM and Wyoming SHPO signed the Programmatic Agreement Between the Bureau of Land Management and the Wyoming State Historic Preservation officer Regarding Mitigation of Adverse Effects to the Pumpkin Buttes Traditional Cultural Property From Anticipated Federal Minerals Development, Campbell County, Wyoming (PB PA) with Appendices A-G; all incorporated here by reference. The PBPA describes types of mitigation that operators can apply to projects within 2 miles of Pumpkin Buttes to reduce adverse effects. The types of mitigation primarily involve impacts to the view shed, or setting, of the topography surrounding the buttes. These references also address the PB TCP or the subject matter and BLM incorporates them by reference here: Buffalo RMP Record of Decision 2003 (pp. 8-9, 18); 43 CFR 1610.3-2, National Historic Preservation Act of 1966; YPC Lancer CX3, WY-070-390CX3-13-57, pp. 6-7, 2013; WPX North Butte 4, et al., EA, WY-070-EA12-123, Sections 3.3 and 4.2.3 (all), 2013; and the analysis and decisions found in WY State Director Review (SDR)-2010-030, pp. 25-28, and 31-33.

3.12. Transportation

The main access to the proposed wells is off of Wyoming State Highway 50. There is 1 existing culvert 18 inches in diameter on a secondary road segment that Peak proposes to use for well access. The two main secondary road surfacing materials used in the PRB are gravel and clinker (scoria). Gravel is a hard / durable material and by definition it is loose rock that has a particle distribution from 0.8 to 2.5 inches in diameter. One cubic yard of gravel weighs around 3,000 pounds. Clinker rock is a red-brown shale that was baked and fused by in situ burning of underlying coal. Clinker found in the PRB (called porcelanite) has similar properties to ceramic; it readily breaks into smaller, sharp-edged fragments. Its weight varies depending upon the parent material but it usually light, having a specific gravity greater than one.

4. ENVIRONMENTAL EFFECTS

This section describes the environmental effects of Alternatives A and B. This analysis addresses the direct and indirect effects of implementing the proposed wells, the cumulative effects of the proposed wells, combined with reasonably foreseeable federal and non-federal actions, identifies and analyzes mitigation measures (COAs), and discloses any residual effects remaining, following mitigation.

4.1. No Action Alternative.

BLM analyzed the no action alternative as Alternative 3 in the PRB FEIS and it subsequently received augmentation of the effects analysis in this EA through the analysis of mineral projects, their approval, and construction; and through the analysis and approval of other projects. BLM incorporates by reference these analyses in this EA; see Table 3.1 above. This updated the no action alternative and cumulative effects. The project area has about 62 acres of surface disturbance from existing roads, well pads, and oil and gas facilities. Under the no action alternative, on-going well field operations would continue with the development of single and multi-well pads as they are approved by the WOGCC. The production and the drilling and completion of these new wells would result in noise and human presence that could affect resources in the project area; these effects could include the disruption of wildlife, the dispersal of noxious and invasive weed species, and dust effects from traffic on unpaved roads. Present fluid mineral development in the PRB is under half of that envisioned and analyzed in the PRB FEIS. There is only a remote potential for significant effects above those identified in the PRB FEIS to resource issues as a result of implementing the no action alternative.

4.2. Alternative B, Proposed Action (Proposal)

This analysis presumes Peak and BLM enforce best management practices associated with the APDs' drilling plans and surface use plans of development (see the administrative record), Conditions of Approval and recommended mitigation measures as they apply as well as Onshore Oil and Gas Order No.'s 2 and 7.

4.3. Air Quality

In the project area, air quality impacts would occur during construction (due to surface disturbance by earth-moving equipment, vehicle traffic fugitive dust, well testing, as well as drilling rig and vehicle engine exhaust) and production (including well production equipment, booster and pipeline compression engine exhaust). The amount of air pollutant emissions during construction would be controlled by watering disturbed soils, and by air pollutant emission limitations imposed by applicable air quality regulatory agencies. BLM incorporates by reference the analysis found in the August 2012 Lease Sale EA, WY-070-EA12-44, pp. 45-51 (air quality, greenhouse gas emissions, and visibility). 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.

4.4. Soils, Ecological Sites, and Vegetation

4.4.1. Direct and Indirect Effects

The PRB FEIS analyzed direct and indirect impacts to soils associated with fluid mineral development. For these affects refer to p. 4-134 of the PRB EIS.

Constructed Well Pad

The greatest impacts to the soil resources associated with this project include the construction of pads larger than the typical size considered by the PRB FEIS. The well pads to facilitate horizontal well drilling and HF operations may exceed 5.5 acres including cut and fill slopes depending on site topography. Initial pad size is reduced per APD through interim reclamation and, if the well produces, the industry practice is drilling multiple wells from 1 pad. It can cost $7-10 million per well so prudent economics require a company to find a proven producer prior to designing and drilling new wells from the pad. Of course the drilling of additional wells from the pad drives down the average well surface disturbance; and if the first well is unsuccessful then reclamation accounts for the entire surface disturbance. The other unanticipated impact associated with hydraulic fracturing involves the amount of large truck traffic (between 200 and 700 trucks/well) to transport water storage containers, water and other hydraulic fracturing materials to the location as well as truck traffic anticipated for removing the storage tanks and flow-back fluid from the hydraulic fracturing.

Anticipated impacts occurring include soil rutting and mixing, compaction, increased erosion potential, and loss of soil productivity. The most notable impacts would occur in association with the construction of well pads, staging areas, and roads. Construction of these facilities requires grading and leveling, with the greatest level of effort required on more steeply sloping areas. Construction activities mix the soil profiles with a corresponding loss of soil structure. Mixing may result in removal, dilution, or relocation of organic matter and nutrients to depths where it would be unavailable for vegetative use. Less desirable inorganic compounds such as carbonates, salts, or weathered materials could be relocated and have a negative impact on revegetation.

Rutting affects the surface hydrology of a site as well as the rooting environment. The process of rutting physically severs roots, thus reducing soil aeration and infiltration thereby degrading the rooting environment. Rutting may result in topsoil and subsoil mixing, thereby reducing soil productivity. Rutting also disrupts natural surface water hydrology by diverting and concentrating water flow thus accelerating erosion. Soil mixing typically results in a decrease in soil fertility and a disruption of soil structure.

Soils compaction results from the construction of wells and associated facilities, continued vehicle and foot traffic as well as operational activities. 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 leads to a loss of soil structure; decreased infiltration, permeability, and soil aeration; as well as increased runoff and erosion. Increased erosion can lead to a decrease in soil fertility and an increase in sedimentation. The duration and intensity of these impacts would vary according to the type of construction activity to be completed and the inherent characteristics of the soils to be impacted.

The potential for erosion would increase through the loss of vegetation cover and soil structure as compared to an undisturbed state. Soil productivity would decrease, primarily as a result of profile mixing and compaction along with the loss in vegetative cover. These impacts would begin immediately as the soils would be subjected to grading and construction activities and impacts would continue for the term of operations. The impacts on soils would move to a steady state as construction activities were completed and well production/maintenance operations begin.

An important component of soils in Wyoming's semiarid rangelands, especially in the Wyoming big sagebrush cover type, are biological soil crusts, or cryptogamic soils that occupy ground area not covered

with vascular plants. Biological soil crusts are important in maintaining soil stability, controlling erosion, fixing nitrogen, providing nutrients to vascular plants, increasing precipitation infiltration rates, and providing suitable seed beds (Belnap et al. 2001). They are adapted to growing in severe climates; however, they take many years to develop (20 to 100) and can be easily damaged or destroyed by surface disturbances associated with construction activities. These impacts, singly or in combination, could increase the potential for valuable soil loss, reduction in soil quality, invasive/noxious/poisonous plant spread, invasion and establishment, and increased sedimentation and salt loads to the watershed system, if applicable mitigation measures are not used.

Pad Construction with a Closed Loop System

Peak proposes a pad design for the 4 wells that would be using a closed loop system. Drilling water specifically would be stored on location in three, 500 bbl HF tanks and drilling fluids would be stored in two, 500bbl HF tanks. A "shaker" separates the cutting from the fluids which are removed to two, 60 by 150 foot, lined bermed containment areas on location. Minimal additional excavation is required to construct the containment areas. After the well is drilled and completed, the dried cuttings would be either be buried on location or disposed of at an authorized facility. Drilling fluids would be disposed of at an authorized facility; See p. 9 of the SUPO. The total working pads range from 5.4 to 8.1 acres with additional space needed to store excess spoil and topsoil which if stock piled 6 feet high will require approximately 1 additional acre per location. The entire disturbance area will be enclosed within a fenced area to exclude livestock. This closed loop alternative is consistent with Wyoming BLM's Instruction Memorandum (IM)-WY-2012-007.

Access Road

There is increased soil disturbance associated with construction and/or upgrade of roads with running surface often 18 feet or more, with sub grade ranging from 20 to 28 feet, greatly increasing the soil disturbance depending on site topography. 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. The operator's proposed crown and ditched access road has minimal cuts/fills across relatively flat terrain. The operator is responsible for having the construction of the road meet Bureau standards. The road should be completed, including any culverts, cattleguards and required surfacing, before the drilling rig or other drilling equipment moves onto the pad in order to protect erodible soils.

Operator propose to use seed mixes for the 4 well locations and roadways developed by the surface owners that is comprised primarily of grass species with the goals being to revegetate the area and provide forage opportunity for livestock. The seed mix does compliment the soil types and ecological sites found in the project area, and the mixing of soil horizons in disturbed areas. The BLM will evaluate reclamation success using the requirements in the BLM State Wide Reclamation Policy found at: http://www.blm.gov/wy/st/en/programs/reclamation.

4.4.2. Soils Susceptible to Erosion

Areas that are difficult to reclaim include drastically disturbed sites, steep slopes, sandy sites, and areas where the parent material is very shallow (typically less than 10 inches deep). Sandy sites and areas where the parent material is very shallow were identified during initial site visits to the well sites. Approximately 6,430 feet of access road to the VanBuggenum 1-11H, the Gilbertz 1-13H, as well as the southwest corner of the Gilbertz 1-13H well pad are proposed over soils highly susceptibility to water and wind erosion; a total of 8.1 acres of surface disturbance. Other access roads avoid these areas. All access

roads are to be crown and ditched to accommodate runoff and minimize soil erosion. Other important though less visible soil characteristics were identified in the project area using SSURGO Data, onsite investigation, and project design review, these are listed below.

- Predicted disturbance would impact soils by exposing material deep in the soil material, which may have chemical and physical properties contributing to limited reclamation potential (LRP) properties.
- Amount of bare ground, physical and chemical properties, and site conditions create sites classified as highly erosive to wind and water erosion.
- The proposed cut and fill slopes 1.5:1 (67%) will contribute to the erosion classification and exceed the 25% slope restriction.

During the construction and drilling phase of the project, the operator plans to maintain cut and fill slopes at 1.5H: 1V slopes. This slope is very steep equivalent to 67% slope and is very challenging if not impractical to stabilize, and revegetate to meet the requirements of the Wyoming Reclamation Policy. These constructed slopes will be bare ground void of vegetation with the fill slopes being less stable due to soil mixing. Sediment transport from the surface disturbance areas is likely to be extensive even with proposed mitigation measures implemented.

The MSUP states production facilities will have cut and fill slopes reduced to3V:1H (33% slope). These slopes exceed 25%. These slopes need to have mitigation applied to reduce the slope length to address erosion and stability issues. Highly erosive soils due to the loss of vegetation and the physical and chemical properties encountered make the site susceptible to wind erosion. Slope length and steepness are components in defining water erosion potential thus creating a highly erosive site to wind and water erosion. Modeled erosion amounts far exceeded the soil loss tolerance factor of the soils in the area, therefore expedient stabilization is required.

The reclamation plans developed by Peak and BLM applied COAs that would be implemented to mitigate or reduce the impacts associated with construction and operation. Interim reclamation consists of minimizing the footprint of disturbance by reclaiming all portions of construction disturbance not needed during production operations. Final reclamation would meet the guidelines outlined in the statewide reclamation policy. These actions would notably reduce intensity of the impacts to soils as well as the estimated time it would take to return the disturbed soils to a stable and productive state.

4.4.3. Reclamation Potential

The soil depth identified in the SSURGO data ranges from 14 to 60 inches deep (A and B Horizons) at the 4 well locations; an adequate depth to isolated or buffer the rooting zone from the C and Cr soil horizons that inhibit plant growth. The predicted cut depth exceeds the identified soil depth, thus impacting C and Cr horizons which are described as “little affected by pedogenic processes”, or unaltered parent material. The physical and chemical properties of the material is variable and very limiting in its potential to support plant growth, variable in erosion potential and suitability for construction material. During the construction process, the topsoil A Horizon will be stripped and the underlying soil horizons will be inverted and mixed; thus the exposure and creation of material described as Limited Reclamation Potential areas. During the construction process, this material is mixed and exposed to the surface creating and opportunity to contaminate surface soil. Even after the well pad is reduced during the production phase of the project, topsoil depth distributed over this parent material will be 10 inches or less. Suitable topsoil and subsoil material to an adequate depth is required to support desired vegetation.

The majority of the proposed access road to the Gilberts1-13H (~5,300 feet) lies over the map unit poorly rated as topsoil or reclamation source material, Keeline-Tullock loamy sands, 6 to 30% slopes.

4.4.4. Cumulative Effects

For details on expected cumulative impacts, refer to the PRB FEIS, pp. 4-151. The PRB FEIS defines the designation of the duration of disturbance (pp. 4-1 and 4-151). Most soil disturbances would be short term impacts with expedient interim reclamation and site stabilization. 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, if applicable mitigation measures are not used.

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.

4.4.5. Mitigation Measures

Peak will reduce impacts to vegetation and soils from surface disturbance by following its plans, using BLM applied mitigation, and the BLM Wyoming Reclamation Policy. These practices, as well as other mitigation measures identified in the MSUP and COAs, will results in less surface disturbance and overall environmental impacts. The use of a closed loop system will reduce surface disturbance minimize impacts to the soil resource. Peak will stabilize areas not needed for production during and within 30 days after construction is initiated. For safety of travel, to reduce rutting and increase traction, Peak place a minimum average of 4 inches of aggregate across the roadway. To protect erodible soils, all road construction should be completed, including any culverts, cattleguards, and required surfacing, before the drilling rig or other drilling equipment moves to the pad. Peak will ensure that the construction of the road meets the design criteria and BLM standards. Peak will provide erosion control along all cut and fill slopes to achieve successful reclamation. Erosion control features include water bars, mulching, straw crimping, or erosion blankets, etc. Peak will provide for construction oversight of the well pad.

Straw/Excelsior wattles are most effective as erosion control if applied on slopes less than 3H:1V. In the absence of manufacture's specifications included in the operator's MSUP, the minimum spacing requirements will be as follows:

Slope	6-inch waddle	9-inch waddle	12-inch waddle
≤4H:1V	20 feet	40 feet	60 feet
3H:1V	15 feet	30 feet	45 feet
2H:1V	10 feet	20 feet	30 feet
1H:1V	5 feet	10 feet	15 feet

Topsoil stored for a period greater than 90 days will not exceed piles of 10 feet in depth and will be seeded with the BLM-approved seed mix to prevent wind and water erosion.

The well pad cut and fill slopes at the 1.5V:1H and 2V:1H constructed slopes are features that exhibit severe erosion potential that will require disturbed areas to be stabilized (stabilization efforts may include mulching, matting, soil amendments, et. cetera) in a manner which eliminates accelerated erosion and stabilizes the site in accordance with the Wyoming Reclamation Policy. Stabilization efforts shall be finished within 30 days of the initiation of construction activities. This applies to all surface disturbances within the 4 constructed well pad areas.

Production Pad
Erosion control fabric used for reclamation of steep slopes should be photodegradable or biodegradable. Non-photodegradable/biodegradable erosion control fabric will be removed from the federal leases following establishment of a self-perpetuating native plant community and sustained soil stability.

In the absence of manufacture's specifications included in the operator's MSUP, erosion control fabric will be installed as follows:
a. The fabric will be 'keyed' into the slope by digging a small trench at the top of the slope;
b. Lay the top end of the material into the trench to line it;
c. To line it the edge is folded underneath itself and then it is secured using staples;
d. The trench is then filled in to the previous soil level; and
e. Fabric should be overlapped no less than 1 foot on edges and stapled on 3 foot spacing and at every seam.

Stabilization of steep slopes greater than 4H:1V will include but is not limited to the following components to minimize soil erosion and loss of seed:
a. Surface roughening/pocking or scarification perpendicular to the slope;
b. Install slope breakers such as waddles and water bars at the appropriate spacing;
c. Seed with appropriate seed mix; and
d. Apply straw mulch or bio/photodegradable erosion control fabric on highly erodible soils.

4.4.6. Residual Effects
Residual effects across the project 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. In spite of the above residual effects, the BLM considers that Alternative B with is within the parameters for surface disturbance and surface disturbance reclamation in PRB FEIS ROD**.**

4.5. Ecological Sites and Vegetation
4.5.1. Direct and Indirect Effects
The PRB FEIS discusses most direct and indirect effects to ecological sites and vegetation, p. 4-153 to 4-164. The proposed action would impact the common plant communities that occur on the site and the transition between the communities. Other impacts anticipated to occur include those in the direct and indirect effects listed above under soils section. Direct effects to ecological sites would occur from ground disturbance caused by construction of well pads, ancillary facilities, associated pipelines, 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 would result in loss of vegetation and prevent reclamation for the life of the project. Sagebrush does not regenerate easily after human disturbance such as urban or agricultural development, or even after natural occurrences such as wildfire. It takes years, even generations, for sagebrush to fully grow back. Sagebrush still has not returned to some areas of the Columbia Basin burned by a large fire 40 years ago (Pacific Northwest National Laboratory Shrub Steppe Ecology Series May 2010).

Soil impacted by the road and well location in the project area is susceptible to wind and water erosion especially once stripped of vegetation. This is primarily due to the low annual precipitation, low organic matter content, physical and chemical properties of the soils in the area. Soils are either well drained or excessively drained which results in low water holding capacity, and low potential for restoration. These properties create unstable soils and physical and chemical properties that limit plant growth along the access routes. These locations have very thin fragile topsoil with fragile root systems used to stabilize the

surface and allow plant growth. Authorizations for surface disturbing actions are based upon the assumptions that a disturbance can ultimately be successfully reclaimed.

4.5.2. Cumulative Effects

The PRB FEIS discusses the cumulative effects to ecological sites, pp. 4-153 to 4-172. Cumulative effects to ecological sites include the further alteration of disturbance regimes from the increased disturbance, increase in noxious weeds, and alterations in vegetation community's diversity and cover.

4.5.3. Mitigation Measures

Implementation of the soils COAs and mitigation measures listed above the operator's Integrated Weed and Pest Management Plan and the BLM listed in the SUPO (specifically Plans for Reclamation of the Surface) will reduce surface disturbance impacts to ecological sites and vegetation. See the administrative record for some of these documents. BLM selected seed mixes which contain native grasses and forbs could restore disturbed areas to properly functioning vegetation communities with the exception of sage-brush since it's not in the current seed mixes. BLM offers the same protections to privately owned surfaces that are disturbed as a result of federal mineral development as those administered by the BLM and therefore BLM developed a site specific seed mix for the access/pipeline corridors for the proposed project. The company will apply these mitigation measures to the 4 well pads which will require expedient reclamation. The surface owner may choose a seed mix that may be more beneficial for grazing. The operator will submit a site specific reclamation plan and adapted to the drastically altered conditions and utilizing modern technologies.

A 30 day stabilization requirement is applied to all cut and fill slopes of the well pad and access/pipelines which will have impacts to sensitive areas identified in the field. If applied correctly, the seed mix which contains native grasses, in addition to residual seed from forbs, and shrubs could restore disturbed areas to properly functioning vegetation communities. The private landowner has chosen a seed mix only grass species that is more beneficial to ranch operations. See mitigation section in the soils section above for a full description of the policy as it applies equally to ecological sites.

4.5.4. Residual Effects

Residual effects were also identified in the PRB FEIS, p. 4-408 such as the loss of vegetative cover, despite expedient reclamation, for several years until reclamation is successfully established. The alteration of biodiversity of ecological sites could result from disturbance, alterations in vegetation in reclaimed areas, and the spread and establishment of weed species. The production portion of the well pad and the access roads will present a long term challenge for BLM and the operator to stabilize; interim reclamation which should create a stable functioning ecosystem that prepares the site for eventual final reclamation according to guidance provided in the Wyoming Reclamation Policy. BLM developed site specific seed mixes by ecological site and precipitation zone in the PRB, but can only require their use on BLM surface. The seed mix chosen for private land is selected by the surface owner and is typically designed to be more beneficial to cattle grazing than to soil stabilization. The result may be long term wind and water erosion to soils with little or no re-vegetation success. The BLM considers these residual effects from Alternative B with 4 proposed wells are within the parameters for acceptable surface disturbance and its reclamation in the PRB FEIS ROD and Onshore Oil and Gas Order Number 1.

4.6. 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. Compliance with the drilling and completion plans and Onshore Oil and Gas Orders Nos. 2 and 7 minimize an adverse impact on ground water.

4.6.1. Groundwater

4.6.1.1. Direct and Indirect Effects

With applied mitigation measures there are no reasonable/foreseeable 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 ongoing, 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 Fox Hills, the deepest penetrated fresh water zone in the PRB, ranges in depth from 7,212 to 7,312 feet at the 4 well locations. This is well above the target Shannon Formation. Table 4.1 shows the depths where casing will be set and cemented in place. The operator will verify that there is competent cement across the aquifer, from 100 feet above to 100 feet below the Fox Hills Formation. This will ensure that ground water will not be adversely impacted by well drilling and completion operations.

Table 4.1. Casing Set and Cementing Depths in relation to the Fox Hills

#	Well Name/ #	Depth of Surface Casing	Depth of Intermediate Casing	Depth to Fox Hills
1	VanBuggenum 1-2H	2,500 feet	9,788 feet	7,154 – 7,213 feet
2	VanBuggenum 2-2H	2,500 feet	9,872 feet	7,206 – 7,267 feet
3	VanBuggenum 1-11H	2,500 feet	9,918 feet	7,223 – 7,312 feet
4	Gilbertz 1-13H	2,500 feet	9,837 feet	7,152 - 7,221 feet

4.6.1.2. Cumulative Effects

The volume of water produced by this federal mineral development is unknowable at the time of permitting. Peak will have to produce a well 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, Peak will submit a Sundry to the BLM within 90 days of a wells 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 2 alternatives for water management: deep disposal via re-injection or disposal into evaporation pits. Both alternatives are protective of groundwater resources when performed in compliance with state and federal regulations.

4.6.1.3. Mitigation Measures

Adherence to the drilling COAs, the setting of casing at appropriate depths, following safe remedial procedures in the event of casing failure, and utilizing proper cementing procedures should protect fresh water aquifers above the target coal zone. Adherence to WDEQ permits and regulations will also mitigate impacts from produced water. This will ensure that groundwater will not be adversely impacted by well drilling and completion operations.

4.6.1.4. Residual Effects

No residual effects are anticipated. With that said, BLM is currently developing policy for a process to disclose to the public the chemicals used for the drilling and hydraulic fracturing of oil and gas wells.

4.6.2. Surface Water

4.6.2.1. Direct and Indirect Effects

Peak will use a closed loop drilling system, which is consistent with Instruction Memorandum No. WY-2012-007. WSEO well log records of the 3 existing stock water wells within 1 mile of the proposed wells

and the nearest CBNG well (1,068 feet to the SW) indicate that the top of the ground water table is at least 140 feet. A closed loop drilling system would avoid possible contamination from an open reserve pit/drilling mud system.

Springs
This project should not effect any springs as none are known in the area; however the stock water reserviors likely charge through active seeps with surface flow downstream.

Storm Water Controls
A WYPDES non-point source permit for construction activities would address potential surface water impacts from storm water runoff. These 4 well locations will be incorporated into Peak's discharge stormwater associated with large construction activities as required by WYDEQ.

4.6.2.2. Cumulative Effects
Refer to the PRB FEIS, p. 4-115 to 4-117 and Table 4-13 for cumulative effects relative to the watershed and p. 117 for cumulative effects common to all sub-watersheds. The designation of the duration of disturbance is defined in the PRB FEIS, pp. 4-1 and 4-151. Most soil disturbances would be short term impacts with expedient interim reclamation and site stabilization.

4.6.2.3. Mitigation Measures
Use of a closed loop system will reduce surface disturbance minimize surface water impacts.

4.6.2.4. Residual Effects
Residual effects will similar to residual effects associated with wetlands.

4.7. Minerals – Leasables; Locatables; Salables
There are 11 mining claims in the same section hosting 4 proposed oil wells. As indicated in Section 3, these mining claims -likely target uranium. A number of actual and proposed uranium projects (using in-situ recovery, ISR) occur in or adjacent to the proposed wells. Possible conflicts may occur between any uranium projects planned/underway and these proposed wells. Pine Tree is a proposed uranium project whose boundary includes and surrounds these wells. It is unlikely that this project will be developed in the near term due to the low uranium price. Peak should ensure they check for uranium projects in the areas of these wells, and contact those companies to preclude conflicts. Uranium recovery entails surface disturbances for construction of roads, facilities, and wells –similar to those in CBNG projects. It is important that all companies affected take the initiative to keep the others informed about their status and design plans for pipelines, electrical power, roads, so they may optimize their own projects without impeding the others' projects, and thus preclude the imposition of top-down federal or state solutions.

4.7.1. Cumulative Effects
Drilling of wells and installation of pipelines will occur. Low levels of traffic generated by construction activities and daily operations when the project is operational would not significantly increase traffic or accidents on roads in the vicinity. However, the addition of ISR uranium projects in the vicinity will add to the cumulative effect of soil disturbances and may delay interim and final reclamation on some of the roads proposed for use in Peak's horizontal oil well project.

4.7.2. Mitigation Measures
It is between the operators to coordinate their projects as the BLM may have little jurisdiction over this. In the event Peak alters one or all of the approved oil well locations, then Peak will need to apply for the changes via Sundry Notice (Form No. 3160-5) and BLM will analyze it in a separate NEPA document.

4.7.3. Residual Effects

Residual effects across the project area would include a relatively short-term loss of soil productivity within with the uranium project areas. This would occur due to surface disturbances for installation or uranium well fields, roads, and associated infrastructure. As these uranium ISR projects are typically short-term in length (8-15 years), so should not affect long-term soil productivity. 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.

4.8. Wetland/Riparian

Peak's closed loop proposal, with properly applied mitigation, should not adversely impact watershed values, including natural drainages. There is little to no evidence the proposal will adversely impact other water resources, however, there is the potential that gas and or oil pipelines constructed by '3rd party' operators could directly impact wetlands. Watershed values, including natural drainages, would not be unduly impacted by the proposal with properly applied mitigation. Other water resources will not be adversely impacted by the proposal. Possible contamination effects of fresh water aquifers will be reduced through the use of tested casing, by setting casing at appropriate depths and by following safe repair procedures in the event of casing failure. Other downhole well operations are expected to cause minimal impacts using standard engineering practices. The cumulative impacts of the proposed action, when considered with other existing and proposed development in the project area are not expected to be significant. The application of mitigation measures will ensure that the incremental impacts of this well, when considered with any existing development are insignificant. For more information on cumulative impacts, please refer to the PRB FEIS.

4.8.1. Cumulative Effects

Cumulative effects to wetland/riparian areas from oil and gas development are discussed in the PRB FEIS, pp. 4 178 and 4-179. Proposed surface disturbances would result in temporary, construction-related impacts to wetlands which would be reclaimed through interim reclamation and site stabilization, as committed to by the operator and as required by the BLM in COAs.

4.8.2. Mitigation Measures

No crossings of wetland/riparian areas by linear features, such as pipelines, roads, and power lines are proposed. The use of a closed loop system will reduce surface disturbance minimize potential sediment deposition into the wetlands/riparian area. The lower edge of soil or other material stockpiles will be outside the active flood plain.

4.8.3. Residual Effects

Turbidity and sediment loading in the streams would probably increase due to erosion of project disturbed areas and sediment transport to the associated drainages due to storm water runoff. These impacts are mitigated by expediently stabilizing the disturbance and reducing the sediment reaching the streams.

4.9. Invasive Species

4.9.1. Direct and Indirect Effects

The operator 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, and 3) education. Cheatgrass or downy brome (Bromus tectorum) and to a lesser extent, Japanese brome (B. japonicus) exist in the affected environment. These species are found in such high densities 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 Scotch thistle, spotted knapweed

and buffalo burr. However, expedient reclamation and other mitigation as required by BLM applied COAs will reduce potential impacts from noxious weeds and invasive plants.

4.9.2. Cumulative Effects

Cumulative effects resulting from noxious and invasive weed species are discussed in the PRB FEIS, p. 4-171. Species of concern identified in the IPMP, include the following: Dalmatian toadflax, common tanzy, Canada thistle, and spotted knapweed.

4.9.3. Mitigation Measures

Successful reclamation through application of the operator's reclamation plans will discourage establishment of invasive species during operations. In addition, measures incorporated into the programmatic COAs listed in the COA document will further mitigate the potential spread and establishment of weed species. The operator will be responsible for prevention and control of noxious weeds and weeds of concern on all areas of surface disturbance associated with this project (well locations, roads, water management facilities, etc.). Use of pesticides shall comply with the applicable federal and state laws. Pesticides shall be used only in accordance with their registered uses and within limitations imposed by the Secretary of Interior. Prior to the use of pesticides on public land, the holder shall obtain from the BLM authorized officer written approval of a plan showing the type and quantity of material to be used, pests to be controlled, method of application, location of storage and disposal of containers, and any other information deemed necessary by the authorized officer to such use.

Phased reclamation plans will be submitted to BLM for approval prior to individual well abandonment via a Notice of Intent (NOI) Sundry Notice. Individual facilities, such as well location and road need to be addressed in these plans as they are no longer needed. Individual items that will need to be addressed in reclamation plans include:

- Cuttings Pit closure (Close ASAP after suitably dry, but no later than 180 days from time of drilling unless an extension is given by BLM Authorized Officer.)
- Configuration of reshaped topography, drainage systems, and other surface manipulations
- Waste disposal
- Revegetation methods, including specific seed mix (pounds pure live seed/acre) and soil treatments (seedbed preparation, fertilization, mulching, etc.). On private surface, the landowner should be consulted for the specific seed mix.
- Other practices that will be used to reclaim and stabilize all disturbed areas, such as water bars, erosion fabric, hydro-mulching, etc.
- An estimate of the timetables for beginning and completing various reclamation operations relative to weather and local land uses.
- Methods and measures that will be used to control noxious weeds, addressing both ingress and egress to the individual well.
- Decommissioning/removal of all surface facilities
- Any mulch utilized for reclamation needs to be certified weed free.

Based on the implementation of the COAs, and the measures outlined within the MSUP and its associated plans including the IPMP and Reclamation Plan, no additional mitigation measures are recommended.

4.9.4. Residual Effects

Control efforts by the Operator would be limited to the surface disturbance associated the construction and operation of the project. Cheatgrass and other weed species that are present within non-physically disturbed areas of the project area are anticipated to continue to spread unless control efforts are expanded. Cheatgrass and to a lesser extent, Japanese brome (*Bromus japonicus*) are found in high densities and numerous locations throughout northeast Wyoming. Efforts are being made by BLM, USDA, WGFD and other partners at some small infestation areas are being treated but for the most part,

control programs are not considered feasible at this time and these annual bromes will continue to be found within the project area.

4.10. Fish and Wildlife

4.10.1. Big Game

4.10.1.1. Direct and Indirect Effects

The PRB FEIS analyzed impacts to big game, pp. 4-181 to 4-210. As discussed in that document, impacts to mule deer may occur through alterations in hunting and/or poaching, increased vehicle collisions, harassment and displacement, increased noise, increased dust, alterations in nutritional status and reproductive success, increased fragmentation, loss or degradation of habitats, reduction in habitat effectiveness, and declines in populations. The current populations for pronghorn, white-tailed deer, and mule deer are above, above, and below WGFD goals, respectively.

4.10.1.2. Cumulative Effects

The cumulative effects associated with Alternative B, are within the analysis parameters and impacts described in the PRB FEIS. Refer to the PRB FEIS, pp. 4-181 to 4-215, for details on expected cumulative impacts.

4.10.1.3. Mitigation Measures

BLM proposes no mitigation with Alternative B.

4.10.1.4. Residual Effects

The incorporated design features and mitigation will not eliminate all project effects. Irretrievable impacts are listed in the PRB-EIS p. 4-408 that include loss of wildlife habitats beyond the life of the project, depending on the success of reclamation and decreased wildlife populations. Habitat effectiveness, nutrition status, and reproductive success of big game species would decrease (PRB-EIS, p. 4-406).

4.10.2. Raptors

4.10.2.1. Direct and Indirect Effects

Direct and indirect impacts to raptors, from oil and gas development, are analyzed in the PRB FEIS, pp. 4-216 to 4-221. No direct impacts to raptor nests are anticipated from the project. However, indirect impacts are likely to occur as a result of project activities. 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. Human activities in close proximity to active raptor nests may interfere with nest productivity. Romin and Muck (1999) indicate that activities within 0.5 mile of a nest are prone to cause adverse impacts to nesting raptors. If mineral activities occur during nesting, they could be sufficient to cause adult birds to remain away from the nest and their chicks for the duration of the activities. This absence can lead to overheating or chilling of eggs or chicks and can result in egg or chick mortality. Prolonged disturbance also can lead to the abandonment of the nest by the adults. Routine human activities near these nests also can draw increased predator activity to the area and resulting in increased nest predation.

There are 4 known raptor nests located within 0.5 miles of project components and suitable nesting habitat is present throughout the project area. To reduce the risk of decreased productivity or nest failure, the BFO requires a 0.5-mile radius timing limitation during the breeding season around active raptor nests and recommends all infrastructures requiring human visitation be located in such a way as 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. Construction, drilling and production could deter raptors from selecting a nest site in the vicinity of the 4 well locations.

If Peak would voluntarily restrict well site visits and work-over operations at the 4 well locations during the raptor breeding season, raptors may not avoid selecting the area for nesting. The operator did not volunteer any such mitigation and such a measure is more restrictive than BLM-BFO land use plans provide for. Additional direct and indirect impacts to raptors, from oil and gas development, are analyzed in the PRB FEIS, pp. 4-216 to 4-221.

4.10.2.2. Cumulative Effects

It is likely that impacts to raptors will be greater than those analyzed in this plan for Peak proposes up to 3.1 miles of overhead power line to power the wells. But the powerline will be constructed by a "third party" and not Peak so it is uncertain where those powerlines will actually fall on the landscape - making it impossible at this time to adequately analyze the impacts of the overhead power lines. The cumulative effects associated with Alternatives B are within the analysis parameters and impacts described in the PRB FEIS, p. 4-221.

4.10.2.3. Mitigation Measures

Measures intended to avoid, minimize, and mitigate impacts to raptors are outlined in the COA documents, including operator committed measures and site-specific COAs. For example, to reduce the risk of adverse impacts to nesting raptors, no surface-disturbing activity will occur prior to surveys to document nest occupancy shall be conducted by a biologist following BLM protocol, between April 15 and June 30. All survey results shall be submitted in writing to a Buffalo BLM biologist and approved prior to surface-disturbing activities. Surveys outside this window may not depict nesting activity. If a survey identifies active raptor nests, a 0.5 mile timing buffer will be implemented. The timing buffer restricts surface-disturbing activities within 0.5 mile of occupied raptor nests from February 1 to July 31.

4.10.2.4. Residual Impacts

There would be an increase in traffic, construction activity, and human presence in the area over the life of the project that would affect the quality of the area for nesting raptors. Disturbance to nesting raptors can cause nest failure, nest abandonment, and unsuccessful fledging of young (PRB FEIS, p. 4-218). Timing limitations would protect nests from disturbance during the construction phase of the project. Timing limitations will not apply during well completion operations, well monitoring and maintenance activities and those activities would possibly discourage raptors from using nest locations or abandon the nest if a pair had initiated nesting prior to such disruptive activities occurring.

4.10.3. Migratory Birds

4.10.3.1. Direct and Indirect Effects

The PRB FEIS discussed direct and indirect effects to migratory birds, 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 would result in a "take" as defined (and prohibited) by the MBTA, a non-discretionary statute, and in turn a violation of the law. The BLM determined that the proposal is in compliance with Instruction Memorandum No. WY-2013-005 Interim Management Guidance for Migratory Bird Conservation Policy on Wyoming Bureau of Land Management (BLM) Administered Public Lands Including the Federal Mineral Estate. BLM will apply a survey and timing limitation that pad construction (vegetation removal) 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 be performed in areas where vegetation will be removed or destroyed.

The BLM identified suitable nesting habitat for several BLM sensitive sagebrush obligates is present at the well sites. The habitat at the 4 well locations and along the proposed access roads consists of sagebrush-steppe community with sagebrush canopy cover up to 15% with good understory of grasses. Vegetative cover exceeds 50% of the surface even though the area has had of long-term, intense grazing operations. 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 are vulnerable. Surface disturbing activities associated with the 4 wells will have GSG or raptor timing limitations applied, thereby providing some protection to migratory birds.

Peak proposes using a heater treater during the production phase of the project. Heater treaters, and similar facilities, having vertical open-topped stacks or pipes can attract birds. Those facilities without exclusionary devices can pose a mortality risk. Once birds crawl into the stack, escape can become 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). The use of a closed loop system will minimize impacts to the migratory birds that may become trapped in an open drilling/reserved pit or exposed to hazardous vapors from drilling fluids.

4.10.3.2. 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.

4.10.3.3. Mitigation Measures

BLM proposes timing limitations on surface disturbing activities for migratory birds. Use of a closed loop system will minimize impacts to the migratory birds that may become trapped in an open drilling/reserved pit or exposed to hazardous vapors from drilling fluids. Peak made no specific commitments to exclude birds from exhaust stacks (particularly with a circumference of greater than 2 inches), pits, ponds, and open-topped tanks, and other facilities that may pose a threat. Therefore, BLM will apply a COA to ensure that migratory birds are excluded from all facilities that pose a mortality risk, including, but not limited to, heater treaters, flare stacks, and secondary containment where escape may be difficult or hydrocarbons or toxic substances are present.

4.10.3.4. Residual Effects

Although it is unlikely that migratory birds would nest in the area that construction would occur, any migratory bird species and individuals that are, may have nests destroyed, or be disturbed, by construction activities. Disruption from construction activities may also cause abandonment of active nests. If Peak does not properly maintain all exclusionary devices implemented for the project, birds may remain at risk of direct mortality.

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

BLM summarized the effects to threatened, endangered, and candidate species in Table 4.3, below and described them in the PRB FEIS, pp. 4-250 to 4-257.

Table 4.3. Summary of Threatened and Endangered Species Habitat and Project Effects

Common Name	Habitat	Presence	Project Effects	Rationale
Threatened				
Ute ladies'-tresses orchid	Riparian areas with permanent water	NS	NE	Habitat is no present. No known Ute ladies'-tresses orchid or seed source exists within the drainage.
Candidate				
Greater Sage-Grouse	Basin-prairie shrub, mountain-foothill shrub	K	WIPV	Suitable nesting and brood rearing habitat is present and the project will negatively affect GSG.

Presence	Project Effects
K – Known, documented observation in project area. **NS -** Habitat suitable but species is not suspected to occur within the project area.	**NE** – No Effect **WIPV -** Will Impact Individuals or Habitat with a consequence that may contribute to a trend towards federal listing or cause a loss of viability to the population or species.

4.11.1. Threatened and Endangered Species

4.11.1.1. Ute Ladies'-Tresses Orchid (ULT)

4.11.1.1.1. Direct and Indirect Effects

Suitable habitat is present in the Project area but there are no known populations of ULT in the Fourmile or All Night Creek drainages. Approximately 6.5 acres of ULT habitat was modeled and mapped in the project area boundary but no surface disturbance is proposed through the habitat. Implementation of the proposed project would not affect the ULT.

4.11.1.1.2. Cumulative Effects

The PRB FEIS discussed the cumulative effects to ULT, pp. 4-253 to 4-254).

4.11.1.1.3. Mitigation Measures

BLM proposes no mitigation but recommends that Peak avoid this identified habitat (located NENE, NENW and NWNE Section 1, T43N/R75W) for any future development plans with Alternative B.

4.11.1.1.4. Residual Effects

It is possible that impacts to ULT habitat may be greater than those analyzed in this plan for Peak may install buried pipelines to the wells but the pipelines will be constructed by a "third party" and not Peak so it is uncertain where those pipelines will actually fall on the landscape making it impossible at this time to adequately analyze the full impacts to potential ULT habitat.

4.11.2. Candidate Species

4.11.2.1. Greater Sage-Grouse (GSG)

4.11.2.1.1. Direct and Indirect Effects

The 2010 FWS listing decision discussed impacts to GSG associated with energy development in detail. Impacts to GSG are generally a result of loss and fragmentation of sagebrush habitats associated with roads and infrastructure. Research indicates that yearling GSG hens also avoid nesting in developed areas, while older hens will continue nesting attempts in impacted habitats (Lyon and Anderson 2003, Holloran 2005, Holloran et al. 2010, FWS 2010). The VanBuggenum 1-2H well location, access road and associated infrastructure are located within 2 miles of 1 occupied GSG lek, the Mud Springs Creek lek. All 4 wells are in and adjacent to suitable nesting habitat (See Figure 4.1). Construction of the well pad, access road and overhead powerline (not with the access road) will result in a direct loss of GSG habitat. For a specific breakdown of proposed disturbance see Table 2.2. Alternative B. Implementation of the project will adversely impact nesting habitat, both through direct loss and avoidance of the area by GSG.

4.11.2.1.2. Cumulative Effects

There are 6,764 wells according to the WOGCC database, April 16, 2014 (2,892 are abandoned) in the cumulative impact assessment area, an area of 1,347 square miles, which amounts to a density of approximately 5.0 wells per square mile. Currently, there are approximately 1,014 proposed wells (WOGCC, April 16, 2014) (including the 4 from this project) within 12.4 miles of the 31 GSG leks. With the addition of the proposed wells, the well density within 12.4 miles of the leks would increase to 5.8 wells per square mile, nearly 6 times the 1 well per square mile recommendation made by the State Wildlife Agencies' Ad Hoc Committee for Sage-Grouse and Oil and Gas Development. Table 4.4, below, shows the well density within the 12.4 mile analysis area. Table B1, in Appendix B, further describes well density at 12.4 miles by individual lek.

Table 4.4. Well Density within the 12.4 Mile Impact Area

Analysis Area	Area mi^2	# of Existing & Approved Wells	Well Density (Existing)	Proposed Wells	Well Density (including proposed)
buffer of leks within 12.4 miles of the 4wells	1,347	6,764	5.0 wells/mi^2	1,014	5.8 wells/mi^2

The 2012 BLM-contracted population viability analysis for the Northeast 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 impacting 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 GSG population that has already experienced an 82% decline within the expansive energy fields (Walker et al. 2007a), a level of impact that has severely reduced options for delineating priority habitats that are large enough and in high enough quality habitats to sustain populations." (Taylor et al. 2012).

Current well densities reduced the function of PRB priority habitats, affecting all of the remaining active leks within core (Taylor et al. 2012). Continued energy development around the priority habitats will continue to impact their remaining value. Declines in active leks and male attendance indicate that the WNv outbreaks and energy development reduce GSG populations and that they 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). It is likely that impacts to GSG habitat will be greater than those analyzed in this EA as Peak proposes 3.1 miles of overhead power lines across open rangeland to supply power to the well The powerlines will be constructed by a "third party" and not the operator so it is unclear where those powerlines will fall on the landscape making it impossible at this time to adequately analyze the impacts of the overhead power lines. BLM's preference is to bury the powerlines in or adjacent to a surface disturbance such as a road or pipeline. The operator plans to install buried gas and/or oil pipelines to the well location if the well is productive that may or may not follow the access road.

4.11.2.1.3. Mitigation Measures

In order to reduce the impacts to GSG associated with noise, construction, and human disturbance resulting from implementation of the proposed project, BLM will consider a timing limitation (March 15-June 30) on surface-disturbing activities to maintain connectivity between GSG leks surrounding the 4

new wells. The BLM agreed to implement the State of Wyoming's Sage-grouse Core Area Strategy (IM 2012-019); which protects approximately 80% of GSG leks in the State. However in the PRB approximately 20% of leks are in core designated habitats, and the shape and size of the Buffalo priority habitats limits the protections afforded these leks. Additional mitigation may be necessary to maintain populations in the PRB. Such mitigation could include; increasing WNv control efforts, avoiding/minimizing surface water discharges, enhancing priority habitat quality, accelerating the pace of development by modifying or eliminating timing restrictions in some areas, efficiently suspending leases in (or habitats supporting) core, identifying areas in core, or undeveloped areas adjacent to core, that are appropriate for off-site mitigation, reducing supplemental predator habitat, and increased reclamation.

Aggressive reclamation of plugged and abandoned well fields, combined with habitat enhancements in functional core and supporting areas, may provide a population of birds to re-populate areas that can be successfully reclaimed. GSG habitat restoration efforts in the PRB are ongoing. The BLM identified historical GSG population centers that are ready for oil and gas reclamation where stakeholders will apply enhanced reclamation techniques. The intent is maintaining and enhancing those areas with remaining GSG and increase suitability of currently uninhabited areas that are important for connectivity. The WY BLM initiated the PRB Restoration Program to implement strategies for accelerated reclamation and GSG habitat restoration in areas affected by federal oil and gas developments. BLM proposes timing limitations March 15- June 30 annually on surface disturbing activities to minimize impacts to GSG within 2-miles of occupied GSG leks. This applies to the Van Buggenum 1-2H well.

4.11.2.1.4. Residual Effects

The PRB FEIS predicted that the PRB oil and gas development would have significant impacts to the GSG population. The impact of the this 4 well development cumulatively contributes to the potential for local GSG extirpation yet its effect is acceptable because it is outside priority habitats and is within the parameters of the PRB FEIS/ROD and current BLM and Wyoming GSG conservation strategies. Current research does not identify specific components of energy development that BLM or operators can alter to measurably decrease impacts to GSG or functionality of their habitats. Even in areas where BLM applied a variety of mitigation measures, negative population impacts are still measurable when well density exceeds approximately 1 well per square mile. Management of energy development based on current priority habitat configurations and associated lease stipulations, conditions of approval, and best management practices (BMPs), may not provide enough contiguous habitats sufficient to protect the remaining population viability of PRB GSG without a substantial investment in restoration. The PRB FEIS based its analysis and decision, in part, on the removal of all CBNG wells and most infrastructures at final well abandonment after the CBNG played out 10-15 years after drilling. In areas that are or were important to GSG, leaving infrastructure on the landscape may hamper restoration (Taylor et al. 2012).

4.11.3. Special Status (Sensitive) Species (SSS)

The PRB FEIS discusses impacts to sensitive species on pp. 4-257 to 4-265. BLM will take actions to meet 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." The effects to sensitive species resulting from implementation of the project are in Table B-2 in Appendix B. Information regarding bald eagles is discussed below.

4.11.3.1. Bald Eagle

4.11.3.1.1. Direct and Indirect Effects

Impacts to bald eagles are discussed in the PRB FEIS, pp. 4-251 to 4-253. A study completed in 2004 suggests that two-tracks and improved project roads pose minimal collision risk to bald eagles. In 1 year of monitoring road-side carcasses, the BFO reported 439 carcasses, 226 along interstates (51%), 193 along paved highways (44%), 19 along gravel county roads (4%), and 1 along an improved CBNG road (less than 1%) (Bills 2004). No road-killed eagles were reported; bald and golden eagles were observed feeding on 16 of the reported road-side carcasses (less than 4%). The risk of big-game vehicle-related mortality along CBNG project roads is insignificant or discountable, when combined with the lack of bald eagle mortalities associated with highway foraging, leads to the conclusion that CBNG project roads do not affect bald eagles. No bald eagle nests or winter roosts were identified within 1 mile of the project area. Suitable habitat and historic bald eagle roosts exists west of the project area along the rim of the Pumpkin Buttes; the nearest roost is 3.8 miles from the VanBugennum 1-11H. The nearest recorded observation was a single adult perched on a cotton wood tree 1.5 miles east of the Gilbertz 1-13H well location January 8, 2011. Implementation of the proposed project would not likely adversely impact bald eagle nesting or roosting due to the lack of suitable nesting and roosting structure available within a 1 mile of the well location but eagles would likely avoid the roosting on power poles within 1 mile of the well site during construction, drilling, and HF operations.

4.11.3.1.2. Cumulative Effects

The PRB FEIS discussed the cumulative effects for bald eagles, pp. 4-251 to 4-253.

4.11.3.1.3. Mitigation Measures

BLM proposes no mitigation.

4.11.3.1.4. Residual Effects

Even with timing limitations, habitat may be degraded to a point that the area no longer provides habitat requirements for wintering bald eagles. A 1.0 mile timing restriction on construction activities does nothing to protect valuable habitats from disturbance and also does not mitigate impacts associated with fee development.

4.11.3.2. Ferruginous Hawk

4.11.3.2.1. Direct and Indirect Effects

The PRB FEIS discusses impacts, including direct and indirect effects, to sensitive species on pp. 4-257 to 4-273. Additional impacts expected from project actions are described in the Raptor Section, above. Additionally, due to the territorial nature of ferruginous hawks, there is greater potential for disturbance to nesting ferruginous hawks. However, no active ferruginous hawk nests were identified during the past survey efforts (See Table 3.3); the 1 ferruginous hawk nest in the project area was reported as gone (GMEC 2013). Therefore, adverse impacts to this species are not anticipated.

4.11.3.2.2. Cumulative Effects

The PRB FEIS discusses impacts, including cumulative effects, to sensitive species on pp. 4-257 to 4 273.

4.11.3.2.3. Mitigation Measures

An annual survey will be required for nesting raptors and a TLS will apply (February 1 through July 31) if an active ferruginous hawk nest is located.

4.11.3.2.4. Residual Effects

Residual effects will be similar to residual effects of other raptors.

4.11.3.3. Brewer's Sparrow

4.11.3.3.1. Direct and Indirect Effects

The PRB FEIS discusses impacts to sensitive species on pp. 4-257 to 4-265. Additional impacts are described in the Migratory Birds section (Section 4).

4.11.3.3.2. Cumulative Effects

Cumulative impacts to sensitive species are discussed in the PRB FEIS on pp. 4-273.

4.11.3.3.3. Mitigation Measures

Raptor and GSG timing limitations on surface disturbing activities would also serve to mitigate some impacts to nesting Brewer's sparrows. To ensure compliance with the MBTA, the BLM recommends that pad construction occur outside of the migratory bird breeding season (May 1 – July 31). 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, and secondary containment where escape may be difficult or hydrocarbons or toxic substances are present.

4.11.3.3.4. Residual Effects

Timing limitations would apply to the entire project. If construction does not occur during May 1- July 31 it is unlikely that active nests will be destroyed by construction activities, as most nestlings will have already fledged. 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 Brewer's sparrows will be negatively affected due to habitat loss and fragmentation and proximity of human activities associated with oil and gas development.

4.11.3.4. Northern Leopard Frog

4.11.3.4.1. Direct and Indirect Effects

The PRB FEIS discusses impacts to sensitive species on pp. 4-257 to 4-265.

4.11.3.4.2. Cumulative Effects

Cumulative impacts to sensitive species are discussed in the PRB FEIS on pp. 4-273.

4.11.3.4.3. Mitigation Measures

No mitigation is proposed with Alternative B.

4.11.3.4.4. Residual Effects

No residual impacts are anticipated.

4.11.3.5. Western Burrowing Owl

4.11.3.5.1. Direct and Indirect Effects

The PRB FEIS discusses impacts to sensitive species on pp. 4-257 to 4-273.

4.11.3.5.2. Cumulative Effects

The PRB FEIS discusses impacts to sensitive species on pp. 4-257 to 4-273. Practices such as poisoning or shooting of prairie dogs or other intentional methods of extermination can potentially affect burrowing owl productivity through a reduction in nest site availability.

4.11.3.5.3. Mitigation Measures

The Thunder Basin National Grasslands in Campbell County, WY, has a NEPA analysis recommending a 0.25 mile timing restriction buffer zone on surface disturbing activities for burrowing nest locations during their nesting season (April 15 to August 31). BLM will consider adopting this analysis if a

Western burrowing owl nest is observed within 0.25 miles of the project area during annual raptor surveys following the most current BLM protocol, between April 15 and June 30.

4.11.3.5.4. Residual Effects

Timing limitations do not mitigate habitat loss. Wells, pipelines, and roads that are built in prairie dog colonies would directly impact nesting habitat and may reduce the quality of adjacent habitats for burrowing owls, regardless of the timing of their construction.

4.12. Cultural Resources

4.12.1. 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. Portions of the project, as designed are within the setting of the Pumpkin Buttes TCP (48CA268). The BLM must consult the 2009 Pumpkin Buttes Programmatic Agreement (PB PA), in part, to conduct this analysis – recalling that the types of mitigation primarily involve impacts to the view shed, or setting, of the topography surrounding the buttes.

The Van Buggenum 1-2H proposal lies within 2 miles of the Pumpkin Buttes TCP. The proposal will result in a finding of no adverse effect on the setting of the Pumpkin Buttes TCP. Impacts to the setting are mitigated through application of the BMP described in the Pumpkin Buttes PA. These measures incorporate standard BMPs to reduce visual contrast and will be incorporated during all phases (drilling, construction, operation, reclamation, etc.) of all the Van Buggenum 1-2H APD and its associated infrastructure (new surface disturbance to junction with existing disturbance).

The Gilbertz 1-13H proposal lies within 2 miles of the Pumpkin Buttes TCP and has the potential to adversely impact the visual setting of the Pumpkin Buttes TCP. Peak has been unable to provide the BLM with a visual contrast rating analysis (VCR) showing the level of impact that the proposal will have on the setting of the TCP. The BLM will complete the necessary VCR analysis as soon prior scheduling commitments and weather conditions allow. BLM must also consult with the Wyoming SHPO and interested tribes to determine if the setting of the TCP is intact in the Gilbertz 1-13H proposal area and if it is, what steps may be necessary to resolve any potential adverse effects. It is recommended that BLM defer a decision on this APD until the completion of the analysis and consultations.

The Van Buggenum 2-2H and Van Buggenum 1-11H proposals lie within 2 miles of the Pumpkin Buttes TCP and have the potential to adversely impact the visual setting of the Pumpkin Buttes TCP. Peak provided the BLM with visual contrast rating analysis (VCR) showing that the proposals as submitted will adversely impact the setting of the TCP. The BLM will conduct additional analysis to determine if changes to the proposal designs will allow the projects to proceed. The BLM will begin VCR analysis as soon prior scheduling commitments and weather conditions allow. BLM must also consult with the Wyoming SHPO and interested tribes to determine if the setting of the TCP is intact within the Van Buggenum 2-2H and Van Buggenum 1-11H proposals' area and if it is, what steps may be necessary to resolve any potential adverse effects. It is recommended that BLM defer a decision on these APDs until the completion of the analysis and consultations.

The Van Buggenum 1-2H location incorporates the mitigation described in the Pumpkin Buttes PA and, as designed, the proposal will create a weak contrast to the setting of the TCP, which results in a finding of "no adverse effect" to the site. Following the Wyoming State Protocol Section VI(B)(1) and the Pumpkin Buttes PA the BLM determined that the Van Buggenum 1-2H project will result in an "No Adverse Effect". The BLM notified the SHPO of this determination on February 03, 2014.

4.12.2. 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.

4.12.3. 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.

4.12.4. 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.

4.13. Transportation

4.13.1. Direct and Indirect Effects

The Peak proposes an additional 2.6 miles of proposed crown and ditch resource roads. The road is proposed with a minimum travel way surface of 18 feet. The design speed for the road is 20 mph with an average daily traffic (ADT) ranging from 2 to 20 trips per day. Dust may become a periodic driving visibility and human health issue. The crown and ditch road has a maximum grade of 4%. There is 1 existing culvert 18 inches in diameter and additional cross drain culverts will be added as needed during construction. Culvert installation will follow the typical installation details provided in the engineered diagrams. Additional culverts and wing ditches may be needed through the life of the project and will be addressed via the sundry process.

Transportation in the project area would be affected on a long-term basis. The proposed development will increase the ADT on all of the roads in the project area for the duration of well production. Well lifespan is anticipated to be 10 to 20 years. During this period both the proposed and existing roads will have accelerated erosion and sedimentation, increased dust, dust abatement, higher noise levels, and additional

traffic increasing accident potential. The roads will be used by the local ranchers, oil and gas personnel, federal government personnel, and to a lesser extent, the general public for recreational purposes. Long term impacts would be if the private land owners wish to keep the roads when the wells are no longer in production for their ranching operation.

Vehicles have better traction with a road when the road surfacing material is compacted, creating a safer driving surface. Because clinker is a soft, non-durable, material, during compaction it breaks down into dust rather than being compacted. It typically lacks a distribution of particle sizes. Regular gravel without gradation parameters is a hard durable material but lacks the distribution of particle sizes required for compaction. Whereas gravel from crushed aggregate that is screened to meet Gradation W parameters, is a hard durable material that has a distribution of particle sizes that are designed to interlock when compacted - creating a solid driving surface. A solid driving surface also promotes sheet flow of surface run-off directing water away from the road; whereas clinker rock tends to promote infiltration into the road bed due to the porosity of burnt shale resulting in rutting and erosion. The benefit of keeping water off or away from the road is to reduce costs of maintenance. Although it is less suitable material for road surfacing, clinker rock is more readily available and less costly. There are fewer gravel sources and gravel is more costly due to the supply and demand and hauling fees.

4.13.2. Cumulative Effects

Conditions of existing roads in the area are highly variable. Roads generally are unpaved, and are constructed of native soils rated as marginal construction material. Mobilization of drilling and construction equipment relies on semi-trucks with trailers designed for use on paved roads and highways. The gross vehicle weight of these combination vehicles often exceeds 80,000 pounds with drilling rigs exceeding 100,000 pounds. There is concern that the use of these vehicles, especially when loaded, on roads not completely constructed may contribute to increasing a potential for motor-vehicle accidents.

4.13.3. Mitigation Measures

All constructed road segments will be completed, including any culverts, low water crossings and required surfacing, before the drilling rig or other drilling equipment moves onto the pad. Peak is responsible for having the licensed professional engineers certify that the actual construction of the road meets the design criteria and is constructed to Bureau standards. BLM will apply a COA that requires the operator to provide for construction oversight of the road and well pad. In addition, the operator will be required to contact the BLM at least 4-days prior to construction to provide BLM the opportunity to complete onsite construction inspection. Peak may mitigate excessive dust with magnesium chloride or other treatments.

4.13.4. Residual Effects

Transportation use along the roads would be converted either for the duration of the well operation to primarily oil and gas use. During this timeframe, the road network would experience all weather use with an ADT of 2-20 vehicles. This is far in excess of seasonal fair-weather use of primitive roads used for livestock operations and recreational use. Additional traffic, risks of accidents, and indirect effects would be proportionate to the number of employees and activates for each year of the project. If roads are constructed as proposed, stabilized, and well maintained the residual effects associated with road high traffic us should be minimal.

Section Four Summary

BLM used the aggregate effects method in updating the cumulative effects for this EA; see Table 3.1. Cumulative effects to land uses from oil and gas development are discussed in the PRB FEIS, pp. 4-298 and 4-107 to 4-129. Any and all foreseeable effects from not following the recommended mitigation measures will not rise to significance, though such omissions may cause a minor increase in erosion, runoff, or other impacts.

5. CONSULTATION/COORDINATION:

List of Preparers (BFO unless otherwise noted)

Position/Organization	Name	Position/Organization	Name
NRS/Team Lead	Jim Verplancke	Archaeologist	Seth Lambert
Supr NRS	Casey Freise	Wildlife Biologist	Jim Verplancke
Petroleum Engineer	Mat Warren/Mark Thomason	Geologist	Kerry Aggen
LIE	Kristine Phillips/Sharon Soule	Supr NRS	Bill Ostheimer
Soil Scientist	Arnie Irwin	Assistant Field Manager	Chris Durham
Assistant Field Manager	Clark Bennett	NEPA Coordinator	John Kelley

6. References and Authorities

Adgate, J.L., Goldstein, B.D., and McKenzie, L.M., Potential Public Health Hazards, Exposures and Health Effects from Unconventional Natural Gas Development, Environ, Sci. and Tech., Am. Chem. Soc., 2014.

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

American Water Works Association. 2013. Water and Hydraulic Fracturing, a White Paper. www.awwa.org/fracturing. Denver, CO. 17pp.

Approved Resource Management Plan for Public Lands Administered by the Bureau of Land Management Buffalo Field Office. 2001. Prepared by the United States Department of the Interior, Bureau of Land Management, Buffalo Field Office,

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.

Balch, J.K, B.A. Bradley C.M D'Antonio, and J. Gomez-Dans. 2013. Introduced Annual Grass Increases Annual Fire Activity Across the Arid West (1980-2009). Global Change Biology. 19-1, pp. 173-183. http://onlinelibrary.wiley.com/doi/10.1111/gcb.12046/abstract.

Bechard, M. J., R. L. Knight, D. G. Smith, and R. E. Fitzner. 1990. Nest sites and habitats of sympatric hawks (*Buteo* spp.) in Washington. Journal of Field Ornithology 61:159-170.

Blair, C. L. 1978. Breeding biology and prey selection of Ferruginous Hawks in northwestern South Dakota. M.S. thesis. South Dakota State University, Brookings, South Dakota. 60 pages.

Blickley, J. L., Blackwood, D. & Patricelli, G. L. 2012 Experimental Evidence for the Effects of Chronic Anthropogenic Noise on Abundance of Greater Sage-Grouse at Leks. *Conservation Biology* **26**, 461-471.

Blickley, J. L., Blackwood, D. L., Hardy, E. L. & Patricelli, G. L. in prep. Temporal flexibility in greater sage-grouse (Centrocercus urophasianus) signaling behavior in response to chronic industrial noise playback.

Blickley, J. L. & Patricelli, G. L. 2010 Impacts of Anthropogenic Noise on Wildlife: Research Priorities for the Development of Standards and Mitigation. *Journal of International Wildlife Law and Policy* **13**, 274-292.

Blickley, J. L. & Patricelli, G. L. 2012 Potential acoustic masking of greater sage-grouse display components by chronic industrial noise. *Ornithological Monographs* **74**, 23-35.

Blickley, J. L., Word, K. R., Krakauer, A. H., Phillips, J. L., Sells, S. N., Wingfield, J. C. & Patricelli, G. L. In review. Experimental chronic noise exposure is related to elevated fecal corticosteroid metabolites in lekking male greater sage-grouse (*Centrocercus urophasianus*). *PloS ONE*.

Bohne, J., T. Rinkes, and S. Kilpatrick. 2007. Sage-Grouse Habitat Management Guidelines for Wyoming. Wyoming Game and Fish Department. Cheyenne, Wyoming.

Bradley, B. A., J. F. Mustard. 2006. Characterizing the Landscape Dynamics of an Invasive Plant and Risk of Invasion Using Remote Sensing. Ecological Applications, 16(3), pp. 1132-1147.

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.

Chapman, S.S., Bryce, S.A., Omernik, J.M., Despain, D.G., ZumBerge, J., and Conrad, M. 2004. Ecoregions of Wyoming (color poster with map, descriptive text, summary tables, and photographs). Reston, Virginia, U.S. Geological Survey (map scale 1:1,400,000).

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.

Curtis, Jan and K. Grimes. 2004. Wyoming Climate Atlas. Wyoming Water Research Program, University of Wyoming; the U.S. Geological Survey; and the Wyoming Water Development Commission. 328 pp. http://www.wrds.uwyo.edu/sco/climateatlas/toc.html.

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 72:187-195.

Duniway, M.C. J. E. Herrick, D. A. Pyke, and D. P. Toledo. 2010. Assessing Transportation Infrastructure Impacts on Rangelands: Test of a Standard Rangeland Assessment Protocol. Rangeland Ecol Manage 63:524-536.

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, BLM 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.

Garton, E.O., J.W. Connelly, C.A. Hagen, J.S. Horne, A. Moser, and M.A. Schroeder. 2011. Greater Sage-grouse Population Dynamics and Probability of Persistence. Pages 293-381 in Greater sage-grouse: ecology and conservation of a landscape species and its habitats, S. T. Knick, J. W. Connelly, C. E. Braun (editors). Studies in Avian Biology, Number 38, University of California Press, Berkeley, CA, USA.Gelbard J. L., and J. Belnap. 2003. Roads as conduits for exotic plant invasions in a semiarid landscape. Conservation Biology. 17:420–432.

Gilmer, D.S. and R.E. Stewart. 1983. Ferruginous hawk populations and habitat use in North Dakota. J. Wildl. Manage. 47:146-157.

Goolsby, J. 2012. Evolution & Revolution of Drilling Technologies & the Impact on Wyoming. Goolsby, Finley, and Associates, LLC. Presentation.

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.

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.

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 .

Knick, S. T., and J. W. Connelly. 2011. Greater Sage-grouse: Ecology and Conservation of a Landscape Species and Its Habitats. University of California Press, Berkeley, California.

Lyon, A.G. and S.H. Anderson. 2003. Potential Gas Development Impacts on Sage Grouse Nest Initiation and Movement. *Wildlife Society Bulletin* 31:486-91.

Lokemoen, J.T. and H.F. Duebbert. 1976. Ferruginous hawk nesting ecology and raptor populations in northern South Dakota. The Condor 78:464-470.

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.

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.

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, WY.

Northeast Wyoming Sage-grouse Working Group. 2006. Northeast Wyoming Sage-Grouse Conservation Plan.

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.

Olendorff, R.R. 1973. The ecology of the nesting birds of prey of northeastern Colorado. U.S.I.B.P. Tech. Rept. No. 211. Colorado State Univ., Fort Collins, Colorado.

Patricelli, G. L., J. L. Blickley, and S. L. Hooper. 2012. The impacts of noise on greater sage-grouse: A discussion of current management strategies in Wyoming with recommendations for further research and interim protections. University of California, Davis, CA. 25pp.

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

Powder River Oil and Gas Project Environmental Impact Statement and Resource Management Plan Amendment. 2003. Department of the Interior, Bureau of Land Management, Wyoming State Office in Campbell, Converse, Johnson and Sheridan Counties, Wyoming.

Rinkes, T. 2003. Personal communication [Draft notes from Annual Sage-Grouse and Sagebrush Species of Concern Meeting]. Bureau of land Management Wildlife Biologist/Sage Grouse Coordinator.

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.

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.

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.

Sawyer, H., R.M. Nielson, F. Lindzey, and L.L. McDonald. 2006. Winter Habitat Selection of Mule Deer Before and During Development of a Natural Gas Field. Journal of Wildlife Management 70 (2):396–403.

Sawyer, H., M.J. Kauffman, and R.M. Nielson. 2009. Influence of Well Pad Activity on Winter Habitat Selection Patterns of Mule Deer. Journal of Wildlife Managament 73(7):1052–1061.

Schmutz, J.K. 1984. Ferruginous and Swainson's hawk abundance and distribution in relation to land use in southeastern Alberta. J. Wildl. Manage. 48(4):1180-1187.

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.

Stiver, S. J., A. D. Apa, J. R. Bohne, S. D. Bunnell, P. A. Deibert, S. C. Gardner, M. A. Hilliard, C. W. McCarthy, and M. A. Schroeder. 2006. Greater Sage-grouse comprehensive conservation strategy. WAFWA, Cheyenne, WY. 21 August 2009.

Snow, C. 1974. Habitat management series for unique or endangered species. Ferruginous Hawk Rept. No. 13. Bureau of Land Management.

Taylor, R. L., D. E. Naugle, L. S. Mills. 2012. Viability analyses for conservation of sage-grouse populations: Buffalo Field Office, Wyoming. Final Report. February 27, 2012. University of Montana, Missoula, MT.

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.

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, Fish and Wildlife Service (FWS). 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.

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

US Department of Agriculture, 2006, Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin, Handbook 296, Washington, DC.

US Environmental Protection Agency, 2012, Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews, 77 FR 49490.

US 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.

US 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).

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

US Department of the Interior. 2004. Bureau of Land Management. 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.

US Department of the Interior. 1990. Bureau of Land Management. 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.

U.S. Department of the Interior 2011, Bureau of Land Management. BLM National Greater Sage-Grouse Land Use Planning Strategy. IM 2012-044. December 27, 2011. 2 Attachments.

U.S. Department of the Interior 2003, Bureau of Land Management. Powder River Oil and Gas Project Environmental Impact Statement and Resource Management Plan Amendment. April 30, 2003.

U.S. Department of the Interior, Fish and Wildlife Service (FWS). 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.

Department of Interior. Fish and Wildlife Service (FWS). 2013. Recommended Seasonal and Spatial Buffers to Protect Nesting Raptors. Wyoming Ecological Services Office, Cheyenne, WY. Updated January30, 2013. http://www.fws.gov/wyominges/Pages/Species/Species_SpeciesConcern/Raptors.html 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.

US 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.

US 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.

US Department of the Interior, Geological Survey. 2012. Hydraulic Fracturing – The State of the Science. Induced Seismicity. Leith, B. http://www.usgs.gov/solutions/ppt/2012june08_leith.pptx. Congressional Briefing hosted by the Honorable Gerry Connelly (D-VA). June 8, 2012. View at: http://www.youtube.com/watch?v=XnRH9i8hpbo&feature=youtu.be See, Earthquakes Induced by Fluid Injection. http://www.usgs.gov/faq/index.php?sid=54684&lang=en&action=show&cat=125

US Department of the Interior, Geological Survey. 2012. Kresse, T.M., Warner, N.R., Hays, P.D., Down, A., Vengosh, A., and Jackson, R.B., 2012, Shallow groundwater quality and geochemistry in the Fayetteville Shale gas-production area, north-central Arkansas, 2011: Investigations Report 2012–5273, 31 p.

US 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 .

University of Wyoming, Norton, J., Strom, C., Reclamation Considerations for Oil and Gas Lease Contracts on Private Lands, Bulletin B-1242, Apr. 2013.

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.

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.

Warner, N.R., Jackson, R.B., Darraha, T.H., Osbornc, S.G., Downb, A., Zhaob, K., Whitea, A. and Vengosha, A., 2012, Geochemical evidence for possible natural migration of Marcellus Formation brine to shallow aquifers in Pennsylvania, Proceedings Natl Acad Sciences

White, C.M. and T.L. Thurow. 1985. Reproduction of ferruginous hawks exposed to controlled disturbance. The Condor 87:14-22.

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

WGFD. 2011a. 2011 Sheridan Region Annual Big Game Herd Unit Reports. WGFD. Cheyenne, WY.

WGFD. 2011b. 2011 Sheridan Region Lek Monitoring Results.

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

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

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

Wyoming Department of Environmental Quality, June 14, 2004. Compliance Monitoring for Ground Water Protection Beneath Unlined Coalbed Methane Produced Water Impoundments

Wyoming Oil and Gas Conservation Commission. 2013. Well Files, http://wogcc.state.wy.us/ .

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.