EOG RESOURCES, INC.

MOXA ARCH DEIS COMMENTS

COMMENT LETTER

January 9, 2008

Via Overnight Delivery and Electronic Mail

Moxa Arch DEIS, Project Manager
Bureau of Land Management
Kemmerer Field Office
312 Highway 189 North
Kemmerer, WY 83101

Re: EOG Resources, Inc.'s Comments Regarding the Moxa Arch Area Infill Gas Development Project Draft Environmental Impact Statement

Dear Ms. Easley:

EOG Resources, Inc. (EOG) offers the following comments on the Moxa Arch Area Infill Gas Development Project Draft Environmental Impact Statement (MIDP DEIS). EOG produces significant oil and natural gas from the Moxa Arch Natural Gas Field and is a project proponent for the MIDP. Although EOG has significant concerns with portions of the BLM's analysis in the MIDP DEIS, EOG believes the MIDP DEIS satisfies the twin purposes of the National Environmental Policy Act of 1969 (NEPA), to consider the potential impacts of a proposed federal action and to inform members of the public of those potential impacts. *See Baltimore Gas & Electric v. Natural Resources Defense Council*, 462 U.S. 87, 97 (1983). As the BLM is aware, NEPA is a procedural statute intended to produce informed decision making by federal agencies. *United States Dep't of Trans. v. Public Citizen*, 541 U.S. 752, 756-57 (2004); *Lee v. United States Air Force*, 354 F.3d 1229, 1237 (10th Cir. 2004). While NEPA mandates that agencies follow specific procedures when reaching decisions that significantly affect the environment, NEPA does not impose any requirement on agencies to reach a particular decision. *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350-51 (1989); *Lee*, 354 F.3d at 1237. Moreover, NEPA does not require agencies "to elevate environmental concerns over other valid concerns." *Lee*, 354 F.3d at 1237. Once the agency adequately identifies and evaluates environmental concerns, "NEPA places no further constraint on agency actions." *Pennaco Energy, Inc. v. United States Dep't of the Interior*, 377 F.3d 1147, 1150 (10th Cir. 2004).

SUMMARY

EOG has identified the following issues as ones of major concern:

1. The BLM inappropriately altered the Proposed Action submitted by the Moxa Operators.

2. The BLM did not use the technical data provided by the Moxa Operators to support its analyses, resulting in an inaccuracies in the DEIS. The technical data included:

    a. A directional drilling paper that included the most current costs and operational details from 33 wells drilled in the Moxa Arch Field. The BLM used data from one (older) well drilled by a single operator.

    b. A discussion of best management practices (BMPs) that provides an evaluation and supporting rationale of the types of operational practices that will work in the project area and those that will not (such as consolidated facilities, drilling more than one well from a single well pad, etc.).

3. The BLM analyzed two alternatives that are effectively identical – the No Action alternative and Alternative B.

4. The protocol used for air quality model does not incorporate accurate representations of oil and gas production in the Moxa Arch area, resulting in inaccurate results and flawed conclusions in the analysis of impacts to air quality. More specifically, the impacts to visibility described in the DEIS will not occur.

5. A boom-bust cycle will result from imposition of a drilling limit or cap, as analyzed in Alternative B. The Operators should not be responsible for rectifying the socioeconomic impacts that will result from imposing a cap.

6. The Reclamation Plan in Appendix E should be replaced with the Operators' reclamation commitment.

    a. The Appendix E "plan" is impractical, far exceeds any BLM national or Wyoming BLM policy, and will not result in the assurance of reclamation success.

    b. The Appendix E "plan" lacks a thoughtful application of principles that would be applied on a project-area specific basis.

c. The Appendix E "plan" would not provide for an alteration of procedures that would be developed over time until reclamation success is measurable.

The BLM analyzed the potential impacts of infill development in the Moxa Arch Area (MAA) to a wide variety of resources, under a range of alternatives. For the reasons stated herein EOG continues to support the Proposed Action or Alternative C. EOG is strongly opposed to the unreasonable and unworkable surface disturbance cap imposed under Alternative B. The proposed cap would unfairly benefit Operators with state and private mineral leases, would prevent federal lessees from developing and producing domestic energy, and would deprive the federal, state, and local treasuries of significant revenue. The surface disturbance cap under Alternative B would also be impossible for the BLM or Operators to successfully manage and enforce given the "spatial complexity of the leases, the multiple operators, the variable size of the leases, and the checkerboard land ownership pattern" in the MAA. *See* MIDP DEIS pg. 2-17. The proposed surface disturbance cap is also inherently unworkable because the Moxa Arch Field "is an existing gas field and most of the leased acreage has already had some level of development and disallowing drilling could constitute the taking of a lease right." *See* MIDP DEIS, pg. 2-17.

As currently proposed, the surface disturbance cap would also create a land rush with Operators hoping to have wells approved before the threshold is reached. This "land rush" would also favor the owners of fee and state mineral leases because of the shorter time frames normally required to permit wells on non-federal lands. In fact, because operations on fee and state minerals are ongoing during the preparation of the MIDP EIS, it is reasonable to conclude the surface disturbance cap proposed under Alternative B will be reached even before the Record of Decision for the MIDP is released. Any strategy developed by the BLM for operations in the MAA must treat federal lands separately from fee and State of Wyoming lands.

If the BLM insists on developing and imposing a "rolling" cap on surface disturbance for the MAA, the BLM should provide substantiation and documentation of:

1. The quantifiable adverse effects to species and/or resources that would result from all alternatives in terms of populations and/or habitat required to support population objectives; and

2. The quantifiable expected benefits to a species and/or resource that would result from imposition of a cap, with consideration given to land ownership patterns the BLM's inability to regulate non-federal lands.

If the BLM can provide objective evidence supporting the imposition of a cap, particularly given the land ownership pattern in the MAA, the cap must be imposed on an operator-specific basis and must, therefore, apply only to federal lands. Operators, like EOG, that perform adequate reclamation should not have their operations halted because

other operators, particularly those on non-federal lands, are not meeting the BLM's expectations on successful reclamation. The imposition of a cap on federal surface only would most likely result in the loss of significant federal minerals, and could exacerbate impacts to non-federal lands as they would bear the brunt of development in the MAA. Shifting potential impacts from federal surface to nonfederal surface would result in disproportionate adverse impacts to the species and resources within the MAA.

GENERAL COMMENTS AND RECCOMENDATIONS

Expedite the Record of Decision

Given the fact that this is the fourth NEPA document and the second major EIS prepared for development in the Moxa Arch Field, and the fact that the BLM has already spent approximately two years studying the impacts of additional development within the Moxa Arch Field, EOG encourages the BLM to expedite the completion of the MIDP EIS and Record of Decision (ROD). The BLM's Kemmerer Field Office and the Wyoming State BLM Office need to make the MIDP EIS a top priority and should utilize any resources necessary to complete the Final EIS and issue the ROD as soon as possible. The sooner the BLM issues the ROD for the MIDP, the sooner additional energy supplies can be provided for the nation, and the sooner the economies of southwest Wyoming will be assured of stable jobs, increased tax revenues, and continued economic success.

Differences Between the Alternatives

As presented in table 2-2, MIDP DEIS, pg. 2-2, the overall difference between the amounts of surface disturbance authorized under the various alternatives is not that significant. Under the Operators' Proposed Action only 4.02% of the MAA would be disturbed, compared to the 3.36% of total surface disturbance presently authorized under the No Action Alternative. Even the full-field development scenario presented under Alternative C allows less than 6% of the MAA to be disturbed. However, the production of natural gas and associated hydrocarbons under the various alternatives is very different. For example, under the No Action Alternative only 24.5% of the recoverable natural gas resource would be recovered. Similarly, under the No Action alternative over 1,000 billion cubic feet (BCF) of natural gas and over seven million (7,000,000) barrels of condensate would not be recovered as compared to the Proposed Action. *Id. See* MIDP DEIS, pg. 4-18. Under the Proposed Action, 60% of the resource would be recovered. *Id.* By approving only 0.66% additional surface disturbance under the Proposed Action, the BLM can encourage the production of 35.5% more domestic energy including the production of 1,063 BCF of clean-burning natural gas and 7.4 million barrels of condensate compared to the No Action Alternative. *Id.* Under Alternative C, 85% of the technically recoverable resource would be recovered, a significant increase over even the Proposed Action. *Id.* At 4-19. Given the insignificant difference in the allowable surface disturbance between the Proposed Action, Alternative C and the No Action Alternative, and given the significant domestic energy resources that can be recovered under the Proposed Action and/or Alternative C, the BLM must approve the

Operators' Proposed Action or Alternative C. As described in more detail below, the BLM's assumption that the same amount of natural gas would be produced under Alternative B and Alternative C is plainly erroneous and unsupported by the BLM's analysis.

Add a Best Management Practices Alternative

EOG suggests that the BLM consider analyzing an alternative to the FEIS that incorporates project area–specific measures that address the concerns of the BLM, cooperating agencies, and the public while truly managing the area for multiple use. The BLM and cooperating agencies have a unique opportunity to craft an alternative to the proposed action that would examine the effects of implementing mitigation measures that may benefit the resources across the Moxa Arch area. The development of such mitigation measures would essentially define "best management practices" for oil and gas operations in the Moxa Arch area. Such an alternative would have impacts within the range of the existing alternatives because the impacts would be expected to be less than those anticipated by the BLM under Alternative C, yet greater than the impacts anticipated under Alternative A, the No Action Alternative. The results of a newly developed alternative could benefit resources across the checkerboard, without distinction to surface ownership.

Using the information provided in the DEIS, EOG offers the following examples as the kinds of BMPs that could be considered and analyzed in a BMP alternative:

1. Pronghorn management – Delineate the areas of crucial severe winter relief; define "severe winter episode" (see MIDP DEIS, pg. 3-45) so that the Operators and the public understand precisely the extent and nature of this time; examine the use of restricted oil and gas activity in crucial severe winter relief areas during severe winter episodes.

2. Pronghorn management – Analyze the effects of constructing new fences such that the lower strand does not restrict pronghorn migration; how much fencing lies within migration areas? Are the fences used for livestock containment? Can livestock be contained with modified wire strand placement? Would the Operators be willing to support a re-fencing effort in migration corridors?

3. Pronghorn management – Emphasize/prioritize reclamation efforts in migration corridors; work with the Operators to develop a reclamation strategy that would take into account those areas where immediate reclamation would provide the most benefit to wildlife species.

4. Mule deer management – Develop protective measure/mitigation strategies for stream corridors, which is the most valuable yearlong habitat for this species (see MIDP DEIS, pg. 3-47).

5. Vegetation management – Update the weed survey in the project area so that large areas(1 to 20 acres) of noxious vegetation are located; work with the Operators to eliminate the weeds; incorporate weed management strategies into the reclamation plan committed to by the Operators (***NOT*** the Appendix E plan).

6. Vegetation management – Investigate the use of biological controls to kill the tamarisk along streams; enter into discussions with the Operators for consideration as offsite mitigation.

EOG realizes that the above list does not begin to include all the types of opportunities that could be examined with a more thorough examination of the information provided in the MIDP DEIS. The opportunities, though, can be found in the text and also in the experience of the BLM resource specialists and cooperators.

EOG encourages the BLM to work cooperatively with the Operators to develop strategies that would result in the most benefit to the resources of the Moxa Arch area. The Moxa Operators did not commit to a long list of applicant-committed environmental protection measures in order to provide the BLM with the opportunity to take a hard look at how best to manage the resources of the project area. EOG hopes that the BLM will decide to work with the Moxa Operators to devise strategies that will result in improvements to current resource conditions while allowing oil and gas development to continue. Although more difficult, the task is not impossible.

EOG additionally offers the following specific comments regarding the MIDP DEIS organized by chapter and section:

CHAPTER 1 – PURPOSE AND NEED

Section 1.3 – Purpose and Need for the Project

Issue – "The proposed project meets the purpose and need and planning criteria for oil and gas development contained in the Kemmerer and Green River Resource Management Plans (RMPs) (BLM 1985, 1997b)." *See* MIDP DEIS, pg. 1-7.

Comment – Map 1-2 indicates the MAA is entirely within the Kemmerer Resource Area. *See* MIDP DEIS, pg. 1-3, Map 1-2. The previous EIS for operations in MAA suggest the field is entirely within the Kemmerer Resource Area as well. *See* Final EIS Expanded Moxa Arch Area National Gas Development Project (BLM 1996), pg. 1-1. The BLM must ensure consistency between the language in the MIDP DEIS and Map 1-2.

Section 1.5.2 – Wyoming Mitigation Guidelines and Practices for Surface Disturbing and Disruptive Activities

Issue – On page 1-13 the BLM states that it has "adopted a standard set of guidelines and post-lease COAs that apply to all surface-disturbing activities on federal lands and minerals in Wyoming (Appendix A)."

Comment – Appendix A does not represent a set of BLM standard mitigation measures, but appears to be a sample set of guidelines intended for consideration at the site-specific level. As plainly noted in the language on page A-1, identical requirements would not be imposed in all circumstances. Further, page A-1 explains that the BLM "Standard Stipulations" are best thought of as "guidelines" not mandatory stipulations or conditions of approval. *See* Appendix A, pg. A-1. The BLM should explain that the guidelines in Appendix A are intended to generally describe potential mitigation measures and conditions of approvals that could be applied in the MAA. The Final EIS should also explain that, in some cases, the BLM's ability to impose conditions of approval is limited by the terms of the particular oil and gas lease in question and by the BLM's own regulations. *See* 43 C.F.R. 3101.1-2 (2006). Once the BLM has issued a federal oil and gas lease without a no surface occupancy stipulation (NSO), and in the absence of a nondiscretionary statutory prohibition against development, the BLM cannot completely deny development on the leasehold, nor impose mitigation measures inconsistent with the BLM's authority under 43 C.F.R. § 3101.1-2. *See, e.g., National Wildlife Federation, et al.*, 150 IBLA 385, 403 (1999). Only Congress has the right to completely prohibit development once a lease has been issued. *Western Colorado Congress*, 130 IBLA 244, 248 (1994). Further, the BLM cannot modify EOG's valid and existing rights. Courts have recognized that once the BLM has issued an oil and gas lease conveying the right to access and develop the leasehold, the BLM cannot later impose unreasonable mitigation measures that take away those rights. *See Conner v. Burford*, 84 F.2d 1441, 1449-50 (9th Cir. 1988); 43 C.F.R. § 3101.1-2 (2006) (BLM can impose only "reasonable mitigation measures . . . to minimize adverse impacts . . . to the extent consistent with lease rights granted"). The BLM cannot impose mitigation measures inconsistent with EOG's existing lease rights.

Section 1.6.2 – Key Issues

Issue – On pages 1-14 – 1-18 the BLM identifies a series of "key issues" to be addressed in the MIDP EIS.

Comment – Unfortunately, despite the fact the Purpose and Need of the MIDP is to "allow the Operators to exercise their rights to drill for, extract, remove, and market natural gas under valid existing lease rights," the BLM has not included the development of natural gas as a "key issue." *See* MIDP DEIS, pgs. 1-7, 1-14 – 1-18. The BLM is authorized by the Mineral Leasing Act and required by the National Mining and Minerals Policy Act of 1970 and the National Energy Policy, to encourage the domestic production of federal natural gas and oil. The Energy Policy Act of 2005 also recognizes the

importance of public lands for increasing domestic energy sources. Further, as also noted in the Purpose and Need section of the MIDP DEIS, the Clean Air Act Amendments of 1990 strongly encouraged the use of natural gas, as compared to coal, as the preferred source of fuel for electricity production across the nation given the significantly lower carbon dioxide emission levels. The efficient production of natural gas is not only crucial to the local economy; it has significant environmental benefits over other forms of energy production. Given the emphasis Congress and the President have placed on domestic energy production, it should have been identified as a key issue in the MIDP EIS.

CHAPTER 2 – PROPOSED ACTION AND ALTERNATIVES

Section 2.2 – Alternative Development

Issue – Table 2-2 provides a summary of well numbers, infrastructure, project duration, and surface disturbance for the four alternatives. *See* MIDP DEIS, pg. 2-2. Tables 2-3, 2-4, and 2-5 respectively provide approximate disturbance estimates for new wells under the Operators' Proposed Action, Alternative A, and Alterative C. *See* MIDP DEIS, pgs. 2-5, 2-11, 2-13. With respect to Table 2-2-2, the BLM explains, "Summary information for Alternative B is a combination of the No Action and Alternative C. Detailed descriptions of the components of this alternative are presented in Section 2.3.3. Values presented for Alternative B are maximum short-term disturbance values and might not be reflective of the actual short-term disturbance that could occur as a result of implementation of the alternative." *See* MIDP DEIS, pg. 2-2, Table 2-2, n. 1.

Comment – The MIDP DEIS lacks a table representation of approximate surface disturbance estimates for Alternative B analogous to Tables 2-3, 2-4, and 2-5. Without an equivalent table for Alternative B, EOG finds it impossible to ascertain how this alternative could be a reasonable alternative to the Project Description the Operators provided the BLM (not the altered Proposed Action presented in the MIDP DEIS).[1] The BLM has not demonstrates the assumption made to support Alternative B are actually workable by disclosing the agency's quantification of potential impacts. Without this information the Operators cannot accurately assess whether the BLM's assumptions are either technically or financially feasible based on their actual experience in the MAA, Alternative B. The BLM has not provided sufficient evidence or analyses to support its assumptions regarding the feasibility of development under Alternative B.

Section 2.3 – Alternative Descriptions

Issue – The BLM relies on different assumptions for surface disturbance per well for each alternative, as set forth by the table below.

[1] As explained in detail below, the BLM improperly modified various aspects of the Operators' Proposed Action. The BLM cannot alter the action proposed by the Operators without creating a new alternative.

	Proposed Action (p. 2-3)	**Alternative A (p. 2-11)**	**Alternative B**	**Alternative C (p. 2-13)**
Initial disturbance per well (acres)	10.00	15.31	Not specified	8.80
Disturbance after interim reclamation per well (acres)	3.2	4.25	Not specified	2.95

Comment – The disturbance estimates should be uniform for all alternatives if the BLM assumes that vertical drilling would occur, as in the Operators' Proposed Action and Alternative C. The BLM should acknowledge that the current commitment to reclamation success and operating practices that have changed since 1997 would also effectively reduce disturbance under Alternative A.

Section 2.3.1 – Moxa Operators' Proposed Action

Issue – The BLM identifies a "final reclamation phase" of the MIDP that constitutes 10 years within the life of the project. This final reclamation phase extends the BLM's Life-of-Project (LOP) estimate to 60 years. *See* MIDP EIS, pg. 2-2, Table 2-2.

Comment – The "final reclamation phase" will not add 10 years to the life of the project. Table 2-2 fails to reflect that wells are being drilled annually over 10 years such that the production phase also begins in year 1, not in year 11. Final reclamation would, on the average, begin as the first wells drilled become depleted, approximately in year 40. Thus, the LOP estimate should only be 50 years. The BLM has inaccurately lengthened the LOP estimate to 60 years under all alternatives in Table 2-2. The BLM also fails to recognize that ongoing interim reclamation will reduce surface disturbance, this decreasing reclamation time during the productive life of the field.

Issue –The BLM changed the surface disturbance estimates included in the Project Description the Operators provided the BLM. The Operators conservatively estimated that the average initial disturbance associated with each new well would be 8.8 acres. In the Proposed Action in the MIDP DEIS, the BLM modified the Project Description to state that the average initial disturbance associated with each well would be 10 acres, including an additional 1.25 acres for larger pads, increased road/pipeline lengths, stock piles, diversion ditches, cut/fill on steeper slopes. *See* MIDP DEIS, pg. 2-5. Similarly, the Operators estimated long-term disturbance to be approximately 2.75 acres for a typical well. The BLM increased this estimate to 3.2 acres, including an additional 0.5 acre for gathering lines. *See* MIDP EIS, pg. 2-5, Table 2-3, n.3.

Comment – The BLM should have analyzed increased well pads sizes under a distinct alternative rather than change the Operators' Project Description. The BLM cannot alter the Proposed Action even if the agency believes additional surface disturbance assumptions are warranted. The BLM's NEPA Handbook specifically requires the BLM to seek the applicant's concurrence for any modifications to the Proposed Action. *See* BLM NEPA Handbook, H-1790-1, Chapter V.B.1.d.(3), Chapter V.B.2.a.(2), pgs. V-4, V-5 (Rel. 1-1547 10/25/88).

Comment – The BLM failed to provide any rationale for increasing the amount of surface disturbance in the Operators' Project Description. The amount of disturbance in the project description presented to the BLM represents the Operators' best estimate of the actual average amount of disturbance that would result from drilling an *infill* well in the MAA. The MAA clearly contains an extensive network of collector and access roads that will be used to the extent possible for infill operations. In their surface disturbance estimates, the Operators projected that a typical new access road would average 0.5 mile, approximately corresponding to a well density one well per 320 acres. Considering the Proposed Action is an infill project with proposed well densities raging from 4 to 12 wells per section in the core area and 2 wells per section in the flank area, a 0.5 mile estimate of disturbance resulting from access roads is sufficiently conservative to compensate for slight variations in well pad size. The BLM's decision to consider pipeline disturbance adjacent to the access road as additional disturbance does not realistically represent or consider the actual content of the Operators' Project Description and current BLM land management procedures.

Comment – The increase in disturbance resulting from gathering lines is not warranted because the Operators proposed to locate gathering lines adjacent to access roads within the disturbance for road construction. *See* MIDP DEIS, Appx. B, pg. B-9. The seemingly small increases to the "proposed" disturbance results in a short-term disturbance increase of 14% from 16,397 acres to 18,650 acres. Long-term disturbance would correspondingly and disproportionately (because of the BLM's decision to quantify gathering line disturbance adjacent to an access road as distinct from the road disturbance) increase from 5,059 acres to 5,997 acres. The BLM should use the surface disturbance estimates provided by the Operators, not the increased estimate developed by the BLM.

Issue – "The Operators commit to…developing an Initial Reclamation Plan and periodic revisions, if monitoring results indicate the need to alter reclamation procedures.…" *See* MIDP DEIS, pg. 2-6.

Comment – The inclusion of a "reclamation plan" in Appendix E of the MIDP DEIS leaves the Operators with questions as to the applicability and implementation of its reclamation commitment. The BLM must clarify whether the plan in Appendix E represents the "Initial Reclamation Plan" described on page 2-6 of the MIDP DEIS and whether a new plan is required.

Issue – "After interim reclamation is completed, the new long-term disturbance associated with project development would be approximately 5,997 acres. It is expected that this level of disturbance would be present for the life of the wells that are drilled (approximately 50 years: 10 years of drilling and 40 years of production)." *See* MIDP DEIS, pg. 2-7.

Comment – The BLM improperly altered the contents of the Operators' Project Description. This text was written by the BLM and was not part of the Operators' Project Description. The Operators estimated long term disturbance resulting from project implementation to be 5,059 acres. The BLM must use the surface disturbance estimates provided by the Operators, not the increased assumptions developed by the BLM. "For externally initiated proposal, the applicant must concur (in writing) with any modifications to the proposed action." *See* BLM NEPA Handbook, H-1790-1, Chapter V.B.1.d.(3), Chapter V.B.2.a.(2), pgs. V-4, V-5 (Rel. 1-1547 10/25/88).

Issue – "The Operators will adhere to all conditions included with their leases in addition to all federal and state laws and regulations. According to BLM [Instruction Memorandum] No. 2004-194, best management practices to be considered in nearly all circumstances include the following:

- Interim reclamation of well locations and access roads soon after the well is put into production;
- Painting of all new facilities a color which best allows the facility to blend with the background, typically a vegetated background;
- Design and construction of all new roads to a safe and appropriate standard, "no higher than necessary" to accommodate their intended use; and
- Final reclamation recontouring of all disturbed areas, including access roads, to the original contour or a contour that blends with the surrounding topography.

The Operators commit to performing these environmental protection measures during the implementation of their Proposed Action." *See* MIDP DEIS, pgs. 2-7 – 2-8.

Comment – The BLM inappropriately expanded the best management practices that are set forth in BLM Instruction Memorandum (IM) No. 2004-194 and that the Moxa Operators committed to in their Proposed Action. The BLM included additional, lengthy commitments associated with each best management practice that were not identified in either BLM IM Nos. 2004-194 or 2007-021. For example, the BLM inserted the following text after the interim reclamation commitment detailed in the first bullet (above):

> Where practical, road surfaces and turnarounds would also be revegetated. With low traffic roads, this would result in a hardpan, two-track road that is stable and requires less maintenance. To ensure continued energy production operations, the operator would be allowed to drive, park, and set up future workover and maintenance operations on newly revegetated

> areas. Where there is a moderate to high risk of wildfire, a small buffer area would be left around production facilities or grass would be mowed prior to workover setup. Where future wells are anticipated to be drilled from the same well location within two years, approval to delay interim reclamation may be granted."

The additional text inappropriately changes the Operators' commitment from those described in the Proposed Action. *See* BLM NEPA Handbook, H-1790-1, Chapter V.B.1.d.(3), Chapter V.B.2.a.(2), pgs. V-4, V-5 (Rel. 1-1547 10/25/88). In particular the BLM's NEPA Handbook requires the BLM to consult with the project proponents if the BLM is proposing mitigation measures that would alter the Proposed Action. *See* BLM NEPA Handbook, H-1790-1, Chapter V.B.1.d.(3) (Rel. 1-1547 10/25/88). Accordingly, the BLM should remove additional text in the MIDP DEIS associated with each of the four commitments to which the Moxa operators did not commit. The Operators' Proposed Action described in the MIDP EIS must mirror the actual commitments of the Operators in their Project Description. EOG has attached the Project Description the Operators submitted to the BLM in December 2005 to these comments for incorporation into the administrative record. *See* EOG Attachment A. Any "explanation" appropriately belongs in the analysis of impacts in Chapter 4. Mitigation, as it is described in the allowed practices, also belongs in Chapter 4. The Operators did not commit to these conditions or allowed practices. Therefore, the text added by the BLM should be removed under each of the four applicant-committed BMPs

Section 2.3.2 – Alternative A (No Action)

Issue – In Section 2.3.2 the BLM identifies the No Action Alternative.

Comment – Although the BLM is required to include the No Action Alternative by NEPA, and although the No Action Alternative is a useful comparative tool, the BLM should clearly inform the public that selection of the Alternative A would not meet the purpose and need of the proposed action, would be inconsistent with the BLM's mandate to encourage natural gas production from federal lands, and would be contrary to the National Energy Policy and Executive Order 13211, 66 Fed. Reg. 28355 (May 18, 2001). The adoption of the No Action Alternative may also violate EOG's valid and existing rights. As the BLM is aware, once federal oil and gas leases are issued without a no surface occupancy stipulation, and in the absence of a nondiscretionary statutory prohibition against development, the agencies cannot completely deny development on the leasehold. *See, e.g., National Wildlife Federation, et al.*, 150 IBLA 385, 403 (1999); 43 C.F.R. § 3101.1-2 (2006). Only Congress has the right to completely prohibit development once a lease has been issued. *Western Colorado Congress*, 130 IBLA 244, 248 (1994). Thus, the BLM's decision in this case is limited to fashioning mitigation measures designed to reduce or eliminate potential adverse environmental impacts. *See National Wildlife Federation, et al.*, 150 IBLA at 403 (1999). In the Final EIS, the BLM should discuss the fact that an oil and gas lease is a contract between the federal government and the lessee, and that the lessee has certain rights thereunder. *See Mobil*

Oil Exploration & Producing Southeast, Inc. v. United States, 530 U.S. 604, 620 (2000) (recognizing that lease contracts under the Outer Continental Shelf Lands Act give lessees the right to explore for and develop oil and gas); *Oxy USA, Inc. v. Babbitt*, 268 F.3d 1001, 1006-7 (10th Cir. 2001) (noting that the Tenth Circuit has long held that federal oil and gas leases are contracts), *rev'd on other grounds, BP America Prod. Co. v. Burton*, 127 S. Ct 638 (2006). The BLM partially recognizes that the adoption of an alternative prohibiting further development on producing leases is impractical and may constitute a taking on page 2-17 of the MIDP DEIS, and should include similar language with respect to the No Action Alternative.

Issue – The BLM characterizes Alternative A as serving "two functions, as the no action and as a low development alternative." MIDP DEIS, pg. 2-1.

Comment – The No Action Alternative should analyze the denial of the Moxa Operators' proposal and not a low-development alternative. Although the MIDP DEIS recognizes that the 1997 ROD for the Expanded Moxa Arch Area Natural Gas Development Project authorized additional wells in the MAA that have yet to be drilled, the No Action Alternative must only analyze denial of the Operators' proposal and continuance of the status quo. Characterization of Alternative A as a "low development alternative" suggests that the BLM has analyzed an alternative of allowing a small level of development beyond that authorized in the 1997 ROD. Further, from a practical perspective, the No Action Alternative is essentially a no development alternative because the surface disturbance limitations imposed under the 1997 Rod effectively prohibit further development in the productive portions of the MAA.

Issue – "The operators previously committed to extensive reclamation and re-vegetation that has not been successful for a variety of reasons including poor practices, low reclamation success, drought, etc." MIDP DEIS, pg. 2-8.

Comment – The BLM must revise this language to remove the implication that reclamation and revegetation "has not been successful." It is inaccurate to imply that all reclamation and revegetation in the MAA has "not been successful." Furthermore, this statement suggests that all Operators have engaged in poor reclamation and revegetation practices. EOG has conducted its operations to comply with the requirements of the 1997 ROD for the Expanded Moxa Arch Area Natural Gas Development Project. Moreover, the BLM's language ignores that many sites have met DEQ stormwater notice of termination criteria and are stable from wind and water erosion. Weed control measures are ongoing. Numerous sites have been plugged and abandoned, and many sites on federal and private surface have been reclaimed to BLM and private party satisfaction. This statement must be revised. EOG has implemented various innovative strategies to improve the results of its reclamation efforts. The fact that a few Operators have not implemented appropriate reclamation techniques does not demonstrate or indicate that all reclamation in the MAA has not been adequate.

Issue – Map 2-3 notes that wells that could be drilled under Alternative A would be located primarily outside of the high production potential area referred to by the Operators as, the core. *See* MIDP EIS, pg. 2-10.

Comment – The BLM fails to acknowledge that the wells previously authorized in the 1997 ROD for the Expanded Moxa Arch Area Natural Gas Development Project would be drilled only if economic conditions were favorable and sufficient production expected. It is probable that wells outside of the core area will not be drilled. Wells that are uneconomic will not be drilled.

Section 2.3.3 – Alternative B

Issue – "Alternative B would place a limit on the amount of active surface disturbance in the MAA." *See* MIDP DEIS, pg. 2-12.

Comment - The BLM uses the phrase "active surface disturbance" in its description of Alternative B and throughout the MIDP DEIS. The BLM did not provide a definition of "active surface disturbance." As a result, EOG must surmise the meaning of this phrase without certainty as to what the BLM is analyzing in the alternatives. The BLM should define and consistently use the phase "active surface disturbance" in the Final EIS for the MIDP.

Issue – "The intent of this alternative is to allow the Operators to fully develop the MAA while conserving the key resource values identified during scoping and outreach to cooperating agencies as discussed in Chapter 1, section 1.6 in addition to meeting the objectives of the RMP and BLM's multiple use management goals. . . . Alternative B would allow for full field development under a scenario with the same surface disturbance allowed for Alternative A/No Action." *See* MIDP DEIS, pg. 2-12.

Comment – Alternative B places unreasonable and unjustified limitations on surface disturbing operations in the MAA. As the numbers set forth in the table below reveal, Alternative B would not allow for any additional development beyond that allowed under the No Action Alternative. Alternative B, therefore, inappropriately precludes additional development in the MAA.

Alternative B	Alternative A - No Action
Total "active" disturbance limit of 10,921 acres.	Total "active" disturbance limit of 10,921 acres.
Includes 8,073 acres existing disturbance (estimated).	Includes 8,073 acres existing disturbance (estimated).
2,848 ac. remains for future O&G development (estimated).	2,848 ac. remains for future O&G development (estimated).
Includes 1,364 ac. on BLM. Remaining 1,484 ac. are private USFWS, BOR, State.	Includes 1,364 ac. on BLM. Remaining 1,484 ac. are private USFWS, BOR, State.

Comment – The BLM has not justified the severe surface disturbing limitations contemplated under Alternative B. The BLM must not select an alternative it cannot justify and support with sound science. The BLM's analysis in the MIDP DEIS or in other recently released studies indicates that big game populations in the MAA, despite the recent drought and ongoing oil and gas development in the Moxa Arch Field. *See* MIDP DEIS, pgs. 3-42 – 3-50 (noting that pronghorn, mule deer, elk and moose populations in the MAA are stable). Similarly, information in the MIDP DEIS, information from the Wyoming Game and Fish Department (WGFD), and other recent studies indicate sage-grouse populations in the MAA are stable or improving. *See* MIDP DEIS, pg. 3-57 (noting increased sage grouse populations in 2004); Tom Christiansen, Brief Status of Sage-grouse Population Trends and Conservation Planning in Wyoming as of March 16, 2007, and 2007 Sage-grouse Hunting Season Proposal (noting that while there have been historic declines in sage-grouse populations, there have been mid-term and short-term increases in populations); Taylor, Hayden-Wing, *et al.*, *Greater Sage-Grouse Populations and Energy Development in Wyoming*, pg. 24 (noting that sage grouse populations in the MAA are stable. To date, oil and gas operations have disturbed only minute amounts of various habitat types in the MAA. *See* MIDP DEIS, pgs. 3-35 (only 2% of sagebrush habitat disturbed), 3-25 (only 2% of alkali soils disturbed), 3-36 (only 1% of barren rock/exposed soils disturbed), 3-36 (only 1% of riparian areas disturbed), 3-36 (2% of agricultural lands disturbed), 3-26 (no juniper woodlands disturbed). The BLM has simply failed to justify the imposition of the unreasonable surface disturbance cap proposed under Alternative B. The analysis in the MIDP DEIS does not justify or support the imposition of a surface cap and the BLM's decision to impose such a cap would be arbitrary and capricious.

Comment – Alternative B would not meet the Purpose and Need of the Operators' Proposed Action because it would virtually eliminate all oil and gas development operations within the MAA. Where the action subject to NEPA review is triggered by a proposal from a private party, the BLM is required to give "substantial weight to the goals and objectives of that private actor." *Citizens' Comm. to Save Our Canyons v. United States Forest Service*, 297 F.3d 1012, 1030 (10th Cir. 2002); *Fuel Safe Washington v. Federal Energy Regulatory Comm'n.*, 389 F.3d 1313, 1324 (10th Cir. 2004). The BLM's NEPA Handbook similarly recognizes that "[f]or externally initiated proposals, the purpose and need generally reflects what the applicant intends to accomplish by the proposed action, e.g., to transport and sell natural gas to consumers." *See* BLM NEPA Handbook, H-1790-1, Chapter V.B.1.e.(1), pg. V-4 (Rel. 1-1547 10/25/88). The BLM has violated this requirement by developing an alternative that does not accomplish the purpose and need of the proposed action which is to "allow the Operators to exercise their rights to drill for, extract, remove, and market natural gas under valid existing lease rights granted by the BLM, State of Wyoming, and private owners and to increase the daily gas delivery from the MAA to help meet the growing national demand for clean burning energy sources." *See* MIDP DEIS, pg. 1-7. Alternative B would effectively preclude further development in the MAA. The BLM's

assertion that the Operators will be able to drill and develop natural gas resources in the MAA with virtually the same results as under Alternative C—which authorizes over four-times the amount of initial surface disturbance than Alternative B—is not supported by the analysis in the MIDP DEIS or actual experience in the Moxa Arch Field. The BLM cannot simply assume the Operators would be able to maintain an active drilling schedule while meeting wholly unreasonable reclamation and surface disturbance limitations. The BLM must not select Alternative B, and should not carry the Alternative forward into the Final EIS.

Comment – Alternative B is not consistent with the BLM's guidance regarding the selection of a reasonable range of alternative for an oil, gas, or geothermal project for two reasons. BLM Washington Office Instruction Memorandum 2005-247 (Sept. 30, 2005), describes the alternatives that must be analyzed in an oil and gas EIS. These include alternatives which meet the purpose and need for the proposed action, and alternatives which are not substantially similar in effects to an alternative that is analyzed in the EIS. *See* BLM Washington Office Instruction Memorandum 2005-247, Attachment 1-1. As described above, Alternative B does not meet the purpose and need of the proposed action because the alternative is not practical or feasible; development operations it the MAA would be halted within the first one to two years following the adoption of a ROD implementing Alternative B. Similarly, because almost no development would be allowed to occur under Alterative B, Alternative B is substantially similar to Alternative A, the No Action Alternative and should not have been analyzed in detail in the MIDP DEIS.

Comment – Alternative B is not a reasonable alternative and should not have been analyzed in detail by the BLM. The BLM has failed to provide any evidence supporting the BLM's objective to unreasonably limit surface disturbing operations in the Moxa Arch Field. Further, the BLM has failed to demonstrate Alternative B would allow the Operators to accomplish the goal of the project, which is to effectively and efficiently extract and produce oil and gas resources. Limiting all future disturbing operations to the surface disturbance limitations in the 1997 Record of Decision for the Expanded Moxa Arch Area Natural Gas Development Project (1997 ROD) is not reasonable or practicable. There is no evidence or analysis suggesting the Operators would be able to meet the unreasonable surface disturbance limitations, while still effectively and economically producing oil and gas resources. Alternatives that do not accomplish the purpose of an action are not reasonable and need not be studied in detail by the agency." *Citizens' Comm. to Save our Canyons v. United States Forest Service*, 297 F.3d 1012, 1030 (10th Cir. 2002) (citations and internal punctuation omitted). "NEPA does not require agencies to analyze the environmental consequences of alternatives it has in good faith rejected as too remote, speculative, or impractical or ineffective." *Id.* at 1030-31. The Council on Environmental Quality (CEQ) has described reasonable alternatives as "those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable." *CEQ's Forty Most Asked Questions*, Question 2a, 46 Fed. Reg. 18028, 18027 (March 23, 1981) (emphasis added).

Based on EOG's extensive experience in the Moxa Arch Field, it would not be practical to continue operations, much less conduct infill development in the MAA under the current surface disturbance restrictions. Operations in Zone 2 have already been halted because of the limits in the 1997 ROD. The BLM has not analyzed or identified potential mechanisms or operational tools that would allow operations to continue under the limits imposed by the 1997 ROD. Alternative B is not practical, should not have been analyzed in detail, and must be eliminated from further consideration by the BLM.

Comment – The BLM cannot assume the Operators would drill the same number of wells per year under the Proposed Action or Alternative C as would be drilled under Alternative B. First, the economics alone dictate that fewer wells will be drilled annually. The BLM itself acknowledges that directionally drilled wells cost between $300,000 and $350,000 more than a vertical well in the MAA. *See* MIDP DEIS pg. 4-72. Directional wells are also more expensive to complete and maintain. *See* MIDP DEIS, pg. 4-81. EOG and the Other Operators submitted a detailed technical paper regarding the feasibility and increased costs associated with directional drilling in the MAA to the BLM in August of 2006. **The Operators' actual experience in the MAA demonstrates that directional wells costs approximately $600,000 to $750,000 more per well** depending on the offset of the directional well. *See* Directional Drilling Paper, pg. 11. Thus, **a directional well could actually cost over twice as much than a vertical well in the MAA.** A copy of the Directional Drilling Paper is attached to these comments for the BLM's consideration and inclusion in the administrative record. *See* EOG Attachment B. Because Operators have limited budgets each calendar year, the increased costs of directional drilling alone will cause less wells to be drilled on an annual basis. Further, because fewer wells per year will be drilled, the BLM's socioeconomic and production analyses under Alternative B are not remotely accurate. The BLM must either eliminate Alternative B from detailed consideration or revise the socioeconomic impacts section of the EIS.

Comment – The BLM cannot assume the Operators would drill the same number of wells per year under the Proposed Action or Alternative C as would be drilled under Alternative B. The increased length of time it takes to drill a directional well in the MAA will reduce the total number of wells that can be drilled on an annual basis. The BLM admits that directionally drilled wells require additional time to drill, yet assumes that that same number of wells can be drilled each year. *See* MIDP DEIS, pg. 4-81 (noting that it takes eight (8) days longer to drill a directional well). The Operators' analysis demonstrates that directionally drilled wells in the MAA take even longer than assumed by the BLM in the MIDP DEIS. The Operators' actual experience in the MAA demonstrates that directionally drilled wells average 28.5 days for a 1,320 foot offset and 33 days for a 1,475 foot offset. *See* Directional Drilling Paper, pg. 11. This data was obtained from drilling numerous wells in the MAA, not the single directionally drilled well referenced by the BLM throughout the MIDP DEIS. *See, e.g.*, MIDP DEIS, pgs. 4-81 (describing a single directionally drilled well drilled by Westport). With the additional drilling time required for each well, fewer wells will be drilled on an annual

basis. The BLM must realize too that if problems occur, as they frequently do with directional wells, some wells may require substantially longer times to drill. Problems can result in loss of a well bore. The BLM must either eliminate Alternative B from detailed consideration, or completely reanalyze the socioeconomic impacts associated with Alternative B.

Comment – The practical result of implementing Alternative B would be a denial of EOG's right to economically produce the mineral resource from its valid existing leases. Drilling would, in fact, not occur under economic conditions similar to those which currently exist because directional drilling, which is the only drilling technology that could be used to partially meet the disturbance limit imposed under Alternative B, would not be economically viable in the majority of the MAA. The Operators provided a detailed report regarding the economic costs associated with directional drilling in the MAA. The BLM did not accurately take into account the increased costs associated with development under Alternative B. The BLM should also carefully study the technical information in the Directional Drilling Paper submitted by the Operators in August of 2006 attached hereto as EOG Attachment B. Directional drilling is not economically feasible in the majority of the MAA.

Comment – Because the BLM cannot assume, or begin to demonstrate, that the same number of wells can be drilled annually under Alternative B as under Alternative C, the BLM's socioeconomic analysis for Alternative B is entirely flawed and unsupportable. The BLM should have consulted with the Operators regarding the increased costs and increased drilling times associated with Alternative B to determine how operations would have been impacted. In all likelihood, virtually all drilling and development activities in the MAA would halt under Alternative B, leading to significant adverse impacts to the economy and tax base of southwest Wyoming. The BLM's socioeconomic analyses and estimates of natural gas recovered under Alternative B cannot be supported and must be completely redone.

Comment – Because it would not be economical to produce federal minerals under the strict surface disturbing limitations imposed under Alternative B, Operators that do not own fee leases within the MAA would likely move their operations to other areas where they could be assured of a return on their investment. The unreasonable limitation on surface disturbance coupled with the fact individual Operators will be impacted by the operations of every other operator in the MAA will likely make operations unreasonably risky. Operators will be forced to move their development dollars elsewhere, particularly given the relatively marginal economics associated with development in the MAA.

Issue – "Within 1-year of the signature of the record of decision for this project, the operators would provide BLM with a baseline calculation of disturbance with geospatial data layers supporting that calculation. That baseline would become the baseline from which all new disturbance would be measured and from which successfully reclaimed acreages would be subtracted." *See* MIDP DEIS, pg. 2-12.

Comment – The BLM has not justified why a baseline calculation of disturbance must be prepared post-ROD. Several Operators in the MAA recently funded a hosted worker in the Kemmerer BLM Field Office who surveyed and mapped existing disturbance in the Moxa Arch Field. Further, the BLM has prepared estimates of existing surface disturbance in the MIDP DEIS itself. *See* MIDP DEIS, pg. 2-1.

Issue – "However, the number of wells actually drilled per year would depend on the acreage available under the 10,921 acre cap and the estimated acres of disturbance for new wells proposed in the Operators' drilling plan." *See* MIDP DEIS, pg. 2-12.

Comment – The BLM acknowledges the difficulties with reclamation due to drought conditions on page 2-11 of the MIDP DEIS itself, yet fails to analyze how such conditions may impact oil and gas operations under Alternative B. The BLM assumes, without analysis or support, that the Operators would be able to counteract the impact of drought on reclamation success in order to actively drill up to 205 wells per year. The BLM's assumption that up to 205 wells could be drilled per year, used to support the BLM's faulty assumptions that Alternative B will lead to the same type of beneficial economic and natural gas recovery estimates under Alternative C cannot be supported. The BLM must analyze how drought conditions or unsuccessful reclamation practices will impact future oil and gas operations under the unreasonable surface disturbance cap imposed under Alternative B.

Issue – "However, the number of wells actually drilled per year would depend on the acreage available under the 10,921 acre cap and the estimated acres of disturbance for new wells proposed in the Operators' drilling plan." *See* MIDP DEIS, pg. 2-12.

Comment – Alternative B would create an unnecessary and unwise "race" for new disturbance because Operators in the MAA would be concerned that all drilling operations would cease if reclamation efforts are not successful or if drought conditions continue in Southwest Wyoming. The first permits approved post ROD may be the only permits authorized for several years. It is even possible that no new permits will be authorized if operations on state and fee leases conducted during the preparation of the MIDP EIS actually surpass the proposed cap. BLM should not adopt an alternative that would promote an unwise "land grab" in the MAA or encourage operators to rush development in the area on State of Wyoming, fee, or federal lands.

Comment – Alternative B would allow 1,364 acres to remain available for drilling on BLM lands while 1,484 acres on private United States Fish and Wildlife Service (USFWS), Bureau of Reclamation (BOR), and State of Wyoming lands would remain available. The BLM did not consider that a disturbance limit of 10,921 acres would result in disproportionate drilling operations on nonfederal lands and would favor those operators whose leases included nonfederal lands. Accordingly, impacts to resources would continue to be unevenly distributed through the checkerboard surface ownership in the MAA to an even greater extent. Selecting Alternative B could easily result in

sufficient economic hardship to some operators such that their operational viability may be threatened.

Comment – Alternative B would be difficult if not impossible to implement and enforce. Recent experience with a similar surface disturbance limitation in the Atlantic Rim Natural Gas Field Development Project has already demonstrated many difficulties. These include, but are not limited to, questions about how to address areas with poor vegetation prior to surface disturbance, areas infested with noxious weeds prior to disturbance, and even areas free of vegetation prior to disturbance. The BLM cannot assume that areas undisturbed by oil and gas operations contain beneficial vegetation. Questions have also arisen about how surface disturbance would be monitored. Further, the BLM in Rawlins, Wyoming has already encountered other difficulties implementing a "rolling" surface disturbance cap in the Atlantic Rim Area, despite the fact the ROD for that project was only released in May of 2007. The BLM in Kemmerer should carefully consult with the BLM office in Rawlins, Wyoming prior to adopting Alternative B, or any alternative with a "rolling" surface disturbance limitation.

Comment – Alternative B would be impossible to implement and enforce in the MAA given the number of operators and the spatial complexity of the Moxa Arch Field. Although the "rolling" surface disturbance cap has worked with moderate success in the Jonah Natural Gas Field, that success has primarily resulted from the fact that there are only two major operators in the entire Jonah Natural Gas Field, a very different situation than the Moxa Arch Field with over 30 operators. Further, the entire Jonah Field is only 30,000 acres in size making monitoring and enforcement much easier. The Moxa Arch Field is much larger at over 475,000 acres, which would make effective monitoring and enforcement very difficult.

Comment – The surface disturbance cap under Alternative B would be difficult to implement and enforce given the checkerboard land pattern in the MAA.. The BLM recognizes the spatial complexity of the MAA on page 2-17 of the MIDP DEIS. *See also* MIDP DEIS, pg. 1-4. Rolling surface caps have only been moderately successful in the Jonah Natural Gas Field, which is located almost exclusively on BLM administered minerals and surface. *See* Record of Decision, Jonah Infill Drilling Project, pg. 1 (2006) (the Jonah Field is comprised of 94% BLM surface/minerals). In comparison, the Moxa Arch Field contains significant private surface and minerals (the Moxa Arch Field is comprised of 42% private minerals/surface). *See* MIDP DEIS, pg. 1-1.

Comment – The BLM has not sufficiently analyzed the impacts Alternative B would have upon mineral development in the MAA. The assumption that the Operators would work together to promote reclamation for the mutual benefit of all the Operators ignores the competitive realities of natural gas development. The Operators compete with each other for resources and even equipment and labor. Alternative B is not a reasonable alternative and must be eliminated.

Comment – The BLM elected not to analyze in detail an alternative that would only allow drilling on selected leases each year, or drilling a certain percentage of leases per year because of the complexities involved in administering such an alternative and because "the decision on which leases to drill on each year or how much disturbance could occur on each lease would likely be arbitrary and not supportable." *See* MIDP DEIS, pg. 2-17. The same rationale applies to Alternative B. Alternative B would be difficult or impossible to administer given the number of federal leases, the discontinuous nature of lease ownership within the MAA, and the fact that decisions regarding which leases should be developed would be arbitrary and unsupportable. The BLM should apply the same rationale to Alternative B, and eliminate the alternative from further detected analysis.

Comment – The "rolling" surface disturbance limitation proposed under Alternative B would create an unfair advantage for oil and gas operators owning fee minerals, leases, or surface within the MAA or those operators holding significant leases for State of Wyoming lands. Such operators would not be subject to the limitations imposed under Alternative B, and would be free to develop minerals under whatever conditions they deem appropriate. Further, operators with substantial fee leases in the MAA would have no incentive to minimize surface disturbing operations or utilize enhanced reclamation efforts or low-impact operations such as mat drilling because they would have an operational advantage over any operators who only own federal leases within the MAA. By maximizing surface disturbing operations on fee leases, some operators could actually prevent the development of federal minerals in the MAA for substantial periods of time thereby removing competition for equipment and labor. This could potentially result in the drainage of federal minerals. Alternative B is not practicable or reasonable.

Comment – Because Alternative B would unfairly advantage operators with fee mineral leases or fee ownership in the MAA development on federal lands within the checkerboard portions of the MAA would be significantly slowed. As the BLM recognized with respect to a potential phased development alternative "[b]y phasing, and slowing development in the checkerboard it could prolong field development and prolong the impacts that occur to the above resources [wildlife species, water, air socioeconomics, visual resources, and soils]." *See* MIDP DEIS, pg. 2-17. BLM must not adopt Alternative B because it would unnecessarily slow development and prolong potential negative impacts to a variety of resources. The BLM's own analysis demonstrates that Alternative B is not practicable or reasonable and must not be analyzed in detail, much less adopted by the BLM.

Comment – The "rolling" surface disturbing limitation proposed under Alternative B would promote the recovery of fee and state minerals over federal minerals in the MAA because development on fee minerals would not be limited under Alternative B. Further surface disturbing operations on fee surface and minerals would have an adverse impact on operations on federal surface and minerals by limiting the number of

acres that could be disturbed. Promoting the development of fee minerals over federal minerals would have an adverse impact on the state and federal treasuries. The BLM cannot assume the Operators would be able to effectively develop federal minerals in the MAA under the onerous surface disturbance cap imposed under Alternative B, particularly because the BLM provided absolutely no analysis or information suggesting the Operators would be able to successfully reclaim acres in the MAA to the extent necessary for operations to continue in the MAA under the BLM's "rolling" surface disturbance cap. Alternative B must be eliminated from further consideration.

Comment – The proposed surface disturbing limitations under Alternative B could lead to the drainage of federal minerals if the Operators are unable to timely develop their federal leases. Because surface disturbing operations are not limited on fee surface/minerals, but have an adverse impact on the number of federal acres where surface disturbing operations can take place, development could take place to fee leases, offsetting wells could not be drilled on federal leases, and federal minerals may be drained. It would be extremely unfair if the BLM required federal leases to pay compensatory royalties if this occurs under Alternative B because it is the BLM's own decision to limit surface disturbing operations that led to the drainage, not the Operators' failure to diligently develop its leasehold. Alternative B is not a reasonable alternative.

Issue – "Per the reclamation plan committed to by the Operators and described for the Proposed Action, the Operators would submit quantifiable documentation and summary reports to the BLM to determine how many acres are available under the surface disturbance limit (the details of the reclamation plan that would be implemented as part of Alternative B are detailed in Appendix E)." *See* MIDP DEIS, pg. 2-12. The BLM also indicates on pages 2-12 that the best management practices (BMPs) for the Proposed Action would apply under Alternative B.

Comment – The BLM incorrectly assumes the reclamation plan submitted by the Operators would be agreed to under any alternative, and particularly that it would be agreed to if the BLM selects Alternative B. The Operators' Reclamation Plan was a part of the Proposed Action and would not be agreed to under Alternative B. Because the Operators' proposed reclamation plan contains aspects that are entirely voluntary, such as funding a hosted worker, the BLM cannot impose the proposed reclamation plan without the Operators' consent. The proposed reclamation plan is only available under the Proposed Action, or an alternative acceptable to the Operators. Given the extreme additional costs associated with Alternative B, and the fact little or no oil and gas exploration would take place under Alternative B, the Operators will not agree to the voluntary funding and development of an enhanced reclamation plan or the placement of a full time reclamation specialist in the BLM Kemmerer Field Office if Alternative B is adopted. Further, the Operators' reclamation plan under the Proposed Action contains the potential for offsite mitigation. The BLM cannot require offsite mitigation, it must be entirely voluntary. *See* BLM Instruction Memorandum 2005-069 (Feb. 1, 2005); Wyoming Instruction Memorandum WY-96-21 (Dec. 14, 1995). Similarly, the BMPs

the Operators have agreed to apply only under the Proposed Action, not onerous or unreasonable alternatives such as Alternative B. The BLM must correct this statement in the Final EIS for the MIDP.

Issue – The BLM suggests that several techniques identified under Alternative B to potentially reduce surface disturbance "will be analyzed in greater detail to provide a comparison between the other project alternatives." *See* MIDP DEIS, pg. 2-12. Among the various techniques identified by the BLM are directional drilling and mat drilling. *Id.* at 2-12 – 2-13.

Comment – The BLM failed to provide any analysis regarding the feasibility or economic viability of mat drilling in the MAA, and arbitrarily relied on insufficient information for the proposition that directional drilling is economically feasible in the MAA.

First, with respect to mat drilling techniques, the BLM failed to provide any information regarding the increased costs associated with mat drilling, and whether such additional costs are viable in the MAA. In addition to the purchase of the actual mats, the purchase of specialized equipment necessary to lay the mats, and special training to utilize said equipment, there are additional costs associated with training drilling crews, the installation of flareless flowback equipment and closed-loop systems for drilling fluids and muds, all of which are necessary for mat drilling proposals to actually reduce surface disturbing operations with mat drilling. *See* Jonah Field Experimental Well Pad Development Techniques Environmental Assessment, WY-100-EA05-345, September 2005 (Jonah Mat Drilling EA), pgs. 6 – 8. Further, for mat drilling techniques to reduce the overall footprint of construction activities, centralized completion facilities and "parent pads" must be utilized to locate production equipment such as dehydrators and tanks. The BLM has not analyzed the feasibility of parent pads in the MAA where downhole density is expected to be far less than the Jonah Field and Pinedale Anticline. Centralized or "remote" completion techniques are not generally possible in the MAA given the distances between well locations and the fractured lease ownership pattern within the MAA. The only location where mat drilling has been tested in Wyoming is the Jonah Field in Sublette County, which is distinctly different from the Moxa Arch Field for several important reasons including the fact that the Jonah Field is currently spaced on a 10-acre pattern, as compared to the 40 – 120-acre spacing patterns in the MAA. Further, the production volumes from a typical Jonah well are far greater than those in the MAA making more expensive production techniques, such as mat drilling, economical. Finally, the 10-acre spacing pattern in the Jonah Field both necessitates production techniques that minimize surface disturbing operations, and the consolidated lease ownership allows greater flexibility to co-locate production and completion facilities. The BLM itself acknowledges the diverse and discontinuous lease ownership pattern in the MIDP DEIS. *See* MIDP DEIS, pgs. 1-4, 2-17. The BLM's wholly unsupported assumption that mat drilling techniques can be utilized in the MAA was not

properly analyzed and a decision to adopt Alternative B would be arbitrary and capricious.

Second, the BLM has not demonstrated that mat drilling is technically viable in the MAA. Based on information contained in the BLM's file for the Jonah Mat Drilling EA, EOG understands that mat drilling techniques can only be used where the topography exhibits less than a 3% slope. The BLM has not presented information demonstrating mat drilling is even feasible in the MAA, or demonstrated that a sufficient portion of the MAA has slopes less than 3% thereby making mat drilling possible.

Third, the BLM has not demonstrated that directional drilling is economically feasible in the MAA. The Operators submitted a detailed technical analysis of directional drilling in the MAA to the BLM in August of 2006. See EOG Attachment B. The study was a collaborative effort representing input and concurrence from all the Operators and incorporated the most current project area-specific data available. Moreover, it included documented information regarding drilling times and actual well costs from 29 vertical wells and 4 directional wells and, thus, provided the most representative and current data available. The technical study demonstrated that directional drilling costs are over 200% higher than the costs associated with vertical drilling in the MAA, and that drilling times were over 300% longer. The technical paper further demonstrated that the longer the distances the Operators were required to directionally drill, the greater the costs and drilling times. The Operators' technical study was not referenced in the References section of the DEIS, indicating that the BLM arbitrarily ignored this information and relied solely upon the increased costs associated with drilling a single well drilled by Wesport Oil and Gas in 2005 for the proposition that directionally drilled wells in the MAA average between $300,000 and $350,000 higher than traditional vertical wells. *See* MIDP DEIS, pg. 4-72. The Operators' technical study, which was un-refuted and apparently ignored by the BLM, demonstrated that costs are between $600,000 and $750,000 higher depending on the offset of the well. Ten percent of the directional drilled wells in the MAA could have substantially higher costs including up to $1,300,000 over a traditional vertical well. The BLM's assumptions regarding the economic validity of directional drilling in the MAA must be corrected in light of the information presented by the Operators.

Fourth, the BLM must acknowledge its inability to mandate directional drilling techniques on existing leases. The BLM does not have the authority to require the movement of proposed operations more than 200 meters, unless a nondiscretionary statute is implicated. 43 C.F.R. § 3101.1-2 (2006); *Colorado Envtl. Coal., et al.*, 169 IBLA 137, 144 (2006) (holding that BLM cannot require relocation of a proposed well by 400 meters). Although directional drilling is an important tool in a modern natural gas field, the technique has significant tradeoffs in costs, drilling times, and adverse air quality impacts and cannot be mandated by the BLM in all situations.

Comment – Alternative B is fundamentally flawed by the BLM's refusal to incorporate information from actual experience in drilling vertical and direction wells in

the MAA, as described in the detailed technical analysis of directional drilling in the MAA the Operators submitted to the BLM in August of 2006. The entire technical study is attached this comment letter so that EOG is assured that the BLM has reviewed the paper and it is included in the administrative record.

Comment - Drilling 5,165 new wells on acreage currently approved for approximately 670 vertical wells is unworkable and will not allow EOG to develop the mineral resource, which is its valid existing right under its oil and gas leases. EOG used the following assumptions to graphically depict how surface disturbance from vertical wells could be expected to increase over time if the project were implemented as described in the Proposed Action.

- Initial surface disturbance per well = 8.8 acres. This disturbance amount corresponds to the Operators' estimate provided in its Project Description (but increased by the BLM in the MIDP DEIS) and to the amount analyzed in Alternative C.
- Interim reclamation per well = 6.1 acres. This figure corresponds to the Operators' estimate that was provided in its Project Description (but decreased by the BLM in the MIDP DEIS). The Operators proposed locating gathering lines parallel and adjacent to access roads, thereby further increasing the amount of surface that would be reclaimed during the interim during long term production operations. Thus, the figure of 6.1 acres is more in line with the 5.85 acres of interim reclaimed land analyzed by Alternative C, which considered collocating access roads and gathering lines.
- With the implementation of the Operators' reclamation commitment, interim and final reclamation would be considered by the BLM, State of Wyoming to be successful by the start of the fifth year after the institution of reclamation operations.
- Wells drilled the mid-1970s would start to end their productive life in year 15 after project initiation at a rate of approximately 200 wells per year for approximately 5 years. *See* MIDP DEIS, Table 3-10, pg. 3-20. Equivalent disturbance was calculated at 4.25 acres per well. *See* MIDP DEIS, pg. 2-11.

The graph in Figure 1 illustrates that no new wells will be drilled in the MAA in approximately two years after the approval of the ROD if wells are drilled vertically throughout the MAA, as proposed by the Operators, if Alternative B is adopted. Total new surface disturbance would peak at approximately 10,000 acres. Successful reclamation would allow the Operators to decrease new surface disturbance below a 2,848-acre limit by about year 18.

Comment – The BLM must recognize that ***even if directional drilling were technically and economically viable in all cases***, well pad disturbance would incrementally increase according to the number of wells on a pad. The Operators would not be able to conduct reclamation activities and directionally drill to ensure that the disturbance limit is met.

Drilling 5,165 new wells on acreage currently approved for approximately 670 vertical wells, as described by Alternative B, would be unworkable and represents a taking of EOG's valid existing rights under its oil and gas leases.

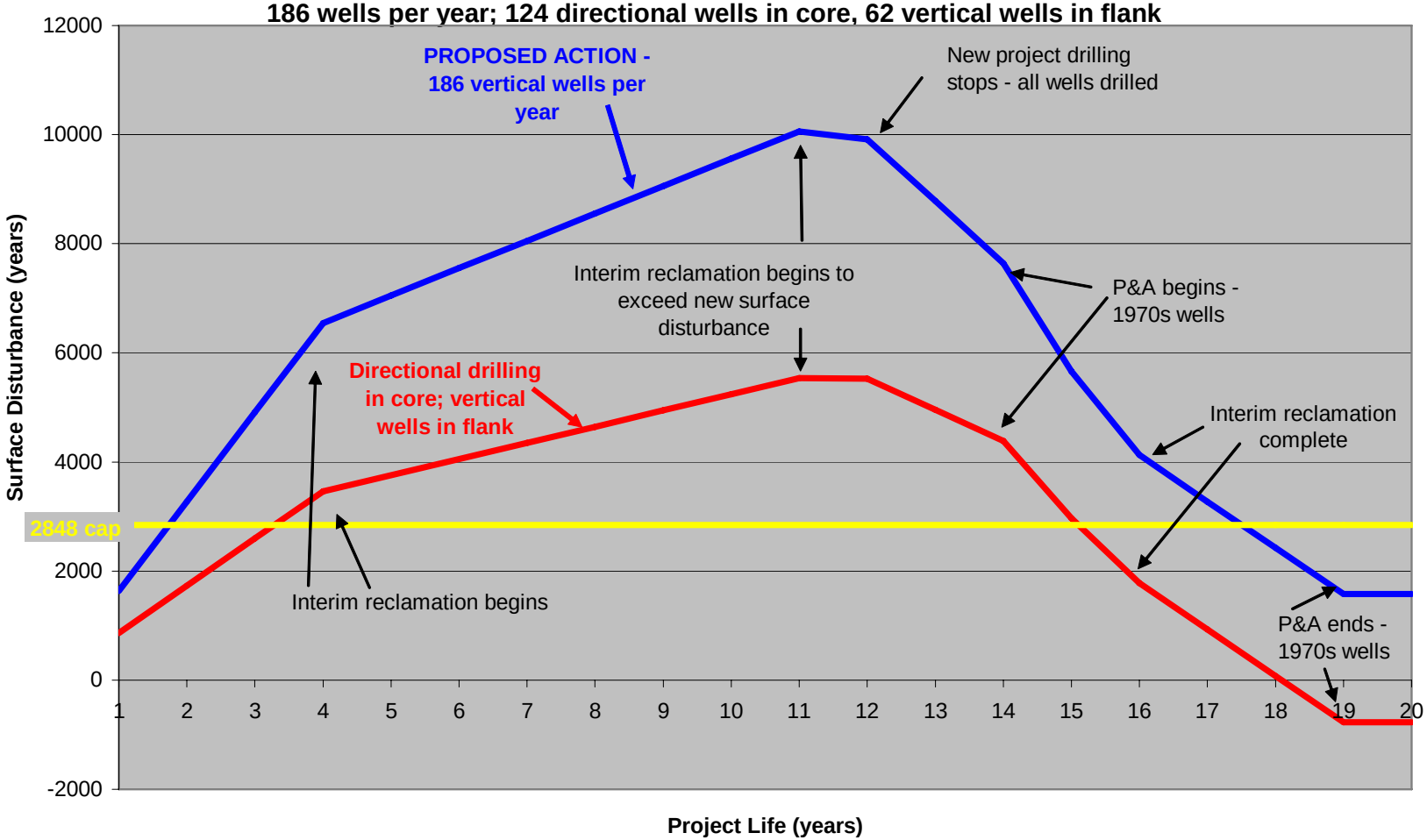
The graph in Figure 1 also illustrates how surface disturbance from directional wells could be expected to increase over time. It incorporates the following assumptions, in addition to the assumptions described for Figure 1:

- 2/3 core wells and 1/3 flank wells would be drilled annually out of the 186 wells total per year until the cap is reached.
- All core wells would be drilled from a central pad located in the center of each quarter-quarter.
- Flank wells would be drilled vertically.
- No more than 186 wells would be drilled annually.
- Directional wells: short-term disturbance would be 8.8 acres for central pad plus additional 0.5 acre each for 3 additional wells.
- Directional wells: long-term disturbance would be 2.7 acres for central pad + additional 0.2 acre each for 3 additional wells
- Vertical well disturbance = disturbance figures for Moxa Operators' proposed action.

The graph in Figure 1 illustrates that no new wells will be drilled in the MAA between years 4 and 5 after the approval of the ROD if they are drilled directionally in the core and vertically throughout the flank. Total new surface disturbance would peak at approximately 5,500 acres. Successful reclamation would allow the Operators to decrease new surface disturbance below a 2,848-acre limit by about year 15.

Altering the assumptions upon which this analysis is based would not fundamentally change the scenario portrayed in the following graph. Shortly after the approval of a surface disturbance cap such as that analyzed in Alternative B new operations would cease.

FIGURE 1: Surface Disturbance
Proposed Action vs Directional Drilling
186 wells per year - vertical
186 wells per year; 124 directional wells in core, 62 vertical wells in flank



Comment – Imposing a surface disturbance cap would result in initial burst of drilling activity followed by an extended period of much lower drilling activity that would exhibit "cycling" dependent upon extent of reclamation success.

Figure 2 illustrates an initial brief period of well drilling activity whether all the wells are drilled vertically or whether only the core wells are drilled directionally. The number of wells that could be drilled annually would vary substantially based upon the success of reclamation. Year 5 shows more wells being drilled because interim reclamation on the initial wells would presumably be successful by year 5, allowing more drilling than allowable in the previous year. Drilling activity within any particular year would depend entirely on reclamation success, which means that no company would be able to plan for future operations with assurance that drilling would, in fact, be permitted. This graph does not account for the time required by the BLM to confirm reclamation success, which may require an additional growing season, further decreasing the number of wells that would be permitted after the cap is reached.

If all wells were drilled vertically, the project time frame for 1,861 wells would be approximately 26 years. If the core wells were drilled directionally, the project time frame would be approximately 18 years. If all 5,165 wells analyzed by Alternative B are actually drilled, it would take far longer to develop the quantity of the mineral resource analyzed under Alternative B. The BLM must take these longer timeframes into account when analyzing the potential socioeconomic impacts of Alternative B.

The validity of these curves is only as good as the assumptions made to support them. Of course, the assumption that all core wells could be drilled directionally is extremely optimistic and does not consider the technical and economic variables that would allow any Moxa Operator to consider such a drilling strategy. In addition, the steep decline exhibited by the vertical well curve in year 20 does not reflect additional 1970-era wells that may be P&A during this time period forward. Surface disturbance would approximate the cap level until the wells drilled in the 1970s begin to be plugged and abandoned, shown in Figure 2 to be about 14 years after project approval. Nonetheless, the assumptions made to support this analysis provide a clear indication that imposing a cap will result in a boom-bust cycle that most communities will not be able to support.

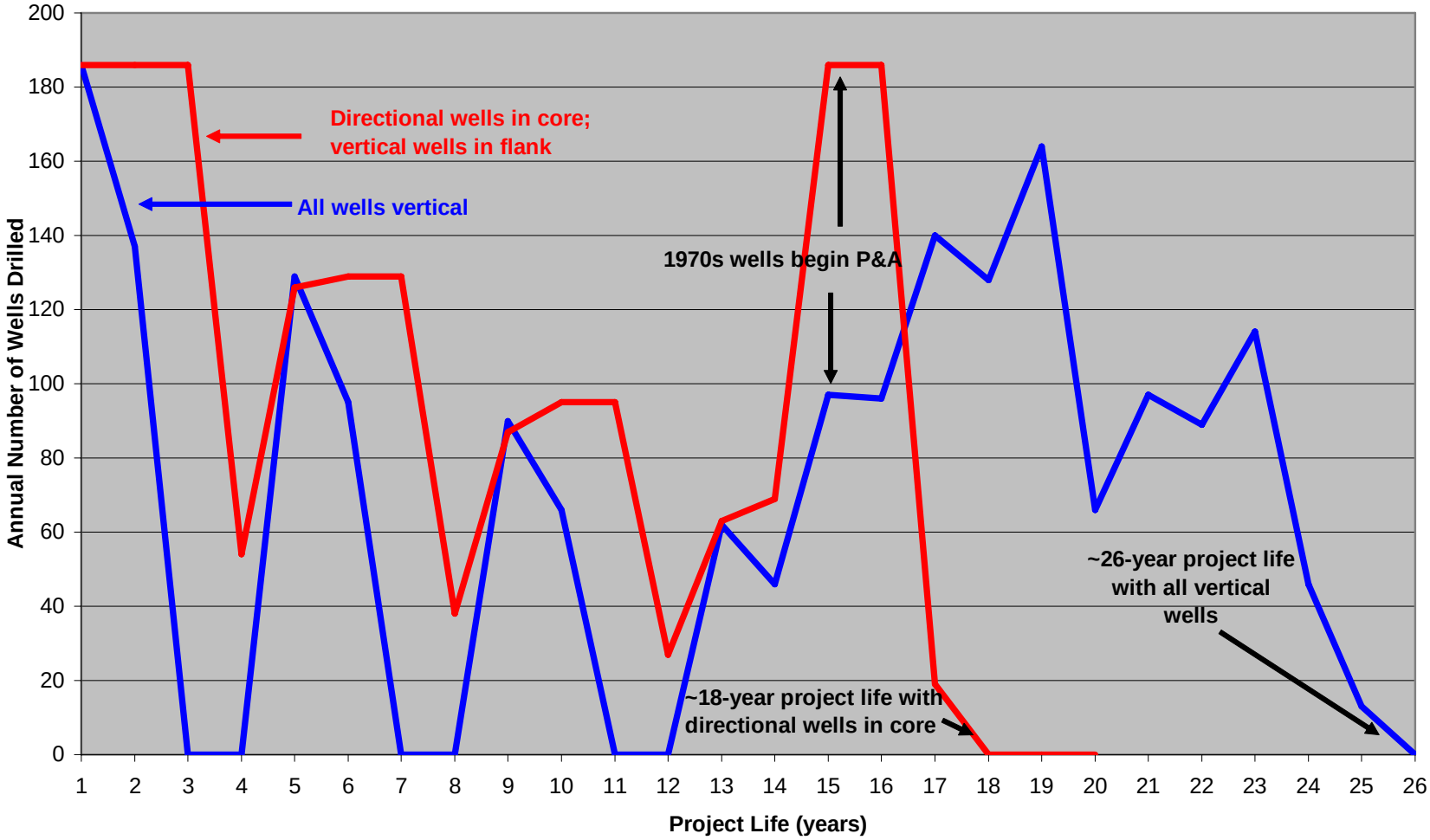
Surface disturbance would approximate the cap level until the wells drilled in the 1970s begin to be plugged and abandoned, shown in Figure 2 to be about 14 years after project approval. In addition, the steep decline exhibited by the vertical well curve in year 20 does not reflect additional 1970-era wells that may be P&A during this time period forward. If the 1970-era wells are plugged and abandoned at a greater rate than shown in this graph, annual project wells drilled would (theoretically) continue to generally increase beyond year 20 until all project wells are drilled in year 22. The older wells, however, may be re-evaluated as warranted by evolving technologies and reconsideration of geologic prospects. The possibility that the older wells could be recompleted or drilled to deeper targets cannot be discounted; thus, reclamation of the older well pads is not a certainty. Nonetheless, the assumptions made to support this analysis

provide a clear indication that imposing a cap will result in a boom-bust cycle that most communities will not be able to support.

The overall result of BLM's proposed Alternative B is that the infill development activities proposed by the Operators would not be able to be drilled until the wells drilled during the early years of the Moxa Arch field—1970s—begin to be plugged, abandoned, and successfully reclaimed in consistently large numbers. This substantial delay is not consistent with the purpose and need of the Operators' Proposed Action, and be eliminated from further consideration in the Final EIS for the MIDP.

If the BLM considers approval of Alternative B, or any other alternative that would impose a surface disturbance cap, the BLM must conduct a full analysis of the economic consequences of initiating a "boom-bust" levels of oil and gas activity and disclose its results in the Final EIS for the MIDP. Furthermore, the BLM should acknowledge in the Final EIS for the MIDP that the economic hardships that may result from such a decision to southwestern Wyoming communities are a direct result of the BLM decision. The Moxa Operators cannot be expected to compensate for such a decision, either monetarily or with the provision of goods and/or services.

FIGURE 2: Project Life and Drilling Activity - Directional vs Vertical Wells
Alternative B
2848-acre cap, 1861 wells



Issue – Table 2-5 represents the "Approximate Disturbance Estimates for New Wells that would be drilled in the MAA under Alternative C." *See* MIDP DEIS, pg. 2-13.

Comment – Placement of Table 2-5 in Section 2.3.3 is inappropriate and confuses the reader. Section 2.3.3 is a discussion of Alternative B, not Alternative C. Table 2-5 should be placed in Section 2.3.4.

Section 2.3.4 – Alternative C

Issue – "Alternative C would allow the drilling of up to 16 well pads per square mile across the core of the MAA, and 4 well pads per square mile in the flank of the MAA." *See* MIDP EIS, pg. 2-13.

Comment – although EOG understands that Alternative C is intended to provide a reasonable range of alternatives as required by NEPA, the BLM must understand that Alternative C is a high development extreme that ignores conclusions of the technical analysis of directional drilling that the Operators submitted to the BLM. Specifically, the technical study revealed that directional drilling can possibly be used under certain, very specific circumstances in the MAA. In some areas, as spacing shrinks, the offsets necessary to allow the consideration of directional drilling would be decreased. With decreased offsets to the bottom hole location from the surface location, directional drilling will become more technically and economically viable and more favorably considered by the Moxa operators. Nonetheless, some directional drilling may be possible in the MAA.

Issue – "Infill drilling as part of Alternative C would consist of approximately 5,165 new wells across the MAA." *See* MIDP EIS, pg. 2-13.

Comment – The projected figure of 5,165 wells under Alternative C far exceeds the 1,740 wells projected in the MAA in the Reasonable Foreseeable Development Scenario (RFD) of the Kemmerer Draft Resource Management Plan released in July of 2007. *See* Final RFD Report Kemmerer Field Office, pg. 8-23. As the BLM is aware, an RFD is not a limit or cap on development, but the BLM's decision to include an alternative with more wells that anticipated under the RFD scenario undermines the credibility of both the Kemmerer Draft RMP/EIS and the MIDP DEIS.

Section 2.4 – Features Common to All Alternatives

Issue – "The operators' committed reclamation procedures described for the Proposed Action would be applied to Alternatives B and C." *See* MIDP DEIS, pg. 2-16.

Comment – The BLM cannot assume the reclamation plan submitted by the Operators would be agreed to under any alternative, and particularly that it would be agreed to if the BLM selects Alternative B. Because the Operators' proposed reclamation plan contains aspects which are entirely voluntary, such as finding a hosted worker, the BLM cannot impose the proposed

reclamation plan under any alternative. The proposed reclamation plan is only available under the Proposed Action, or an alternative acceptable to the Operators. Given the extreme additional costs associated with Alternative B, and the fact little or no oil and gas exploration would take place under Alternative B, the Operators will not agree to the voluntary funding and development of an enhanced reclamation plan or the placement of a full time reclamation specialist in the BLM Kemmerer Field Office under Alternative B. Further, the Operators' reclamation plan under the Proposed Action contains the potential for offsite mitigation. The BLM cannot require offsite mitigation, it must be entirely voluntary. *See* BLM Instruction Memorandum 2005-069 (Feb. 1, 2005); Wyoming Instruction Memorandum WY-96-21 (Dec. 14, 1995). Similarly, the BMPs the Operators have agreed to apply only under the Proposed Action, not onerous or unreasonable alternatives such as Alternative B. The BLM must correct this statement in the Final EIS for the MIDP.

Section 2.5 – Alternatives Considered and Eliminated from Detailed Study

Comment – The BLM properly considered, but did not analyze in detail, various alternatives that do not meet the purpose and need of the proposed activity. For example, the BLM elected not to analyze in detail various phased development or spatial development alternatives in the MAA given the fragmented lease ownership within the MAA. *See* MIDP DEIS, pgs. 2-16 – 2-17. "Alternatives that do not accomplish the purpose of an action are not reasonable and need not be studied in detail by the agency." *Citizens' Comm. to Save our Canyons v. United States Forest Service*, 297 F.3d 1012, 1030 (10th Cir. 2002) (citations and internal punctuation omitted). "NEPA does not require agencies to analyze the environmental consequences of alternatives it has in good faith rejected as too remote, speculative, or impractical or ineffective." *Id.* at 1030-31. The Council on Environmental Quality (CEQ) has described reasonable alternatives as "those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable." *CEQ's Forty Most Asked Questions*, Question 2a, 46 Fed. Reg. 18028, 18027 (March 23, 1981) (emphasis added). As noted above, however, all the reasons identified by the BLM on page 2-17 of the MIDP DEIS not to select a phased or temporal development alternative for the MAA apply equally to the BLM's proposed Alternative B. Given the spatial complexity of the leases, the checkerboard land ownership, the fact that most of the leased acreage already has some level of development, and the varying lease conditions, stipulations, and conditions of approval across the MAA, Alternative B is just as impractical and unwise as the alternatives discussed on page 2-17 of the MIDP DEIS. *See* MIDP DIES, pg. 2-17. The BLM must remove Alternative B from detailed study in the FEIS for the MIDP.

Section 2.6 – Comparison of Impacts by Alternative

Issue – Table 2-6 compares impacts under each alternative and uses subjective terms such as "significant," "high," and "extreme," to describe impacts to various resources. *See* MIDP DEIS, pgs. 2-19 – 2-27, Table 2-6.

Comment – Table 2-6 primarily contains a qualitative description of impacts. Table 2-6 should display an objective comparison of impacts, not a subjective evaluation of impacts. Use of the terms "significant," "high," and "extreme" without explanation throughout this table creates a biased description that cannot be supported in the limited text in the table. The table should quantify the magnitude of impacts where possible. An example of a proper summary of impacts within Table 2-6 is the "Population" resource under the heading "Socioeconomics and Environmental Justice." *See* MIDP DEIS, pg. 2-26, Table 2-6. A poor example of impacts comparison is the "Loss of AUM" resource under the heading "Land Use," in which impacts from the Proposed Action are described as not significant and the other alternatives are described as having the "same but fewer" or "more" impacts, conveying little to no information at all. *See* MIDP DEIS, pg. 2-26, Table 2-6.

CHAPTER THREE – AFFECTED ENVIRONMENT

Comment – Overall, the analyses of the potentially affected environment contained in the MIDP DEIS is thorough and complete. The BLM has provided a detailed and informative description of the existing conditions in the MAA and the cumulative impact area for the MAA. For the sake of clarity, however, the Final Environmental Impact Statement for the Expanded Moxa Arch Area Natural Gas Development Project (BLM 1996), the Draft Environmental Impact Statement for the Expanded Moxa Arch Area Natural Gas Development Project (BLM 1995), the Moxa Arch Environmental Assessment/Decision Record (BLM 1991), and the Supplemental EA for the Moxa Arch Area (BLM 1992) will more accurately inform the public of the significant previous NEPA analyses that have been prepared for the Moxa Arch Area, and to give the public a more complete understanding of how development in the MAA has progressed over the years. Referencing past NEPA documentations and BLM approvals will also provide the reader a more complete understanding of the proposed infill drilling operations.

General Comment on Chapter 3

Issue – Chapter 3 repeatedly contains the statement, "[M]uch of the current reclamation is not complying with the standards authorized as part of the 1997 ROD." *See* MIDP DEIS, pgs. 3-19, 3-22, 3-28, 3-33, 3-45, 3-47, 3-52, 3-57, 3-91.

Comment – These statements unfairly assume that all Operators have not made diligent reclamation efforts since 1996. EOG has conducted its operations to comply with the 1997 ROD and, like other Operators, has diligently attempted to conduct successful reclamation operations. The BLM must revise these statements to recognize that not all Operators are "not in compliance" with the current reclamation standards.

Section 3.1.2 Air Quality

Comment - Air quality in southwestern Wyoming continues to be an important issue for oil and gas operators, the public, and regulatory agencies. Fortunately, according to the analysis in the MIDP DEIS, background air quality concentrations are in compliance with all Wyoming

and national ambient air quality standards. *See* MIDP DEIS, pg. 3-5. However, the BLM did not provide the public with sufficient data to understand that air quality in southwest Wyoming is currently excellent. The recently released Draft EIS for the Kemmerer Resource Management Plan (Kemmerer RMP/DEIS) provided crucial additional information regarding air quality in the vicinity of the MAA. *See* Kemmerer RMP/DEIS, pg. 3-4 ("Air quality in the study area is considered to be good."). The BLM should have provided a more general narrative regarding air quality in southwest Wyoming in the MIDP DEIS.

Comment – The BLM fails to explain in the MIDP DEIS that the Wyoming Department of Environmental Quality (WDEQ), not the BLM, has the regulatory authority and responsibility, with oversight from the Environmental Protection Agency (EPA), to enforce air quality standards in Wyoming. *See, e.g.,* Kemmerer RMP/DEIS, pg. 3-10. The BLM lacks authority to regulate both air emissions and potential visibility impacts. The Interior Board of Land Appeals (IBLA) has made clear that in Wyoming, the WDEQ and the EPA are solely charged with ensuring compliance with federal and state air quality standards. *See Wyoming Outdoor Council, et al.*, IBLA No. 2006-155, at 12 (June 28, 2006). This decision is particularly compelling because it relates to natural gas operations within southwest Wyoming. Similarly, in the Supplemental Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project (PAPA SDEIS) and in other contexts, the BLM has recognized that it has very little authority to regulate air emissions. *See* PAPA SDEIS, pg. 4-62. The BLM previously recognized its inability to mandate air quality mitigation in the Record of Decision for the Continental Divide/Wamsutter II Natural Gas Project, pg.15 ("BLM cannot implement specific air quality mitigations *since it has no authority to do so*.") (emphasis added). The BLM has equally limited authority to regulate potential visibility impacts. The Clean Air Act (CAA) restricts a federal land manager's authority to a secondary role in the regulation of visibility within designated Class I areas. 42 U.S.C. §§ 7475(d)(2)(B). In contrast, the CAA vests the WDEQ with the regulation of potential impacts to visibility and authority over air quality in general. 42 U.S.C. § 7407(a). Therefore, the BLM has no authority over air quality, and cannot impose emissions restrictions, either directly or indirectly, on natural gas operations in southwest Wyoming, particularly if the overall goal is to reduce potential visibility impacts. The BLM must consider these limitations when designing potential mitigation measures when approving project or site-specific level activities. The BLM should also clearly disclose its lack of authority over air quality in Wyoming.

Section 3.1.2.2 – Visibility

Comment – With respect to visibility, the information in the MIDP DEIS demonstrates that visibility in the general region has steadily improved over the past several years. *See* MIDP DEIS, pg. 3-11. Information from the recently released Kemmerer RMP/DEIS similarly confirms that visibility in the area is generally improving. *See* Kemmerer RMP/DEIS, pgs. 3-5 – 3-7. Data from the IMPROVE site in the Bridger Wilderness Area demonstrates that visibility on the 20% cleanest days and 20% middle days has generally improved since the early 1990s and is, in fact, near record high levels. *See* PAPA SDEIS, pgs. 3-58 – 3-59. The IMPROVE

monitoring data indicates dramatic improvements in visibility on the cleanest and middle days in the last 2-3 years despite increased oil and gas development in the Kemmerer and Pinedale Resource Areas. *Id.* The analysis in the recently released Draft EIS for the Eagle Prospect Exploratory Wells Project, jointly prepared by the BLM and Forest Service, affirmatively states that visibility in Bridger Wilderness has improved since 1989. *See* Eagle Prospect DEIS, pg. 3-11 (reflecting data through 2006). The BLM should explain that visibility in the project area is improving despite ongoing and increased levels of oil and gas activities in the area.

Comment – The fact that actual monitoring data indicates visibility in the region continues to improve despite increased development in the area raises significant concerns regarding BLM's modeling for the MIDP DEIS, which indicates visibility in the area has worsened or should be worsening as a result of oil and gas development.

Issue – "PSD Class I and other sensitive areas located within the air quality modeling domain and the distance of each from the MAA are shown on Map 3-1. Federal Class I areas to be evaluated are listed in Table 3-5." *See* MIDP DEIS, pg. 3-8.

Comment – The Federal Class I areas that were evaluated and listed in Table 3-5 were not displayed on Map 3-1. If they had been displayed on the map, a reader would observe that the prevailing winds in the MAA blow from the west/northwest toward the east/southeast, away from the Bridger Wilderness Area. Class I Wilderness areas are displayed on Map 3-2; however, the MAA is not also displayed on this map. A reader who may be unfamiliar of the spatial relationships of Class I areas to MAA would not be able to readily determine what Class I areas lie downwind.

Section 3.2.4 – Mineral Resources

Issue – "The Moxa Arch is a prolific producer of natural gas."

Comment – The Moxa Arch Field is an important source of clean-burning natural gas and an important driver for the economy of southwest Wyoming. Development in the MAA has continued since 1956, making the Moxa Arch Field one of the most consistent producers of oil and gas in Wyoming. The BLM should ensure that its decision on the MIDP does not jeopardize the productivity of this important source of domestic energy and crucial component of economic stability.

Section 3.5 – Noise

Issue – "Noise levels at the Luman and Falcon compressor stations, north of the MAA, measured between 69 and 86 dBA at the source and 58 and 75 dBA (depending on the direction) 1 mile from the source." *See* MIDP DEIS, pg. 3-33.

Comment – The Luman and Falcon compressor stations are located within and adjacent to the Jonah and Pinedale Anticline Natural Gas Fields in Sublette County, Wyoming. Because

topography plays a crucial role in the transmission of noise, there is no guarantee that noise measurements from the Jonah and Pinedale Anticline fields are representative of noise levels from compressors in the MAA. Further, the Luman and Falcon compressor stations are huge facilities necessary to transport natural gas out of the Jonah and Pinedale Anticline Fields, which are more prolific than the MAA. The BLM should disclose that the Falcon and Luman stations are larger than the facilities used in the MAA, and that the noise levels measured at said facilities are, at best, conservative representations of potential noise levels in the MAA.

Section 3.7.4 – Big Game

Comment – The BLM's analysis indicates that pronghorn, mule deer, elk, and moose populations in the MAA are generally stable and nearly meet or exceed their perspective population trend objectives. *See* MIDP DEIS, pgs. 3-45 – 3-50. Given the viability of herds in the MAA despite ongoing oil and gas activities, the BLM should not impose onerous restrictions on future oil and gas development in the MAA. Similarly, the BLM should not place undue emphasis on studies regarding the potential impacts of oil and gas development on mule deer in other oil and gas fields across Wyoming when analyzing potential impacts, or imposing mitigation measures.

Section 3.8.2.1.2 – Sage-Grouse

Issue – "Sage-grouse population levels; lek activity, numbers and sizes; and level of survey efforts have varied annually. In 2004, a team of experts assessed the status of sage-grouse and its habitat across 11 U.S. states and one Canadian province (Connelly *et al*. 2004). The resulting data summary suggests an overall declining sage-grouse population in Wyoming. Sage-grouse numbers throughout Wyoming fell to a record low in the mid 1990s, recovered by 2000, and then fell again as drought affected habitat in the early 2000s. A WGFD 2004 sage-grouse statewide trend analysis detected stabilization in breeding populations in 2003, with a slight increase in 2004 after the 2000-2002 drought affected populations (Christiansen 2004)." *See* MIDP DEIS, pg. 3-57.

Comment – Information released from the WGFD in March of 2007 noted that while there have been historic declines in sage-grouse populations, there have been mid-term and short-term increases in populations. *See* Tom Christiansen, Brief Status of Sage-grouse Population Trends and Conservation Planning in Wyoming as of March 16, 2007, and 2007 Sage-grouse Hunting Season Proposal. *See* EOG Attachment C. Cooperative efforts between the BLM, State of Wyoming, and many others are working and should be allowed to continue. The BLM should revise and update the analysis regarding sage-grouse populations in the Final EIS for the MIDP DEIS. The BLM should also consider the impacts hunting sage-grouse has upon the overall population, as well as the economic impact limitations on oil and gas activities, as compared to hunting activities, will have upon the State of Wyoming and the local area.

Comment – A recently released study by Renee Taylor and Dr. Larry Hayden-Wing regarding the impacts of oil and gas development on sage-grouse in Wyoming indicate that while

development in the MAA has had an impact on individual sage-grouse leks within the MAA, particularly where the ¼ mile NSO stipulation was not maintained, the overall sage-grouse population in the MAA is stable. *See* Taylor, Hayden-Wing, *et al.*, *Greater Sage-Grouse Populations and Energy Development in Wyoming*, pg. 24. The BLM should incorporate this study and its analysis into the Final EIS for the MIDP. *See* EOG Attachment D.

Section 3.10.1 – Population and Demographics

Issue – "Growth in the study area can be primarily attributed to mineral resources development and service industries." *See* MIDP DEIS, pg. 3-72.

Comment – Oil and gas development is a crucial pillar of the economic stability in southwest Wyoming. The BLM must ensure that its decision regarding future development of the MAA does not jeopardize the primary economic driver of the region. As currently drafted, Alternative B would have devastating consequences on oil and gas activities and, subsequently, the socioeconomic stability of southwest Wyoming. As discussed in more detail above, BLM's unsupported assumption that the level of development activities under Alternative B will be remotely similar to the level of activity under Alternative C is completely unrealistic.

Section 3.10.3.2 – Industry Earnings

Issue – Mineral extraction provided between 11.0% and 31.3% of the industry earnings in Lincoln (14.2%), Sweetwater (31.3%), Uinta (11.0%), and Sublette (18.1%) counties in 2000.

Comment – The BLM's analysis demonstrates the crucial role the mineral extractive industries, and oil and gas in particular, plays in the economic stability and well-being of southwest Wyoming. Given the increase in oil and gas development activities since 2000, the percentage of industry earnings has likely substantially increased in the past several years. To the extent possible, the BLM should provide updated data regarding industry earnings in the study area. To the extent such information is not available, the BLM should clearly disclose that fact in accordance with 40 C.F.R. § 1502.22.

Section 3.10.6 – Taxes and Revenues

Issue – "The minerals industry accounts for a substantial share of revenues to the state and to local governments in Wyoming." *See* MIDP DEIS, pg. 3-84.

Comment – The information in Section 3.10.6, and all of Section 3.10 of the MIDP DEIS, overwhelmingly demonstrates that the economies of southwest Wyoming are highly dependent on oil and gas development. The BLM must carefully consider the impacts its decision on the MIDP will have upon the regional, state, and national economies. In addition to the fact that Alternative B would substantially eliminate oil and gas development in the MAA on federal acreage, the BLM must carefully analyze the impacts the adoption of Alternative B will have upon the federal and state treasuries. Because Alternative B indirectly—and

inappropriately—encourages development of private minerals over federal minerals by capping overall disturbance within the MAA regardless of where it occurs (private or public surface/minerals), the BLM must analyze and disclose the adverse impacts the adoption of Alternative B will have upon state and federal revenue.

Section 3.12 – Visual Resources

Issue – "Class IV areas allow major modifications to the existing character of the landscape. Activities may dominate the view and be the major focus of viewer attention. However, management of Class IV areas should attempt to minimize the impact of activities through careful location, minimal disturbance, and repeating the basic elements." *See* MIDP DEIS, pg. 3-97.

Comment – The second sentence of the above-quoted portion of the MIDP DEIS is inconsistent with the governing provisions of the Kemmerer Resource Management Plan. As described in the recently released Draft EIS for the Kemmerer RMP revision a Class IV VRM is intended "[t]o provide for management activities that requires [sic] major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high." *See* Kemmerer RMP/DEIS, pg. 3-127. This description applies to existing VRM classifications in the Kemmerer Resource Area. Although operators such as EOG attempt to minimize the potential visual impacts of oil and gas operations even in Class IV VRM areas, there is no requirement on lands designated as VRM Class IV to "minimize the impact of activities through careful location, minimal disturbance, and repeating the basic elements." The BLM should correct this misstatement in the Final EIS for the MIDP.

CHAPTER 4 – ENVIRONMENTAL CONSEQUENCES

With the exception of its analyses of Alternative B and BLM's air quality analysis, the MIDP DEIS adequately discloses the potential environmental impacts associated with infill drilling development within the Moxa Arch Field and informs the public of the potential consequences of the BLM's authorization. The MIDP DEIS provides sufficient information and a reasonable range of alternatives for the BLM to make an informed and reasoned decision regarding the MIDP.

Section 4.1.2 – Significance Criteria

Issue – "Determining significance is complex, in that impacts are dynamic and may change during the planning period. Significance can be real and supportable by fact, or perceived and perhaps not fully supportable even with rigorous study. For this analysis, the approach to establishing significance criteria was based on legal issues (i.e., government regulatory standards), public input, available scientific and environmental documentation, and professional judgment of resource specialists." *See* MIDP DEIS, pg. 4-1.

Comment – The MIDP DEIS does not define what is meant by the use of subjective words such as "significance" to describe impacts. The use of undefined adjectives to describe impacts will leave the interpretation of their magnitude up to the subjective evaluation of the reader. The description of the magnitude of impacts should be defined in a uniform context throughout the MIDP DEIS for every resource. The evaluation of impacts should be made solely in consideration of factual information supported by scientific documentation/evidence rather than opinion and conjecture. The extent to which public input and professional judgment of resource specialists is given weight during impact evaluation reflects the extent to which bias and lack of information can skew the analysis.

Section 4.2 – Air Quality

Comment – EOG cooperated with BP America on the development of its air quality comments on the MIDP DEIS and hereby incorporates all of BP America's comments regarding air quality on the MIDP DEIS into EOG's comments by this reference.

Issue – "In summary, the modeling results indicate that, for the Proposed Action and alternatives, neither direct impacts nor cumulative source impacts would exceed any air quality standards (WAAQS, UAAQS, CAAQS, and NAAQS) or PSD Class I area increments." *See* MIDP DEIS, pg. 4-11.

Comment – Importantly, the BLM's modeling demonstrates continued compliance with all WAAQS, NAAQS, and PSD Increments. Given the BLM's lack of authority over air emissions in Wyoming, and given the fact the BLM's admittedly conservative modeling demonstrates compliance with the WAAQS, NAAQS, and PSD Increments under the Proposed Action and the various alternatives, the BLM should not attempt to impose overly prescriptive or unnecessary air quality mitigation techniques or conditions of approval on operations in the Moxa Arch Field.

Section 4.2.1.1 – Emissions

Issue – The BLM describes the project emissions used in the air quality modeling for the MIDP EIS on page 4-3 of the MIDP DEIS and Appendix C of the MIDP DEIS.

Comment – The BLM's emission inventory contains substantial errors in the assumptions used to calculate emissions and the methodology used to derive emissions. As indicated in the tables below, BLM substantially overestimated the emissions from central compressor stations, heaters, drilling rigs, tank flashing, and completion flaring. In some case the BLM's emission estimates are over 35,000 percent higher than the Operators' conservative emission estimates. The BLM additionally made inappropriate assumptions regarding the SO_2 content of the natural gas produced from the Moxa Arch Field that resulted in erroneous emission estimates for central compressor stations and the heaters at individual wells.

As described in the tables below, the BLM incorrectly assumed that four heaters are necessary at each well location when only two heaters are typically used. This resulted in a doubling of the emission estimates for small heaters. The BLM also assumed that the heaters were used 365 day per year, when in fact the heaters are only used when necessary based on weather conditions.

The BLM also grossly exaggerated the amount of central compression that would be required for operations in the MAA. The Operators conservatively assumed that between 17,000 and 50,000 hp of additional central compression would be necessary for infill operations. This estimate was conservative because it did not account for the normal decline in production from wells in the MAA. Although new wells would be drilled, the decline in production from existing wells is expected to counter-balance the need for additional compression. For unexplained reasons, however, the BLM erroneously assumed that 50,000 hp of additional compression would be needed at each of four locations for a total of 200,000 in additional central compression. The BLM cannot modify the Operators' proposed action without the express written consent of the Operators. "For externally initiated proposal, the applicant must concur (in writing) with any modifications to the proposed action." *See* BLM NEPA Handbook, H-1790-1, Chapter V.B.1.d.(3), Chapter V.B.2.a.(2), pgs. V-4, V-5 (Rel. 1-1547 10/25/88). The BLM further exacerbated its erroneous assumptions for Alternative C by assuming that 50,000 of additional compression would be needed at each of seven locations for a total of 350,000 hp, which is approximately 4.3 times greater than current compression in the entire Moxa Arch Field. Records from the WDEQ indicate that in 2005 the Moxa Arch area had a total installed engine capacity of 81,418 hp. This includes wellhead compressors, central compressors, and engines installed at central gas plants. The BLM's assumptions regarding compression in the MAA must be completely re-examined, with input from the Operators.

As described in more detail in BP America's comments, the BLM also used erroneous assumptions for wellhead compression, dehydration emissions, flashing emissions, drilling rig emissions, and completions. The BLM must prepared a completely new emission inventory for the MIDP EIS and prepare new modeling. The existing modeling is not accurate.

Comment – When preparing new modeling for the MIDP EIS, the BLM should consult with the Operators during the development of the Protocol, emissions inventory, and model selection. Project applicants are integral to the NEPA process. BLM's NEPA Handbook provides that coordination with the applicants is essential. *See* BLM NEPA Handbook, H-1790-1, Chapter V.B.1.d.(3), Chapter V.B.1.d(1), pg. V-4 (Rel. 1-1547 10/25/88). It is critical for the project applicants to submit information for the BLM's consideration. *See* 40 C.F.R. § 1506.5(a) (2006). Agencies are given explicit authority to require information from the applicant, although the BLM must independently review and approve the use of information submitted. 40 C.F.R. § 1506.5(a). The BLM should actively seek information from the applicants regarding the technical aspects of the Proposed Action. If the BLM had properly consulted with the Operators during the development of the emissions inventory for the Proposed Action, the numerous errors discussed above could have been prevented thereby saving the BLM considerable time and work,

and saving the Operators considerable expense. The BLM and the Operators have the same goal of developing a thorough and defensible NEPA document continued operations in the MAA.

Table 1. Comparison of BLM and Operator Emission Estimates for Moxa Arch EIS

BLM Estimates from Table F1.1.62 – Appendix A or Source Specific Appendix A Table as Appropriate

Source	Alternative	Pollutant	BLM Estimate (t/yr)	Operator Estimate (t/yr)	Amount Emissions Overstated (t/yr)	Percent error	Comments
Central Compressor Station Engines	Proposed Action	NOx	1931	473	1458	308%	BLM estimate is not consistent with Operators' input that a maximum of one 50k hp central compressor station would be necessary. Operators input is very conservative because it does not account for decline of existing emissions
Central Compressor Station Engines	Proposed Action	SOx	4	0	4	Infinite	BLM estimate is not consistent with zero sulfur content in the Moxa Arch Field produced gas.
Heaters	Proposed Action	NOx	400	174	226	130%	BLM estimate assumes four 0.5 mmbtu heaters per site - only two exist per normal well site.
Heaters	Proposed Action	SOx	2	0	2	Infinite	BLM estimate is not consistent with zero sulfur content in the Moxa Arch Field produced gas.
Drilling Rigs	Proposed Action	NOx	932	644	288	45%	Not able to determine reasons for BLM overestimation of emissions.
Drilling Rigs	Proposed Action	SOx	56	6	50	803%	Not able to determine reasons for BLM overestimation of emissions.
Total SOx + NOx	Proposed Action	SOx + NOx	3325	1297	2028	156%	
VOC Emissions							
Tank Flashing; Dehydrator Overhead;	Proposed Action	VOC	4,142	3736	406	11%	
Completion Flaring	Proposed Action	VOC	8,543	24	8,519	35,496%	The most significant error appears to be the 50% destruction efficiency assumption - which is without merit; 98% should have been used. However, the gas composition used and assumptions made also add to the problem.
Combined VOC's	Proposed Action	VOC's	12,685	3760	8,925	237%	

Table 2. Comparison of BLM and Operator Emission Estimates for Moxa Arch EIS

BLM Estimates from Table F1.3.51 – Appendix A or Source Specific Appendix A Table as Appropriate

Source	Alternative	Pollutant	BLM Estimate (t/yr)	Operator Estimate (t/yr)	Amount Emissions Overstated (t/yr)	Percent error	Comments
Central Compressor Station Engines	Alternative C	NOx	3,379	473	2894	612%	BLM estimate is not consistent with Operators input that one 50k hp central compressor station would be necessary. Operator input is very conservative because it does not account for decline of existing emissions
Central Compressor Station Engines	Alternative C	SOx	7	0	7	Infinite	BLM estimate is not consistent with zero sulfur content in the Moxa Arch Field produced gas.
Heaters	Alternative C	NOx	1109	481	628	131%	BLM estimate assumes four 0.5 mmbtu heaters per site - only two exist per normal well site.
Heaters	Alternative C	SOx	7	0	7	Infinite	BLM estimate is not consistent with zero sulfur content in the Moxa Arch Field produced gas.
Drilling Rigs	Alternative C	NOx	1033	714	319	45%	Not able to determine reasons for BLM overestimation of emissions.
Drilling Rigs	Alternative C	SOx	62	7	55	803%	Not able to determine reasons for BLM overestimation of emissions.
Combined SOx and NOx	Alternative C	SOx	5,597	1675	3,922	234%	
VOC Emissions							
Tank Flashing; Dehydrator Overhead;	Alternative C	VOC	11,494	5,631	5,863	104%	Unclear what the problems here are with the BLM estimate.
Completion Flaring	Alternative C	VOC	24,190	26	24,164	92,938%	It is not clear what the problem with the BLM's estimate is in this instance. The 50% destruction efficiency assumption remains a problem along with the gas composition; 98% should have been used. However, this does not fully explain the errors.
Combined VOC's	Alternative C	VOC's	35,684	5,657	30,027	531%	

Section 4.2.1.3.1 – Dispersion Model Input and Options

Issue – "The CALPUFF model was used to model Project-specific and cumulative emissions of NOx, SO_2, fine particulate matter (PMF), and coarse particulate matter (PMC). CALPUFF was run using the EPA recommended default control file switch settings (Atkinson and Fox 2006) for almost all parameters. Deviations from EPA-recommended defaults are discussed in Appendix C." *See* MIDP DEIS, pg. 4-6.

Comment – As described in Appendix C, Air Quality Technical Support Document, the BLM deviated from the EPA background default value for ammonia when preparing its far-field air quality analysis for the MIDP DEIS. *See* MIDP DEIS, Appendix C, pg. C-34. EOG agrees with BLM's decision not to use 10.0 ppb ammonia background level given the existing conditions in southwest Wyoming and within the Moxa Arch Field in particular. Given actual air quality monitoring data from southwest Wyoming, however, the BLM should have actually used an even lower level of background ammonia. The Federal Land Mangers' Air Quality Related Values Workgroup (FLAG) Phase I Report states that:

> [A]n appropriate estimate of ambient free gaseous NH3 is needed for the modeling analysis. IWAQM refers to Langford et al. (1992), who suggest that typical (within a factor of 2) background values of NH3 are: 10 parts per billion (ppb) for grasslands, 0.5 ppb for forest, and 1 ppb for arid lands at 20 degrees C. Langford et al. (1992) provide strong evidence that background levels of NH3 show strong dependence with ambient temperature and a strong dependence on the soil pH. However, given all the uncertainties in NH3 data, IWAQM recommends use of the background levels provided above, unless better data are available for the specific modeling domain.

In this case, better data information is available for southwest Wyoming and BLM should use that data to assure accurate analytical results. Ammonia is measured just north of the Moxa Arch Field Clean Air Status and Trends Network (CASTNET) station in Pinedale, Wyoming. Long-term seasonal averages from the Pinedale station from 1989 through 2003 indicate much lower background ammonia concentrations and have been consistent over time: 1st Quarter: 0.22 ppb; 2nd Quarter: 0.31 ppb; 3rd Quarter: 0.34 ppb; and 4th Quarter: 0.21 ppb. This information, and the lack of any local ammonia sources such as animal feedlots, indicates that the background level of 1 ppb chosen for the MIDP modeling is overly conservative by a factor of four. As a result, BLM has overestimated the formation of visibility-reducing aerosols in the MIDP DEIS because background ammonia is needed to preferentially produce ammonium sulfate and then ammonium nitrate in the atmosphere. If the formation of ammonium sulfate totally consumes the ammonia, then the formation of ammonium nitrate will be curtailed or even prevented. This condition is called ammonia limiting and is likely occurring within the Moxa Arch Field. As a result of ammonia limiting, the emission of even large quantities of nitrogen oxides has little effect on visibility because the ammonia required to complete the reaction from nitrogen oxides to a visibility limiting particle (ammonium nitrate) will be exhausted.

Section 4.2.3 – Direct and Indirect Impacts

Issue – The BLM did not prepare air quality analysis for Alternative B. Nonetheless, the BLM asserts that the potential impacts of Alternative B will be similar to or less than Alternative C.

Comment – The BLM inaccurately suggests that the air quality impacts of Alternative B will be similar to or less than Alternative C. In fact, based on BLM's own analysis in other recently released documents, the potential air quality impacts of Alternative B will be far greater than the Proposed Action or Alternative C. The BLM assumes that the same number of oil and gas wells will be drilled annually under both Alternatives B and C. *See* MIDP DEIS, pg. 2-12. The onerous surface limitations imposed under Alternative B will likely require the Operators to directionally drill the vast number of wells in the MAA.[2] The BLM acknowledges that directionally drilled wells in the MAA require at least eight additional days per well. *See* MIDP DEIS, pg. 4-81. The Operators' actual experience in the MAA demonstrates that directionally drilled wells average 28.5 days for a 1,320 foot offset and 33 days for a 1,475 foot offset. *See* Directional Drilling Paper, pg. 11. This data was obtained from drilling numerous wells in the MAA, not the single directionally drilled well referenced by the BLM throughout the MIDP DEIS. *See, e.g.*, MIDP DEIS, pgs. 4-72, 4-81. With increased drilling times come increased emissions and additional traffic and associated dust and tailpipe emissions. The BLM's NEPA analysis for the Jonah Infill Drilling Project (JIDP) demonstrates that the emissions from directionally drilled wells are at least 20% higher given the increased drilling times, increased load factors on the drilling rig engines, and increased traffic. *See* JIDP ROD, pg. 13; JIDP FEIS Air Quality Technical Support Document, Vol. 1, pg. 11, App. B, Tbls. B.1.1 – B.2.22. According to the information in the JIDP FEIS, drilling just one directional well in the Jonah Field using a drilling rig equipped with EPA Tier 1 engines would result in an additional 3,069.57 pounds of nitrous oxides (NO_x), 3,781.25 pounds of carbon monoxide (CO), 69.71 pounds of sulfur dioxide (SO_2), and 177.94 pounds of particulate matter (PM_{10}) released into the environment. *See* JIDP FEIS Air Quality Technical Support Document, Vol. 1, App. B, Tbls. B.1.8, B.1.23. These amounts reflect only the increase from the drilling rigs, not increases associated with the additional traffic attributable to directional drilling. Directionally drilling wells in the MAA will have an adverse impact on air quality, which the BLM failed to analyze or disclose in the MIDP DEIS.

Further, with the increased drilling times, the BLM's assumption that the same number of wells will be drilled annually under Alternative B and C is incorrect and additional drilling rigs will be required in the MAA. Given the fact that directional drilling times are over 300% greater than vertical drilling times in the MAA, as many as three times the number of drilling rigs will be required to drill the estimated number of wells per year in the MAA. *See* Directional Drilling Paper, pg. 11. The increase in the number of drilling rigs will also have a significant impact on

[2] As explained above, significant directional drilling is unlikely in the MAA given the substantially increased costs of directional drilling and the generally low profit margins for wells in the MAA.

potential air emissions. Unless Alternative B is removed from detailed consideration, the BLM must model and disclose the potential air quality impacts of Alternative B given the likelihood of increased drilling times and increased rigs necessary to achieve BLM's assumption that the same number of wells will be drilled annually.

Comment – Given the longer drilling times, the BLM either must prepare additional air quality modeling for Alternative B taking into account the longer drilling times, increased load factors, and overall increase in the number of drilling rigs, or prepare additional socioeconomic analysis for Alternative B. The BLM cannot assume the air quality impacts and the socioeconomic impacts of Alternative B and C are the same; the BLM's decision to drastically reduce surface disturbing operations under Alternative B will either have increased air quality impacts over Alternative C or decreased socioeconomic impacts compared to Alternative C. The BLM cannot suggest that Alternative B will have the same air quality and socioeconomic impacts as Alternative C, particularly when the BLM has not presented any evidence or analysis supporting its assumption that the Operators will be able to continue operations in the MAA under the limitations imposed by Alternative B.

Section 4.3 – Geology and Mineral Resources

Issue – "To achieve a reduction in surface disturbance the operators could employ a variety of development and reclamation techniques including drilling multiple wells from a single well pad; centralizing production facilities; minimizing topsoil removal during construction; and co-locating powerlines, flowlines, and roads in common utility corridors. . . . If 100% of all new wells of federally administered lands/minerals were drilled directionally from existing well pads, overall surface disturbance could be reduced by as much as 14,564 acres." MIDP DEIS, pg. 4-14.

Comment – The BLM's description of techniques that could reduce surface disturbance, including directionally drilling, incorrectly suggests that the surface disturbance limit imposed in Alternative B could be met if these techniques were implemented. In fact, the surface disturbance limit is overly restrictive, not practicable, and could not be implemented to recover the gas resource in an effective manner. The BLM must amend the language to reflect that the surface disturbance limit in Alternative B could not be achieved with directional drilling or the techniques the BLM identifies.

Section 4.6 – Noise

Issue – "To avoid adverse environmental impacts, the EPA standard for noise levels is 55 decibels (dBA)." *See* MIDP DEIS, pg. 4-29.

Comment – The BLM's decision to use 55 dBA as a significance threshold is inappropriately assigned to project activities. The EPA has determined "protective noise levels" to protect "public health and welfare." The 55 dBA criteria is associated with areas "Outdoors in residential areas and farms where people spend varying amounts of time in which quiet is a basis

for use (http://www.engineeringtoolbox.com/epa-protective-noise-level-d_720.html)." The EPA has not made a determination of the effects of noise on wildlife in general or to a wildlife species in particular. 55 decibels is a very, very low threshold and the BLM has not explained or justified the benefit of this restriction in unpopulated areas. Just for the sake of comparison, a soft whisper approximates 20 decibels and the sound of leaves rustling, or very soft music easily reaches 30 decibels. Normal human speech is usually as high as 60 decibels and the sound of lawnmowers or shop tools usually reaches 90 decibels. Limiting operations to 55 decibels is not justified or necessary, particularly as noises attributable to drilling operations are short-term and localized.

If any standard is to be prescribed for this project, the BLM must reference the scientific studies describing noise effects to wildlife (not habitat, which is not a noise receptor). Second, the BLM must explain how background noise levels would be measured or quantified to determine whether or how noise levels would change from a new facility. Third, the BLM must explain how the potential impacts from noise generating activities were measured in the BLM's analysis.

Comment – Nonetheless, the BLM properly determined that while certain oil and gas development operations during peak activity periods could exceed 55 dBA at certain locations, "these impacts would be temporary and would attenuate as distance from the source increases." *Id.* Similarly, the BLM properly determined that noise from development operations would "likely not cause "long-term significant impacts over the LOP or any alternative." *Id.*

Section 4.8.1.2 – Fisheries and Wildlife Significance Criteria

Issue – The BLM incorporates and relies upon the WGFD Impact Threshold for Priority Wildlife Species and Habitat from Oil and Gas Development Activities when defining significant impacts. *See, e.g.*, MIDP DEIS, pg. 4-39, Table 4-7.

Comment – The BLM has not formally adopted or endorsed the WGFD's Impact Threshold for Priority Wildlife Species and Habitat from Oil and Gas Development Activities and the BLM should not use the WGFD's recommendation as the sole or primary standard to determine significant impacts in the context of a NEPA document. Further, although the BLM may chose to partially acknowledge the WGFD's to help define significance, the IBLA has specifically ruled that the BLM is not required to adopt or comply with the WGFD's Impact Threshold for Priority Wildlife Species and Habitat from Oil and Gas Development Activities when making decisions regarding the management of federal lands. *See Wyoming Outdoor Council, et al.*, 171 IBLA 108, 119 – 121 (2007).

Section 4.8.2 – Raptors

Issue – "Raptor mitigation measures and BLM stipulations would be similar for all alternatives. . . . However, the Kemmerer RMP would take precedence in determining seasonal and spatial restrictions for development."

Comment – The BLM's statement regarding mitigation measures for raptors is unclear. Is the BLM referring to the existing Kemmerer RMP or the revised RMP currently being prepared by the BLM? In either case, the BLM cannot attempt to impose stipulations or COAs on EOG's existing leases that are inconsistent with its valid existing contractual rights. Once the BLM has issued a federal oil and gas lease without a NSO, and in the absence of a nondiscretionary statutory prohibition against development, the BLM cannot completely deny development on the leasehold, nor impose mitigation measures inconsistent with the BLM's authority under 43 C.F.R. § 3101.1-2. *See, e.g., National Wildlife Federation, et al.*, 150 IBLA 385, 403 (1999). Courts have similarly recognized that once the BLM has issued an oil and gas lease conveying the right to access and develop the leasehold, the BLM cannot later impose unreasonable mitigation measures that take away those rights. *See Conner v. Burford*, 84 F.2d 1441, 1449-50 (9th Cir. 1988); 43 C.F.R. § 3101.1-2 (2006) (BLM can impose only "reasonable mitigation measures . . . to minimize adverse impacts . . . to the extent consistent with lease rights granted").

Comment – The BLM should clarify that the seasonal and spatial stipulations on existing leases referenced in the quoted passage above refer to the existing Kemmerer Resource Management Plan (Kemmerer RMP), not the revised Kemmerer Resource Management Plan the BLM is currently preparing. Congress made it clear when it enacted the Federal Land Policy and Management Act of 1976 (FLPMA) that nothing therein, or in the land use plans developed thereunder, was intended to terminate, modify, or alter any valid or existing property rights. *See* 43 U.S.C. § 1701 note (2006). Because the authority conferred in FLPMA is expressly made subject to valid existing rights, 43 U.S.C. § 1701 note, an RMP prepared pursuant to FLPMA, after lease execution and after drilling and production has commenced, is likewise subject to existing rights. *See Colorado Environmental Coal., et al.*, 165 IBLA 221, 228 (2005). The Kemmerer RMP, when revised, cannot defeat or materially restrain EOG's valid and existing rights to exploit its leases or has a contractual interest in through COAs or other means. *See Colorado Environmental Coal., et al.*, 165 IBLA 221, 228 (2005) (citing *Colorado Environmental Coal.*, 135 IBLA 356, 360 (1996) *aff'd, Colorado Environmental Coal. v. Bureau of Land Management*, 932 F.Supp. 1247 (D.Colo. 1996).

Section 4.8.3 – Big Game

Issue – "Pronghorn, mule deer, elk, and moose are the big game species that occur in the MAA and are managed by the WGFD. Impacts may occur to big game seasonal ranges and migration corridors, which may affect big game populations. However, the population levels for some big game herds naturally fluctuate over time." *See* MIDP DEIS, pg. 4-43.

Comment – The BLM properly notes that significant impacts to pronghorn, mule deer, and elk are not anticipated under the Proposed Action. *See* MIDP DEIS, pg. 4-46. The BLM also notes that herd populations naturally fluctuate, but that big game populations in the MAA are generally stable or improving, and generally meet population objectives, despite recent drought conditions and oil and gas activity in the area. *See* MIDP DEIS, pgs. 3-42 – 3-50. Moreover, many species such as pronghorn antelope and mule deer have been found to habituate

to increased traffic so long as the movement remains predictable. *See* Reeve, A.F. 1984. *Environmental Influences on Male Pronghorn Home Range and Pronghorn Behavior*. Ph.D. Dissertation; Irby, L.R. *et al.*, 1984; "Management of Mule Deer in Relation to Oil and Gas Development in Montana's Overthrust Belt" *Proceedings III: Issues and Technology in the Management of Impacted Wildlife*.

The analysis in Section 4.8.3 is vague and contains contradictions not allowing the BLM to make a reasoned decision in consideration of impacts to big game species. For example, in its discussion of habitat fragmentation, the text references "greater separation between suitable habitat patched" and the effects that may result; however, the DEIS provides no quantification of appropriate size of habitat patches nor does it quantify "separation" so that evaluations resulting from oil and gas development could be surmised. This section acknowledges in a report by Miller that "wildlife can habituate to disturbances" that are predictable and perceived as non-threatening. Although the example given in the DEIS is one of "vehicles on a well-traveled road," EOG contends that well site production facilities would also likely be perceived by big game as "non-threatening." The Miller report is seemingly contradicted by the WGFD analysis referenced on page 4-44, where impacts to big game would result from "tanks" and "pipelines" in addition to direct loss of habitat. Tanks and pipelines would be perceived as predictable and non-threatening by big game.

Issue - The BLM referenced an ongoing 5-year study regarding the potential impacts of oil and gas development on pronghorn, where the first year results "showed continuing problems related to habitat fragmentation and range limited by snow depth" The text continued to state that no significant differences in pronghorn condition were observed but the first year results "might not reflect the total impact of oil and gas development." *See* MIDP DEIS, pg. 4-44.

Comment – The BLM has placed far too much emphasis on the early results from the Berger antelope study indicating potential impacts to antelope populations from oil and gas development. First, the BLM does not emphasize the more important conclusions from the Berger study; notably that no significant differences were detected among pronghorn populations exposed to oil and gas development near PAPA and Jonah Field for such important viability factors as overall survivability, body mass, stress hormones (glucocorticosteroids), disease antibodies, and vitamins and minerals. *See* Berger, pgs. 16, 19, 22, 31, 35, 45. Second, the BLM did not acknowledge that the Berger study relates to oil and gas operations in the Jonah Field and Pinedale Anticline, both of which exhibit far denser surface development (10-acre in Jonah Field) and year-round operations (on the Pinedale Anticline). The applicability of the Berger study to operations in the MAA is, at best, remote. Third, the fact that the pronghorn populations studied by Berger did not utilize habitat within the Jonah Field during the study period does not demonstrate that pronghorn will generally avoid Jonah Field. The Berger study notes that few, if any, of the study population were captured and tagged within the Jonah Field and also determined that that antelope populations in the area demonstrate "remarkable fidelity" to the areas in which they were captured. The studied populations may simply not have ever utilized the relatively mediocre habitat within Jonah Field. *See* Jonah Infill Drilling Project (JIDP) FEIS

(BLM 2006), pg. 3-55 (indicating Jonah Field does not contain any crucial winter range or crucial winter/yearlong range for antelope). Further, the Berger study notes that some pronghorn antelope spend extensive time within developed fields and "adjust their patterns of activity to capitalize on areas adjacent to pads when traffic volume and other human disturbances were diminished, such as occurs at night," a phenomenon which can readily be observed in Jonah Field. Berger (2006), pg. 35.

Fourth, the preliminary conclusions from the Berger study are not supported by the actual pronghorn population counts in the vicinity of Jonah Field and the Pinedale Anticline in recent years. In 2005, antelope population in the Northern Sublette Herd Unit and the Pronghorn Sublette Herd Unit were at all-time highs of 27,537 and 47,930, respectively. *See* Pinedale Anticline Project Area Supplemental (PAPA) DEIS, pg. 3-107 (BLM 2006). The recently released Redraft of the Pinedale Anticline Project Area DEIS indicates the pronghorn population increased again in 2006 to 28,869 in the Northern Sublette Herd Unit and 60,080 in the overall Sublette Herd Unit. *See* PAPA Redraft Supplemental DEIS, pgs. 3-120 – 3-121 (BLM 2007). These levels are dramatically higher than those seen in the late 1990's prior to major oil and gas operations in Jonah Field and PAPA. According to the BLM's analysis in the JIDP EIS, antelope populations in the Northern Sublette Herd Unit were estimated at 19,900 in 1994 and 17,900 in 1998, compared to the reported 27,537 in 2005. *See* JIDP FEIS, pg. 3-54; PAPA Supplemental DEIS, pg. 3-107; PAPA Redraft Supplemental DEIS, pgs. 3-120 – 3-121. By all accounts, antelope populations in the vicinity of Jonah Field are not only stable, but improving.

Fifth, although the Berger study asserts potential impacts from oil and gas development, the fact that the study demonstrates no significant difference among pronghorn populations exposed to oil and gas development for viability factors as overall survivability, body mass, stress hormones demonstrates that the results of the study are indeterminate at this time; this reality should be acknowledged in the MIDP DEIS, not a speculative assertion that the "total impact of oil and gas development" is unknown. The BLM should not place undue emphasis on studies regarding the potential impacts of oil and gas development on big game, especially if they are only 20 percent complete.

Comment – Section 4.8.3 does not consider effects of the various alternatives to specific big game populations and ignores the mixed surface ownership within the Moxa Arch area that will render federal management strategies unable to achieve habitat stability.

Comment – Section 4.8.3 does not reconcile the WGFD definitions of "extreme" or "high" impacts to the fact that big game populations are generally stable and meet their objectives. In addition, sue of the WGFD definitions seemingly contradict text in the affected environment (Section 3.7.4) or, at a minimum, are not explained so that the analysis in Section 4.8.3 makes sense. For example, the discussion of elk (p.4-46) asserts that development of more than 4 wells per section in elk crucial winter range would create an extreme impact to elk. In Section 3.7.4.3, however, the text states that "elk use of the MAA is rare." How can a usage pattern characterized as "rare" result in "extreme" impacts? The BLM should review its

discussion of big game, species by species, in Chapters 3 and 4 to ensure that the conclusions reached are appropriate for the project area.

The BLM must ensure that its management actions are clearly understood, that existing lease rights will be maintained, and that production operations are allowed to continue throughout the year.

Section 4.8.3.4 – Mitigation

Issue – In section 4.8.3.4 the BLM often references risks "of truck/wildlife collisions."

Comment – The BLM has not quantified the risks associated with "truck/wildlife" collisions. What are the documented statistics of wildlife/truck collisions? Moreover, how many of these collisions result from oilfield-associated traffic? How many of these collisions result from general truck transport vehicles using the arterial highways that cross the MAA? Oilfield traffic is subject to speed limits on unpaved roads, generally allowing big game to easily move away from an oilfield vehicle on an access road. In addition, oilfield traffic complies with Gold Book standards for speed limits. The BLM's reference to a risk of truck/wildlife collisions is speculative and is not supported in the DEIS. If the BLM has facts that support its idea that indeed there is a risk of these types of collisions, the BLM needs to provide that documentation in the text. Otherwise, the BLM should acknowledge that mitigation, such as remote monitoring, serves some other purpose.

Issue – On page 4-49 the BLM indicates that any "habitat lost to development in the crucial severe winter relief ranges for pronghorn and elk would need to be fully mitigated/replaced to be available to support existing herds in severe winters." *See* MIDP DEIS, pg. 4-49.

Comment – The BLM has not provided sufficient justification for this proposed mitigation measure. Further, and most importantly, the proposed mitigation measure is contrary to BLM's existing regulations and may be contrary to EOG's existing lease rights. Pursuant to existing BLM regulations, EOG has the right to use so much of the surface as necessary to conduct oil and gas operations. *See*43 C.F.R. § 3101.1-2 (2006). The BLM cannot impose restrictions or require mitigation measures that are inconsistent with EOG's existing lease rights. Once the BLM has issued a federal oil and gas lease without a NSO stipulation, and in the absence of a nondiscretionary statutory prohibition against development, the BLM cannot completely deny development on the leasehold, nor impose mitigation measures inconsistent with the BLM's authority under 43 C.F.R. § 3101.1-2. *See, e.g., National Wildlife Federation, et al.*, 150 IBLA 385, 403 (1999). Only Congress has the right to completely prohibit development once a lease has been issued. *Western Colorado Congress*, 130 IBLA 244, 248 (1994). Further, the BLM cannot modify EOG's valid and existing rights. Courts have recognized that once the BLM has issued an oil and gas lease conveying the right to access and develop the leasehold, the BLM cannot later impose unreasonable mitigation measures that take away those rights. *See Conner v. Burford*, 84 F.2d 1441, 1449-50 (9th Cir. 1988); 43 C.F.R. § 3101.1-2 (2006) (BLM

can impose only "reasonable mitigation measures . . . to minimize adverse impacts . . . to the extent consistent with lease rights granted").

Further, to the extent the proposed mitigation measure is intended to require offsite mitigation, the proposed mitigation measure is inconsistent with BLM existing BLM policy. The BLM cannot require offsite mitigation, it must be entirely voluntary. *See* BLM Instruction Memorandum 2005-069 (Feb. 1, 2005); Wyoming Instruction Memorandum WY-96-21 (Dec. 14, 1995).

Comment – If raising the lower strand of fence would facilitate pronghorn movement (p. 4-43), why does the BLM choose to ignore this type of mitigation?

Section 4.8.3.5 – Residual Impacts

Issue: The text states: "Because some native vegetation takes over 30 years to return to pre-disturbance conditions, residual impacts to big game habitat from vegetation removal are likely to continue after the LOP." *See* MIDP DEIS, pg. 4-50.

Comment: Although sagebush is difficult to re-establish, the text does not explain how big game would be affected by sagebrush removal. Section 3.7.4 lacks a discussion of the dietary requirements of big game that would allow EOG to ascertain how sagebrush removal affects these species.

Section 4.9.2.1.2 – Greater Sage-Grouse

Issue – "It is likely that significant impacts to leks and breeding and nesting habitat have already occurred in portions of the MAA. Holloran (2005) indicated that 4.7 well pads or more within 2-miles of leks result in decreased use of leks and decreased overall nesting success. Many areas of the MAA already have densities greater than this level." *See* MIDP DEIS, pg. 4-54.

Comment – In recent months several organizations opposed to oil and gas development, and even certain BLM Field Offices, have placed undue reliance on the Holloran (2005) study regarding the potential impacts of natural gas development activities on sage-grouse. In discussing the Holloran study, and any potential conclusions derived therefrom, the BLM should specifically disclose the fact that BLM purposefully waived the seasonal and timing stipulations normally associated with sage-grouse leks and specifically allowed the Operators to drill near an active lek during the strutting season in order to assess the potential impacts. The conclusion in the Holloran study that existing stipulations are not adequate therefore appears unfounded and outdated. A recent study prepared by Renee Taylor and Dr. Larry Hayden-Wing confirms that some of Holloran's conclusions are not entirely supported by his data for several reasons. First, as noted above, Holloran's study was based on a study of two leks where the BLM's normal timing and spatial restrictions for sage-grouse were not applied. Second, Mr. Holloran's data from 2004 was obtained during a state-wide decline in sage-grouse attributable to drought and

other factors. Recent data from the BLM and WGFD demonstrate a recent increase in sage-grouse populations state-wide and particularly in the vicinity of the Jonah and Pinedale Anticline Fields, the area Mr. Holloran conducted his study. *See, e.g.,* Taylor, Hayden-Wing, *et al., Greater Sage-Grouse Populations and Energy Development in Wyoming*, pgs. 25 – 31; Revised Draft Supplemental Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project, pgs. 3-129 – 3-135; 4-152 – 4-153 (BLM 2007). Moreover, even prior to the release of the Holloran study, the BLM issued new policies increasing protections for sage-grouse. The new protections include new surface use restrictions, timing limitations, and additional surveys prior to operations in sage-grouse habitat. *See* Wyoming Instruction Memorandum 2004-057 (August 16, 2004). EOG understands the BLM is currently in the process of revising this Instruction Memorandum. The BLM must consider this information when preparing the Final EIS for the MIDP and should not rely upon the Holloran study.

Section 4.9.2.4 – Mitigation

Issue – In Section 4.9.2.4 BLM discusses potential mitigation measures for sage-grouse.

Comment – Impacts to sage grouse could be reduced with the application of reclamation measures. S*ee* MIDP DEIS, pg. 4-59. Implementation of the reclamation plan presented in Appendix E would not facilitate re-establishment of sage-grouse habitat. *See* EOG comments regarding Appendix E. Use of the procedures in Appendix E will not provide the procedures and technical strategies needed to retain and regain sage grouse habitat.

Comment – Constructing facilities to be "hidden beneath the existing vegetative height, *see* MIDP DEIS, pg.4-59, is impractical and nonsensical. Trees and other high vegetation are not typically found in the MAA. In the checkerboard areas, tanks, separation, and dehydration equipment would necessarily be required to be moved off lease to an adjoining section that is privately owned or owned by the state. The BLM does not discuss the issuance of rights-of-way that would necessarily be required. The BLM does not acknowledge that private lands include some of the most suitable wildlife habitat in the MAA. The BLM does not acknowledge the problems that would result from moving production facilities away from the well head. See the discussion of BMPs that is included within these comments, including the discussion of shared facilities.

Section 4.11 – Social and Economic Impacts Including Environmental Justice

Issue – "The socioeconomic impacts of Alternative B would be similar to those of Alternative C." *See* MIDP DEIS, pg. 4-80

Comment – The BLM cannot accurately assume the socioeconomic impacts of Alternatives B and C will be remotely similar. First, as BLM acknowledges, in order to operate under Alternative B the Operators would be required to utilize directional drilling, mat drilling, or other techniques to enhance reclamation and minimize disturbance. These operational

parameters will necessarily lead to increased costs. The Operators' analysis demonstrates that directional drilling alone increases costs by over 200%. *See* Directional Drilling Paper, pg. 11. Even the BLM assumes that directionally drilled wells cost between $300,000 and $350,000 more per well. *See* MIDP DEIS, pg. 4-72. The additional costs will cause less wells drilled per year because Operators have only limited annual budgets. To the extent that capital is expended on increased drilling costs, some wells simply will not be drilled. Additionally, the increased costs associated with directional drilling or mat drilling techniques will make some wells uneconomic resulting in further unrecovered resources. The BLM's erroneous assumption that the same number of wells will be drilled under Alternatives B and C is based on the incorrect assumption that the Operators have unlimited budgets and that the wells drilled in the MAA can support significant additional cost and still be economic. Less wells per year and less wells overall in the MAA will have profound impacts upon the BLM's socioeconomic analysis for the MIDP. The BLM's current socioeconomic analysis for Alternative B is wholly unsupportable.

Additionally because of the increased time it takes to drill a directional well, fewer wells per year will be drilled within the MAA each year thus impacting the BLM's socioeconomic analysis. Alternatively, if the BLM wants to assume that additional rigs will be brought into the MAA so that the same number of wells can be drilled under Alternatives B and C, the BLM's socioeconomic analysis would again need to be completely modified. It would be impossible for the operators to directionally drill the same number of wells each year without substantially increasing the number of rigs in the MAA. The BLM's socioeconomic analysis for Alternative B is substantially flawed.

Section 4.11.3.3 – Economic Activity from Development and Production

Issue – "Table 4-21 shows annual average direct drilling and completion expenditures by alternative. Direct drilling and completion costs range from $203.4M for the No Action, to $300.4M for the Proposed Project and Alternative B, and $331.1M for Alternative C." *See* MIDP DEIS, pg. 4-73.

Comment – Table 4-21 indicates that the estimated economic activity of Alternatives B and C will be similar, not that the economic activity from the Proposed Action and Alternative B will be the same. The BLM should correct the misstatement. As noted above, however, the economic impacts of Alternative B will be similar to the No Action Alternative, not the full-field development scenario presented in Alternative C.

CHAPTER 5 – CUMULATIVE IMPACTS ANALYSIS

Section 5.2.1 – Moxa Arch Area CIAA

Comment – Although Map 5-1 indicates the Atlantic Rim and Desolation Flats natural gas fields are located within the cumulative impacts analysis area, the BLM has not included said fields under Section 5.2.3 Wildlife and Recreation CIAA. The BLM should include a

description of both fields, and any other producing or reasonably foreseeable natural gas fields in its cumulative impacts analysis.

Comment – The BLM should include a table or other information indicating the potential cumulative surface disturbance presently approved or proposed for oil and natural gas fields in its cumulative impacts analysis. To the extent possible, the BLM should further refine this information to indicate the estimated level of disturbance in big game crucial habitat (by species). Finally, the BLM should indicate what percentage of big game habitat will be disturbed by oil and gas operations.

APPENDIX A – BLM STANDARD STIPULATIONS, BEST MANAGEMENT PRACTICES, AND MITIGATION REQUIREMENTS

Section 1.0 – Introduction

Issue – The text reads: "These guidelines provide for consistency…Consistency does not mean…Nor does it mean. . . ." *See* MIDP DEIS, pg. A-1.

Comment – Section 1.0 does not provide an explanation of what "consistency" means as the term is used in this appendix. The EIS needs to define what it means by the use of "consistency."

Section 2.0 – Purpose

Issue – The text reads: "These guidelines have been written in a format that will allow for (1) their direct use as stipulations and (2) the addition of specific or specialized mitigation…." *See* MIDP DEIS, pg. A-1.

Comment – The MIDP DEIS will not determine lease stipulations. The use of the word "stipulations" is incorrect. Stipulations are incorporated into terms of a mineral lease as a result of analysis performed to determine the suitability of federal lands for mineral leasing. The MIDP DEIS is not a leasing document and the BLM cannot change the terms of existing leases. Therefore, to the degree that leasing stipulations are considered while analyzing projected impacts from the proposed oil and gas infill development, the FEIS needs to make clear that the decision resulting from the analysis in the FEIS does not determine and cannot alter lease stipulations. *See also* EOG's comments regarding Section 1.5.2 of the MIDP DEIS above.

If the wording in this section of the MIDP DEIS was taken directly from previously approved Wyoming BLM documents, the EIS text should explain that the text is an incorporation of that document so that the reader will not assume that the BLM continues to repeat its past misuse of terminology by design.

Section 3.0 – Standard Stipulations

Issue – The section is titled "Standard Stipulations."

Comment – This section is incorrectly titled. The text in the second paragraph in this section states: "The term "guidelines" better described the intent and use of these mitigation standards than the terms "stipulations" or "measures." *See* MIDP DEIS, pg. A-1. If the term "guidelines" is more appropriate, use it as the title of this section. Also, see EOG's previous comment regarding Section 2.0 of Appendix A and Section 1.5.2 of the MIDP DEIS.

Issue – The text on page A-2 suggests that seasonal restrictions can be applied at the operational stage. "Unfortunately, the provision has been interpreted by some people to mean that the seasonal restriction disappears at the operational stage (i.e., if a producing well is attained." *See* MIDP DEIS, pg. A-2.

Comment – As development operations are proposed in the future, the BLM cannot attempt to impose conditions of approval on EOG's existing leases that are inconsistent with its valid existing contractual rights. The BLM has incorrectly summarized the nature of the wildlife stipulation applied to EOG's leases. The language of the standard stipulation specifically states that "[t]his limitation does not apply to maintenance and operation activities." *See* Kemmerer RMP (1986), pg. 55. The BLM cannot impose restrictions that defeat or materially restrain EOG's valid and existing rights to exploit its leases through COAs or other means. *See Colorado Environmental Coal., et al.*, 165 IBLA 221, 228 (2005) (citing *Colorado Environmental Coal.*, 135 IBLA 356, 360 (1996) *aff'd, Colorado Environmental Coal. v. Bureau of Land Management*, 932 F.Supp. 1247 (D.Colo. 1996).

Section 3.2 – Raptor Nests

Issue – The BLM indicates on page A-2 of Appendix A that no "activity or surface disturbance will be allowed within a 0.75 miles radius from raptor nests sites from February through July 31." *See* MIDP DEIS, pg. A-2.

Comment – The BLM's summary of restrictions on operations near raptor nests is not entirely accurate and conflicts with the approved Kemmerer Resource Management Plan. *See* Kemmerer RMP, pgs. 9, 29. The BLM should correct the text on page A-2. The BLM should also acknowledge that under the terms of the 1997 Record of Decision for Operations in the MAA, surface disturbing activities were only seasonally restricted within ½ mile of an active raptor nests between February 1 and July 31, except ferruginous hawk nests for which the seasonal buffer was 1 mile. *See* Moxa Arch ROD (1997), pgs, A-II-11 - 12, . A-IV-21.

Section 4.1 – Operator Committed Reclamation and Mitigation Measures

Issue – The section is titled "Operator Committed Reclamation and Mitigation."

Comment – The section should be titled with the title proposed by the Moxa operators, "Proposed Reclamation Strategy." To eliminate possible confusion, the text should not include references to "all other alternatives" and their associated requirements; the Operators' proposed reclamation strategy applies only to the Proposed Action, not all of the alternatives proposed by

the BLM in the MIDP DEIS. In particular the reclamation strategy would not be adopted under unreasonable alternatives such as Alternative A and Alternative B. Moreover, the text of the proposal should read exactly as proposed by the Moxa Operators and cannot be altered by the BLM. To the extent the BLM has questions or proposed modification to the strategy the BLM should consult with the Operators. The Operators' Proposed Reclamation Strategy is included herein in its entirety for the convenience of the BLM:

Moxa Operator
Proposed Reclamation Strategy
6/11/07

The Moxa operators commit to initiating the following action immediately, for consideration in the analysis of the Moxa operator's proposed action. The Moxa operators request that these commitments be included in the EIS for the Moxa Arch Natural Gas Project as an applicant-committed mitigation measure.

1. *The Moxa operators commit to monitor interim and final reclamation operations by performing inspections using an independent 3rd party contractor. The objective is to provide a uniform performance-based evaluation of reclamation efforts and success across the Moxa area, regardless of surface ownership or lease operator. The duties of the contractor will include:*
    a. *Visiting all Moxa locations.*
    b. *Documenting the progress of interim and final reclamation efforts.*
        i. *Develop quantifiable documentation submitted to the BLM and State (agencies) on a periodic (TBD) basis.*
        ii. *Provide location/lease/operator data to the agencies in GIS format.*
        iii. *Reclamation performance assessment methodology will be based upon requirements of both the KFO and the State of Wyoming.*
        iv. *Annual summary "progress" reports will be provided to Moxa operators by the contractor to track reclamation effectiveness.*

2. *The Moxa operators commit to engaging the services of reclamation professional/specialist to provide expertise/recommendations to the agencies and the operators. The goal would be to develop a workable written reclamation strategy specifically designed for the Moxa area that will be provided to the BLM and State of Wyoming. The strategy will incorporate the results of the ongoing monitoring effort and will be modified, if necessary, according to the reclamation monitoring results assessment. When monitoring results demonstrate that reclamation is being performed successfully, the strategy will be finalized as the "Moxa Area Reclamation Plan." The reclamation specialist would be responsible for:*
    a. *Development of an Initial Reclamation Plan and periodic revisions, if monitoring results indicate the need to alter reclamation procedures.*

b. *Evaluation of reclamation techniques used by the mining/other industries, reclamation techniques used in other BLM Field Offices, and their applicability to oil and gas operations in Moxa area. The results of the evaluation will be included in the Initial Reclamation Plan.*
c. *Determine how/if reclamation should vary in different areas of the Moxa.*
    i. *Timing (including initiation, evaluation of results, etc.)*
    ii. *Species composition, considering habitat viability, BLM cover requirements, and SWPPP requirements*
    iii. *Best procedures for an arid environment/drought*

3. *Operators will provide funding (subject to 3b herein) for inspection and enforcement to augment and provide assistance to KFO I&E personnel.*
    a. *If determined necessary by the KFO.*
    b. *Need for funding and KFO support to be re-evaluated annually by KFO and the operators, concurrent with receipt of annual reclamation monitoring progress report.*
    c. *Operators will agree on method to provide funding for the activities contemplated on a yearly basis. The Operators will select a lead party to handle the billing process and to provide supervision of the third party contractors, professionals and specialists. The Operators will meet annually in the fourth quarter to approve a budget and selection of the personnel required herein.*

4. *Offsite mitigation*
    a. *Will be considered by Moxa operators if necessary and reclamation monitoring indicates poor results.*
    b. *The objective of offsite mitigation will be in part to improve/restore habitat in areas that would provide the most benefit to wildlife and result in the least conflicts with oil and gas development, as identified in the EIS analysis.*
    c. *Operators need interagency commitment that any such efforts will be recognized by the BLM and State of Wyoming as actions to enhance species viability across land jurisdictions.*

Section 4.2 – Operator-Committed BMPs

Issue – Section 4.2 contains "operator-committed BMPs" that EOG has not agreed to as part of its Proposed Action.

Comment – The text in the DEIS includes additional text ***not committed to*** by the Moxa Operators. The text should be revised to incorporate only the text actually committed to by the Moxa operators in their project description. The BLM's NEPA Handbook specifically requires the BLM to seek the applicant's concurrence for any modifications to the Proposed Action. *See* BLM NEPA Handbook, H-1790-1, Chapter V.B.1.d.(3), Chapter V.B.2.a.(2), pgs. V-4, V-5 (Rel. 1-1547 10/25/88). The BLM should include only the following text, which constitutes the

Operators' commitment. If the BLM believes additional language is required it should explain that said language is contained for information purposes only.

The Operators will adhere to all conditions included with their leases in addition to all federal and state laws and regulations. According to BLM IM No. 2004-194, best management practices to be considered in nearly all circumstances include the following:

- *Interim reclamation of well locations and access roads soon after the well is put into production;*
- *Painting of all new facilities a color which best allows the facility to blend with the background, typically a vegetated background;*
- *Design and construction of all new roads to a safe and appropriate standard, "no higher than necessary" to accommodate their intended use; and*
- *Final reclamation recontouring of all disturbed areas, including access roads, to the original contour or a contour that blends with the surrounding topography.*

The Operators commit to performing these environmental protection measures during the implementation of their Proposed Action.

Section 4.3 – Additional BMPs

Issue – The section is introduced with: "In addition, the following BMPs may be applied to reduce resource impacts."

Comment – The section neglects to reference the source of the BMPs, which is BLM Instruction Memorandum No. 2007-021. The list in Section 4.3 is included in this IM: "Other environmental BMPs are more suitable for Field Office consideration on a case-by-case basis, 1) depending on their effectiveness, 2) the balancing of increased operating costs vs. the benefit to the public and resource values, 3) the availability of less restrictive mitigation alternatives that accomplish the same objective, and 4) other site specific factors. Examples of typical, case-by-case BMPs include" the list, as presented in the DEIS.

The Operators have not agreed to the proposed mitigation measures in Section 4.3, and the BLM has not demonstrated that such measures are necessary. The BMPs discussed in the MIDP DEIS were evaluated by the Moxa Operators as to their usefulness/viability in the MAA. It is apparent that none of the technical or logistical considerations included in the Moxa Operators' evaluation were considered in the preparation and analyses in the MIDP DEIS. To presume that all of the listed BMPs are applicable to the Moxa Arch area has resulted in analysis that may be misleading to the public and overly broad conclusions that will result in additional impacts not analyzed in the MIDP DEIS. The MIDP DEIS should have included the technical information provided by the Moxa Arch Operators in its discussion of BMPs to provide a balanced and project area-specific assessment of the viability of such practices. The evaluation of BMPs in the MAA prepared by EOG is in attached hereto as EOG Attachment E to provide the BLM additional details.

Issue – The BLM indicates that "[n]oise reduction mufflers could be used to comply with noise standards." *See* MIDP DEIS, pg. A-6.

Comment – The BLM has not defined "noise standards" or explained how noise would be monitored or measured. The mitigation measure should be deleted.

Section 5.0 – Mitigation Measures

Issue – The text on page A-7 of the MIDP DEIS reads "In addition to application of BMPs and standard stipulations throughout the MAA, as described. . . . " *See* MIDP DEIS, pg. A-7.

Comment – Stipulations are lease specific, not general to the project area. Further, the sentence should reference the term "guidelines" which the MIDP DEIS recognizes in Section 3.0 of Appendix A as being the correct term.

Issue – The BLM indicates that annual drilling plans will be required and submitted to the Authorized Officer.

Comment – It is often difficult or impossible to plan oil and gas operations one year in advance. The BLM should understand that operations and plans may change as a result of factors beyond the control of operators including commodity pricing, equipment and labor availability, and geologic results. Any development plans provided by operators will, at best, be estimates of potential activity for the next year, and BLM cannot hold the operators accountable for changes in annual development plans.

Issue – The third bullet on page A-7 reads: "To reduce weed infestation and soil loss…the Operators will be required to seed well pads with a sterile crop cover immediately after construction. Details of acceptable crop covers and other suggested reclamation procedures can be found in Appendix E of the EIS." *See* MIDP DEIS, pg. A-7.

Comment – This mitigation measure should be deleted from a list of mitigation measures. The Appendix E reclamation "plan" is insufficient to meet the reclamation needs in the MAA and does not provide the tools in ensure reclamation success in the project area. Please see EOG's other comments concerning Appendix E.

Issue – The fourth bullet on page A-7 states: "The goal of the transportation plan should be to identify feasible alternatives for access that meet the objectives of the BLM, Wyoming Department of Transportation, County transportation authorities, and the Operators. . . . " *See* MIDP DEIS, pg. A-7.

Comment – The "goal," as stated above, is not within the scope of this EIS, beyond the authority of the BLM to implement, and should be removed. That it not to say, however, that transportation planning should not be an integral component of this project. During the summer

of 2004, the Moxa Operators secured the services of an independent consultant to travel and map all well access roads, well pads, and pipeline routes where a pipeline may depart from following immediately adjacent to the access road. In September 2005, the Moxa Operators provided all data in geographic information systems format to the BLM in addition to committing to updating that data as changes were made and providing the revised data to the BLM annually in January. Updated data were provided to the BLM in January 2006 and 2007.

The Operators committed to evaluating their new access roads for need and suitability. The Operators committed to using the existing roads as much as possible to minimize the amount of new construction and to evaluate whether old roads were, in fact, still needed. If roads were not needed, they were reclaimed. The following text reiterates the commitment made by the Moxa Operators in their project description:

"Plan" objectives include:

- Facilitate identification of roads not needed for operations;
- Maximize use of the existing road system;
- Minimize the number of loop roads;
- Minimize the crossing of side slopes greater than 40 percent;
- Minimize profile grades; and
- Minimize drainage crossings, with emphasis placed on drainages with potentially large runoff flows and floodplains.

The new roads are expected to cross federal, state, private surfaces. The exact location of well access roads will be determined at the time of the onsite with the appropriate surface management agency.

New roads may be built in order to move a drill rig and well-service equipment from one site to another and to allow access to each site. The BLM has developed road construction standards in its *Surface Operating Standards for Oil and Gas Exploration and Development, 4th Edition* (Oil & Gas Gold Book) (BLM and USFS, 2005) and in BLM Manual 9113."

To the extent that the BLM may not fully understand this commitment, the Moxa Operators are in the process of developing a written Transportation Plan that more fully explains the actions that would be taken during project development and is included in DRAFT FORM with these comments as attachment F.

Issue – The fifth bullet on page A-7 reads: "The Operators will be required to disperse water from pits. . . . " *See* MIDP DEIS, pg. A-7.

Comment – The text should replace the term "*disperse*" with the phrase "facilitate evaporation" to provide the Operators and the BLM the flexibility needed in the MAA. Using the term "disperse" suggests a limited or single approach to removing water from pits and

spraying or dispersing the water on the surface, which may not be practical, feasible, or the best approach to handle water in the MAA.

Section 5.0 – Mitigation Measures, Table A-1

Issue – Section 5.0 of the MIDP DEIS contains Table A-1, which allegedly is a "Consolidated Table of Application of BMPs and Mitigation Measures for Resources."

Comment – No reference is made in the text of the MIDP DEIS to Table A-1 and BLM has not attempted to explain the purpose or intention of Table A-1. Will all of the identified mitigation measures be required?

Comment – The BLM has not explained the difference between "mitigation" and "BMPs" in the Table and why certain resources have BMPs and Mitigation listed separately. The FEIS should make the distinction between the BMPs and mitigation measures clear in the text, if there is, in fact, a distinction. Under some resources, BMPs and mitigation are combined, while in other sections they are distinct, and no rationale is provided in the text to justify the differences. Finally, Table A-1 contains several mitigation measures and BMPs that are not identified or explain earlier in the MIDP DEIS making them almost impossible to understand in the Table. The BLM must remove Table A-1 from the MIDP FEIS.

Comment – The MIDP FEIS should explain the intent of the contents of this table and should relate suggested BMPs/mitigation back to the appropriate sections of the EIS that justify the imposition of the listed mitigation measure. Doing so will help the Operators and the public understand why such measures are necessary and explain how the BLM intends to address potential impacts associated with continued oil and gas development in the MAA.

Comment – The BLM must explain whether the mitigation measures in Table A-1 are voluntary, mandatory, or whether they are simply mitigation measures that may be considered on a site-specific basis when deemed necessary to protect a specific resource. The inclusion of Table A-1 without explanation is confusing. Further, several of the proposed mitigation measures and BMPs are beyond the BLM's jurisdiction and authority.

Comment - The MIDP FEIS should identify those BMPs/mitigation measures that are drawn from the previous Moxa ROD (1997) and the currently applicable resource management plan and explain why these measures should be applied to the proposed project. The MIDP EIS should provide justification/scientific rationale for the inclusion of BMPs/mitigation measures that reference a limit or specific threshold. Failing to justify the thresholds and limits could make the document susceptible to attack as arbitrary and capricious.

Comment – The proposed mitigation measures and BMPs in Appendix A require the Operators to fund a number of studies and take other actions that will make development in the MAA far more expensive. As the BLM is aware, the profit margins in the MAA are already very

thin, requiring the operators to fund numerous mitigation measures may make further development in the MAA economically infeasible.

Section 5.0 – Mitigation Measures, Table A-1

Comment - The BLM should remove the following BMPs/mitigation from Table A-1 and include provision that address these concerns in a ***revised*** Appendix E that recognizes that technical and economic concerns will affect the Moxa Operators' ability to drill directionally or utilize consolidated facilities.

- Soils BMP #2: Where avoidance of (badland and steep slope sensitive soils) is not feasible, incorporate special soil stabilization and erosion control measures. *See* MIDP DEIS, pg. A-8.
- Soils BMP #4, Water BMP #4, Fisheries and Wildlife BMP #6: Drilling multiple wells from a single pad in sensitive soils (badland and sand dune). *See* MIDP DEIS, pg. A-8.
- Soils BMP #6, Fisheries and Wildlife BMP #6: Centralizing facilities in sensitive soils/sensitive wildlife habitats. *See* MIDP DEIS, pgs. A-8, A-10.
- Soils Mitigation #1, Water Mitigation #1, Vegetation/Wetlands Mitigation #1, Fisheries and Wildlife Mitigation #3, Livestock Grazing and Rangeland Health Mitigation #1: Seeding well pads with a sterile crop cover immediately following construction. *See* MIDP DEIS, pgs. A-8, A-9, A-10.
- Vegetation/Wetlands BMP #1, Fisheries and Wildlife BMP #9, Livestock Grazing and Rangeland Health BMP #1: Interim reclamation of well locations and access roads in the available period within 1 year after the well is put into production (Operator committed). *See* MIDP DEIS, pgs. A-9, A-10.
- Vegetation/Wetlands BMP #2: Use only native species for interim and final reclamation unless authorized by the BLM. *See* MIDP DEIS, pg. A-9.
- Vegetation/Wetlands BMP #3: Follow reclamation procedures (Appendix E). *See* MIDP DEIS, pg. A-9.
- Vegetation/Wetlands Mitigation #3: Treat halogeton infestations prior to surface disturbance or before reclamation. . . ." *See* MIDP DEIS, pg. A-9.

Issue – Table A-1, Mitigation Measures, Table A-1, Fisheries and Wildlife, Mitigation #4; Livestock and Grazing Mitigation #3. *See* MIDP DIES, pgs. A-10, A-11.

Comment – Under Fisheries and Wildlife, Mitigation #4, and under Livestock Grazing and Rangeland Health, Mitigation #3, suggest that the Moxa operators have yet to provide transportation data to the BLM. See the comments included in this document that describe the efforts initiated in 2005 and data provided on an annual basis to the BLM regarding transportation planning.

Issue- Mitigation #5 under Fisheries and Wildlife calls for the "Development of a supplemental Wildlife and Livestock Mitigation document that will identify specific mitigations to be applied both onsite and offsite." *See* MIDP DEIS, pg. A-10.

Comment – The BLM has failed to demonstrate in the MIDP DEIS a need for a plan to identify mitigation for wildlife species. Furthermore, the BLM should recognize that the Moxa Operators do not have resource expertise that would enable them to develop such a plan or even agree that a plan that would be developed is suitable for the MAA and the species considered.

Although the Moxa Operators committed to considering offsite mitigation, the BLM should remember that offsite mitigation is entirely voluntary (BLM IM 2005-069). The BLM should also acknowledge that on federal lands, the BLM is responsible for land and resource management. Broad resource management prescriptions are more appropriately developed during the development of resource management plans, not in a project-specific EIS. Mitigation #5 should be removed from the MIDP EIS.

Issue - Mitigation Measures, Table A-1, Cultural Resources, BMP/Mitigation #4. The text reads: "Cultural/historical resource treatment planning and/or Programmatic Agreement." *See* MIDP DEIS, pg A-11.

Comment – BMP/Mitigation #4 should be removed from this EIS because all surface disturbing operations are conducted in compliance with applicable laws, regulations, guidance, and programmatic agreements between the BLM and the Wyoming State Historic Preservation Office. The BLM has not justified the need for a special programmatic agreement regarding operations in the MAA.

Issue – Mitigation Measures, Table A-1, Noise. The BLM includes the following combined mitigation measure/BMP: "Reduce noise levels to 49 dBA or less, particularly during the bird nesting season (April 1 through June 30) to minimize effects of continuous noise on bird populations. Constant noise generators should be located far enough away from sensitive habitats or muffled such that noise reaching those habitats is less than 49 dBA." *See* MIDP DEIS, pg. A-9.

Comment – The proposed mitigation measure is unclear, unreasonable, and unenforceable as currently drafted. First, the criteria is more restrictive than the EPA noise level described in Section 4.6 of 55 dBA, which is a standard not intended to apply to wildlife (See comments concerning Section 4.6). Second, BLM has not defined which "bird" the mitigation measure applies. Does the BLM intend the mitigation measure to apply to any birds, or only select species? Third, the mitigation measure does not state that it applies only when specific bird nests or habitat are present. Finally, the BLM has not defined or identified sensitive bird habitat in the MIDP DEIS. Fourth, the MIDP DEIS does not support the rationale for imposition of this limit based on documented scientific studies specific to species being "protected."

Issue – Mitigation Measures, Table, A-1, Socioeconomics, contains the following proposed mitigation measures on page A-11.

- #1 – "Assist local government with funding of public service projects that have been impacted by population growth related to oil and gas development."
- #2 – "Develop and fund portable infrastructure enhancements to compensate for boom and bust times.
- #3 – "Work with WY DOT and/or affected counties to install signs such as school bus stop signs.
- #4 – "Provide incentives or land for local builders to build hosing prior to start-up of MAA drilling activities. The City of Evanston has adequate utility capacity for significant growth. Therefore, these incentives would be best provided in the Evanston area."
- #5 – "If housing becomes available in the Evanston area, encourage workers to reside in this area since facilities and services there are adequate for a larger population base."

Comment – The proposed mitigation measures are wholly outside of the BLM's jurisdiction and inappropriate for inclusion in the MIDP DEIS—all must be removed from further consideration in the MIDP EIS. The operators cannot take on the role of a local or state government to provide general services to potentially impacted communities. The increased revenue from oil and gas development should assist with additional facilities and infrastructure. Further, because this is an infill project designed to allow oil and gas development to continue in the MAA, a significant boom and bust cycle is unlikely. Mitigation measures #4 and #5 are particularly egregious in a free market economy. The operators cannot provide incentives or financial handouts to a particular sector or the economy or force their employees or contractors to live in certain areas.

Issue – Mitigation Measure, Table A-1, Health and Human Safety. *See* MIDP DEIS, pg. A-12.

Comment – EOG is happy to participate in meetings that address coordinated emergency response to events that may involve its operations; however, requiring the provision of documentation to an unidentified agency of compliance with federal HAZMAT regulations and/or the Uniform Fire Code is beyond the authority of the BLM. EOG complies with all applicable laws and regulations to ensure the health and safety of its personnel as well as that of the public.

APPENDIX A.2 – STANDARDS FOR HEALTHY RANGELANDS FOR THE PUBLIC LANDS ADMINISTERED BY THE BUREAU OF LAND MANAGEMENT IN THE STATE OF WYOMING

Issue – Appendix A.2 contains the Standards for Healthy Rangelands for the Public Lands Administered by the Bureau of Land Management in the State of Wyoming.

Comment – The BLM has not explained the purpose or role of Appendix A.2 or explained why it was included in the MIDP DEIS. To the extent Appendix A.2 is a statewide document it should appear as and appendix to the Kemmerer RMP, not project level documents such as the MIDP EIS.

APPENDIX B – DEVELOPMENT AND OEPRATION PROCEDURES TECHNICAL SUPPORT DOCUMENT

Section 2.0 – Introduction

Issue – Section 2.0 references a hazardous materials summary and Reclamation Plan in the first sentence. *See* MIDP DEIS, pg. B-1.

Comment – The Operators did not provide a complete listing of hazardous materials that may be used during operations. The reference to the hazardous materials summary should be removed. The Reclamation Plan is substandard and should be removed from the FEIS (See comments regarding Appendix E).

Section 3.0 – Project Development

Issue – The text on page states on page B-2 that: "Drilling and development would, in most areas, continue year-round, unless prohibited by Standard Stipulations…(Appendix A).

Comment – This sentence was not part of the Operators' project description and must be removed. Furthermore, drilling and development would occur in timeframes consistent with *lease stipulations* and COAs, as contained in the Kemmerer RMP.

Issue – Section 3.2 Workovers is presented at the beginning of the detailed project description. *See* MIDP DEIS, pg. B-2.

Comment – The Operators' project description was written to describe activities in the approximate sequence of normal development operations. Workovers would not occur prior to construction and initial drilling operations. The inclusion of this section out of sequence may be confusing to members of the public not familiar with oil and gas operations. EOG suggests that the BLM replace Appendix B with the project description as written by the Moxa Operators and provided to the BLM. "For externally initiated proposal, the applicant must concur (in writing) with any modifications to the proposed action." *See* BLM NEPA Handbook, H-1790-1, Chapter V.B.1.d.(3), Chapter V.B.2.a.(2), pgs. V-4, V-5 (Rel. 1-1547 10/25/88).

Issue – On page B-5 the BLM references an outdated version of the Gold Book.

Comment – Although the BLM correctly references the 4th edition, the BLM should reference the Revised 4th edition issued in 2007.

Issue – In Section 3.7 Drilling Operations, the text reads: "*Until new technology becomes available,* steel production casing will be run and cemented in place in accordance with the well design and as specified in the APD and COAs." *See* MIDP DEIS, pg. B-6.

Comment – Comment: The Operators' proposed actions states "*If deemed economically justified,* steel production casing will be run and cemented in place in accordance with the well design and as specified in the APD and COAs. The applicant must concur (in writing) with any modifications to the proposed action. *See* BLM NEPA Handbook, H-1790-1, Chapter V.B.1.d.(3), Chapter V.B.2.a.(2), pgs. V-4, V-5 (Rel. 1-1547 10/25/88).

Issue – The BLM describes the proposed cementing requirements in Section 3.7 of Appendix B. *See* MIDP DEIS, pg. B-6.

Comment –The cementing requirements, as they were presented in the Operators' proposed action, were drawn from the 1997 Moxa EIS ROD. These requirements were edited for presented in the DEIS. The cementing requirements should be presented in the FEIS in their entirety as part of the Operators' project description. The applicant must concur (in writing) with any modifications to the proposed action. *See* BLM NEPA Handbook, H-1790-1, Chapter V.B.1.d.(3), Chapter V.B.2.a.(2), pgs. V-4, V-5 (Rel. 1-1547 10/25/88).

Section 6.0 – Production Facilities

Issue – In Section 6.0 the text reads: "*Most* gas will be measured electronically." *See* MIDP DEIS, pg. B-8.

Comment – The Operators' proposed actions states "*All* gas will be measured electronically." The BLM must change the text to accurately state the Moxa Operator's project description, as presented to the BLM. The applicant must concur (in writing) with any modifications to the proposed action. *See* BLM NEPA Handbook, H-1790-1, Chapter V.B.1.d.(3), Chapter V.B.2.a.(2), pgs. V-4, V-5 (Rel. 1-1547 10/25/88).

APPENDIX E – RECLAMATION PROCEDURES PLAN

Comment - Appendix E is unacceptable, unreasonable, and must not be adopted by the BLM. The proposed reclamation plan is impractical, far exceeds any national or Wyoming BLM policy, and will not result in the assurance of reclamation success.

The Moxa Operators committed to the development of a reclamation plan developed to address the specific needs of the project area. The intent of the Moxa Operators is:

1. To demonstrate to the BLM that the Moxa oil and gas operators recognize that the extent and degree of success of reclamation in the project area has been less than optimal.

2. To provide a mechanism for developing a reclamation plan that would ensure successful reclamation to the highest degree possible.

3. To commit to a mechanism for ensuring accountability and participation by all Moxa operators.

4. To forestall some variation of a rolling surface disturbance limit applicable to the project area ***that would be impossible to administer and would prevent future oil and gas development***

The "plan" in Appendix E is inconsistent with the commitment made by the Moxa Operators, as detailed elsewhere in these comments. Adherence to the "plan" contained in Appendix E ***would ensure a lack of reclamation success because it lacks the thoughtful application of principles that would be applied on a project-area specific basis and would not provide for an alteration of procedures that would be developed over time until reclamation success is measurable.***

Appendix E should be replaced in its entirety by the reclamation commitment made by the Moxa Operators. The FEIS should recognize in the text the steps taken to-date by the Moxa operators to follow through on their commitment. The Moxa Operators have solicited proposals from reclamation professionals recognized for their work in southwestern Wyoming. They were asked to provide cost and time estimates for developing a baseline assessment of reclamation status for surface disturbance resulting from oil and gas operations; developing an initial MAA reclamation plan with variations, as appropriate, to different areas within the project area; performing annual assessment of reclamation success utilizing the procedures initially specified in the reclamation plan; providing measurable assessments of reclamation success to the Moxa Operators on a periodic basis; and modifying the reclamation plan to improve upon the initial results of plan implementation. The Moxa Operators' goal is to demonstrate that they are willing, able, and serious about their plan to provide for success reclamation efforts in the project area. EOG is convinced that the inclusion of the Appendix E plan will doom its efforts, as well as those efforts of all Moxa Operators to failure.

If the BLM insists on including a specific reclamation "plan" as an appendix to the EIS, it should recognize and delete the errors which it incorporates. Some of the errors contained in Appendix E, as written in the DEIS, are detailed in the following comments.

Section 1.0 – Introduction

Issue – On pages E-1 and E-2 the text reads: The text reads: "Reclamation measures covered in this plan fall into three general categories:

1) Initial – referring to measures applied immediately after well pad construction,
2) Interim – referring to measures applied to stabilize disturbed areas and to control runoff and erosion until well abandonment, and
3) Final reclamation – referring to measures that are to be applied concurrently with abandonment of facilities."

Comment - Appendix E, Section 2.2, describes interim reclamation as short term. Because interim reclamation lasts the life of the well or facility, the Section 2.2 title is incorrect and misleading. "Short term" in the title probably should be explained as "short-term disturbance." In the MAA, interim, reclamation may be required to last as long as 40 years, or the life of a well. Therefore, there is no difference between interim and final reclamation in the practical sense. The BLM Washington Office (WO-310) direction in the Gold Book 4th Edition, (Revised 2007) does not describe interim reclamation as temporary. It is viewed as life of the well reclamation. The only difference between interim and final reclamation as far as national BLM policy is concerned, is restoration of the original contour. The plan in Appendix E has created its own policy and definitions outside of national BLM direction and policy and will result in substantial monitoring problems, as will be explained in subsequent comments.

Section 3.1 – Clearing, Topsoil Removal, and Storage

Issue – The text in the second paragraph reads: "Topsoil would be stockpiled separately from subsoil materials. Topsoil stockpiles would not exceed a depth of 2 feet." *See* MIDP DEIS, pg. E-3.

Comment - Storing topsoil to depths not to exceed 2 feet is impractical since as much as 50 percent more disturbed area would be required to store the topsoil if stripped at a depth of 1 foot. For example, a 5-acre pad with 1 foot of stripped topsoil would require another 2.5 acres of area to store the topsoil stockpile. This amount of surface required for storage would be additive to any subsoil or reserve pit "spoils."

As soon as a well is completed, the topsoil would be re-spread over the cut and fill surfaces as part of interim reclamation. This would normally be done within a 12-month period, and there would be no significant loss of biological activity in the stockpiled topsoil within this short time frame. Hence, there is no biological reason for the shallow stockpiles if the interim reclamation practices are followed. There is no national BLM requirement to save topsoil in 2 foot deep storage piles. Topsoil storage to a depth not to exceed 2 feet is completely impractical and unnecessary.

Section 3.2.1 – Uplands

Issue – In the second paragraph under Section 3.2.1 the BLM states "A berm approximately 18 inches high would be constructed around fill portions of these well pads to control and contain all surface runoff generated or fuel or petroleum product spills on the pad surface." *See* MIDP DEIS, pg. E-4.

Comment - Constructing an 18-inch high berm around the fill portions of the pad is a very dated and poor field practice. Such a berm would retain snow melt or rainwater on the pad, creating an artificial and impractical impoundment. The impoundment would create saturated soils for extended periods of time, making the soils impossible to reclaim and re-vegetate. The berm would result in unsafe conditions. These types of locations are common sources of noxious

weeds. Creation of a berm is not a component of national BLM policy; in fact, it is highly discouraged by WO-310 surface protection staff. In addition, there is never a need to berm the entire pad, only those vessels containing potential contaminants (i.e., oil, condensate, chemicals, or saltwater). This paragraph should be eliminated completely.

Section 4.1 – Temporary Erosion Control

Issue – The third paragraph in this section on page E-5 of the MIDP DEIS the BLM states: "If construction is completed more than 30 days prior to the specified seeding season for perennial vegetation, areas adjacent to the larger drainage channels would be covered with jute matting for a minimum of 50 feet on either side of the drainage channel. In addition, to protect soil from erosion, 2 tons/acre of weed-free straw mulch would be applied to all slopes greater than 10%. Temporary erosion control measures may include leaving the ROW in a roughened condition, re-spreading scalped vegetation, or applying mulch." *See* MIDP DEIS, pg. E-5.

Comment - This paragraph requires any construction completed before 30 days of the specified seeding season must be mulched with straw or jute mating. Appendix E lacks a discussion of seeding in association with these measures. There is no national BLM oil and gas policy to match this requirement. The BLM Goldbook recommends mulching as part of seeding, but the standards included in Appendix E both exceeds national policy and is poor field practice as well. A better practice, for example, would be to seed at a higher rate plus add some soil amendments to make up for seeding out of the preferred season then apply mulching as necessary. This would eliminate the need to re-prepare the seedbed for later seeding and have to apply mulch a second time.

Section 6.0 – Interim Reclamation

Issue – The second paragraph in this section states: "In cases where the topography is relatively flat, it may be unnecessary to re-contour the wellhead location at the time of final reclamation. The Operators would determine the necessity of final re-contouring at the time of interim reclamation. If final re-contouring would not be necessary, the Operators would set aside sufficient topsoil for final reclamation of the small unreclaimed area around the wellhead." *See* MIDP DEIS, pg. E-7.

Comment - Because landform re-contouring of well pads on "relatively flat topography." Is not required, it does not meet national BLM policy for landform restoration.

Section 6.1 – Topsoil Respreading and Seedbed Preparation

Issue – The third paragraph in this section reads: "If topsoil is loose after re-spreading, it would be compacted with a cultipacker or similar implement to provide a firm seedbed." *See* MIDP DEIS, pg. E-8.

Comment - Use of a "cultipacker or similar implement to provide a firm seedbed" once the topsoil is respread is an old concept that has its roots in pasture seeding. In wildland seedings, a rough surface is generally more preferable to the smooth surface created with a cultipacker. Unless a site prepared in this manner is mulched, it will erode significantly from both wind and water. Many of the sites now in Moxa Arch may erode after seeding because of the use of such a technique. There is no national policy mandating this outdated, and no reference within the Gold Book for its use. Development of a Moxa-specific reclamation plan, as proposed by the Moxa Operators, would incorporate practices that would best ensure successful reclamation.

Section 6.4 – Seeding Method

Comment – In general, the section is dated with respect to reclamation techniques. It is biased towards drill seeding and does not mention recently developed techniques such as imprinting. If retained in an actual reclamation "plan," methodology should be modified to allow for new and improved seeding methods and not be so restrictive. Incorporation of references to new practices and methodologies is not inconsistent with national policy and probably Wyoming BLM policy.

The third paragraph strongly encourages staggered seeding of shrubs. To successfully accomplish that task, a new seedbed would have to be prepared in a newly seeded area, probably with new seedlings emerging. Such a procedure would almost always reduce the non-shrub seeding success with marginal improvements for shrub seedings. There is no national policy that supports this practice. In fact, staggered seeding significantly exceeds national standards.

The fourth paragraph references "winter-construction mulching." Such a requirement exceeds national standards.

Section 6.5 – Mulching

Comment - The list of mulching materials is too short and should include bark, wood chips, and other methods that could be applied as the technology improves.

The specific requirements for mulching rates for one type of mulching material, the techniques used and required, and the estimated costs are too narrow in scope as well as too specific in nature for the EIS. Many of these techniques are too costly and are very difficult to accomplish over large areas. The concept is probably consistent with national policy but should not be so detailed, especially when these practices have had very little, if any, application in the Moxa Arch area. These are the kinds of practices that would be in the individual operators submitted Reclamation Plans.

Section 11.0 – Reclamation Standards

Issue – The text reads: "The following reclamation standards are based on the Wyoming Interim Reclamation Policy (BLM 2007). The standards are to be used as a guideline to determine whether a reclamation effort is successful and whether the reclamation liability (i.e., bonds) would be released." *See* MIDP DEIS, pg. E-18.

Comment - The text above gives the reader the impression the proposed standards and requirements are based largely on formal Wyoming policy. This is a significant misstatement. Whereas the Wyoming Instruction Memorandum (WY 2007-009) and its attached formal policy provide broad and reasonable guidelines for reclamation, Appendix E, Section 11.0 "Reclamation Standards" provides confusing, largely unattainable standards that greatly exceed any Wyoming BLM or national BLM reclamation standard. This entire section should be completely revised. The following are some examples:

- The twelve bulleted points under "11.0 Reclamation Standards" are taken from the WY IM 2007-009 but the rest of the Appendix consists entirely of Kemmerer FO proposals.

- There is no national standard coinciding to what is proposed under the section heading "11.1 Specific Performance Standards." This section is unworkable and similar to the initial versions for the Atlantic Rim DEIS. The BLM WO had significant comments on that effort and changes were made in the reclamation plan eventually adopted for that project.

  For example, Appendix E proposes three standards of reclamation. There is no national policy, implied or otherwise, for triple standards. National BLM policy for oil and gas activity is interim reclamation of the non-used portion of the producing pad, and this effort would last for the life of the well (5 to 30 years). National BLM policy for final reclamation applies to the time after the well is plugged and abandoned. In both cases, the reclamation success is the same. Different vegetation cover requirements for three different phases are impractical and a little bit naive. This whole section should be replaced with a simple vegetation standard of 70 to 80% of either: 1) the desired plant community, 2) the pre-existing and surrounding vegetation, or 3) the dominant species included in the applied seed mix. Appendix E lacks flexibility and reasonableness.

- With reference to the following statement on page E-20: "Erosion condition of the reclaimed areas is equal to or better condition than that measured for the reference transect for establishing baseline conditions." Does this mean the Moxa operators have to have soil erosion/soil surface factor transects in addition to vegetative cover transects? Besides being very expensive and time consuming, such a procedure is far in excess of national BLM requirements.

- Section 11.2 Reclamation Performance Monitoring includes a long bulleted list of eleven "specific items (that) would be evaluated during the monitoring process." The list is egregious and far beyond any national BLM policy. For example, it requires the assessment of the "degree of rodent damage on seed and seedlings." What standards or techniques would be required? And what does it matter what caused the reduction to seeding success if the operator is held to specific vegetative cover? Another excessive requirement refers to the "degree of livestock grazing and wildlife browsing." Would a Moxa operator be required to conduct leader utilization studies for both wildlife and livestock use? Is this not inherently functions of the BLM and WGF?

- Section 11.3 Reclamation Success Monitoring Specifics: The text states: "reclamation success would include the following qualitative and quantitative vegetation parameters," which are listed as: percent vegetation cover, percent total ground cover, density of shrub and sub-shrub species, aerial extent of shrub mosaics, and species diversity and species composition. This list is excessive and beyond national BLM requirements. What is meant by "aerial extent of shrub mosaics?" The requirements are vague and could be interpreted to require multiple types of (costly) vegetative transects, each geared for a particular parameter, where the results would not necessarily aid in the actual determination of reclamation success.

CONCLUSION

EOG Resources, Inc. appreciates the opportunity to submit its comments on the Draft Resource Management Plan and Environmental Impact Statement for the Kemmerer Field Office Planning Area and looks forward to participating in the BLM's analysis of this important project.

Very truly yours,
EOG RESOURCES, INC.

James R Schaefer /ss

James R. Schaefer
Division Operations Manager

EOG RESOURCES, INC.

MOXA ARCH DEIS COMMENTS

ATTACHMENTS A, B, AND C

Attachment

A

Proposed Action/Project Description

MOXA ARCH AREA
NATURAL GAS DEVELOPMENT
INFILL PROJECT

PROJECT DESCRIPTION

November 2005

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Tables

MOXA ARCH AREA NATURAL GAS DEVELOPMENT INFILL PROJECT DESCRIPTION

INTRODUCTION

EOG Resources, Inc. and certain other operators (identified herein as the "Operators") propose to develop hydrocarbon resources underlying oil and gas leases owned, at least in part, by the Operators within the Moxa Arch area in Lincoln, Uinta, and Sweetwater counties, Wyoming. The Bureau of Land Management (BLM) for the United States government, State of Wyoming, and private owners issued the oil and gas leases covering these lands. The Kemmerer Field Office (FO) manages BLM surface lands and the federal mineral estate in the Project Area.

Oil and gas extraction in the Project Area is guided by relevant programmatic NEPA actions including the Kemmerer Resource Management Plan (1986), the Expanded Moxa Arch Environmental Impact Statement/Record of Decision (ROD, 1997), and the decisions made in applicable project-specific BLM NEPA documents. The BLM operates in accordance with the Federal Land Policy and Management Act of 1976 (FLPMA), which mandates that the BLM consider multiple uses for the lands it administers. FLPMA specifies that the BLM consider the land's inherent natural resources as well as its mineral resources when making land management decisions. The BLM's responsibility extends to environmental protection, public health, and safety associated with oil and gas operations on public lands. Mineral leasing decisions made by the BLM result in a contractual commitment from the United States to allow for exploration, development, and operations by the Operators in accordance with stipulations and restrictions incorporated within its leases. Lease rights include the right to occupy and use as much of the surface as is reasonably necessary to explore, develop, operate, and produce the subsurface oil and gas resources. The Operators understand that the decision that will result from this NEPA document will pertain only to those areas in the Project Area where there are federal surface and/or federal minerals.

The Operators recognize that the State of Wyoming and other local governmental agencies also have authority over various aspects of oil and gas development in all or portions of the Project Area.

PROJECT OVERVIEW

Collectively, the Operators propose to drill approximately 1,861 wells in addition to wells that currently exist in the Project Area. As a result of geologic information obtained by drilling conducted since the 1997 ROD, the proven production and flank areas were redefined from the areas considered in the 1996 EIS such that the area of currently proposed more intense development area ("core" area) has been reduced from the proven production area defined in 1996 and the corresponding flank area (the remainder of the Project Area) has been expanded. Please see the attached map. The Operators estimate approximately 1,226 additional wells will be drilled in the core area and approximately

635 additional wells will be drilled in the flank area. The Operators anticipate drilling infill wells to the Frontier and Dakota formations at varying densities ranging from four to 12 wells in the core area and 320 acres per well in the flank area. The Project Area contains several units in addition to non-unitized lands. The total number of estimated projected wells includes those wells that will be drilled in units. The total number of wells drilled will depend largely on factors outside of the Operators' control such as production success, appropriate engineering technology, economic factors, commodity prices, availability of commodity markets, and lease stipulations and restrictions.

Based on current reservoir and well performance information, approximately 75 percent of the new wells drilled south of the northern boundary of Township 20 North may produce gas from both the Frontier and the Dakota formations, commingled down hole per Wyoming Oil and Gas Conservation Commission (WOGCC) Order 155-91. Production commingled in the same well bore will not result in additional surface disturbance because down hole commingling eliminates the need to drill separate wells to distinct formations.

This proposal assumes that the additional wells will be drilled conventionally, i.e., with vertical well bores. All proposed wells are anticipated to be drilled during an approximate 10-year period after project approval. Although actual operations are subject to change as conditions warrant, the Operators' long-term plan of development is to drill additional wells at the rate of approximately 186 wells per year or until the resource base is fully developed. The average life of a well is expected to be 40 years.

The associated facilities required by the project may include roads, gas pipelines, production facilities (separation, dehydration, metering, treating, fluid storage, compression), disposal well and/or surface disposal facilities, and equipment storage facilities. In general, gas will be transported via subsurface pipeline to centralized compression and treatment facilities although some well site compression may be needed on a limited basis. Produced water will be transported by truck to water disposal wells or evaporation ponds. Project development will result in the use of new roads and roads previously constructed and currently used in the Project Area. New roads are expected to consist primarily of access roads. Existing arterial roads will provide the main access to the Project Area.

PROJECT LOCATION

The Project Area includes all of the lands analyzed in the 1996 EIS. The Project Area is located in the mixed ("checkerboard") land ownership area of western Sweetwater, southeastern Lincoln, and northeastern Uinta counties, west of the Green River in Wyoming. It includes approximately 476,261 acres of mixed federal, state, and private lands. The BLM manages approximately 231,380 acres, the Bureau of Reclamation (BOR) manages approximately 26,903 acres, the U.S. Fish and Wildlife Service (USFWS) manages approximately 1,469 acres, the State of Wyoming owns approximately 13,343 acres, and private landowners own approximately 202,943 acres. The Project Area is generally located within Townships 15 through 23 North, Ranges 111

through 113 West, 6th Principal Meridian. It lies in an area west of Green River, Wyoming, east of Lyman and Opal, Wyoming, and south of the Fontenelle Reservoir. Interstate 80 crosses the southern third of the Project Area.

Table 1: Proposed Well Locations by Surface Owner

Surface Owner	Estimated Acreage in Project Area[1]	Percent of Project Area	Estimated Number of Proposed Well Locations
BLM	231,395	48.6	618
BOR	26,903	5.6	72
U.S. Fish and Wildlife Service (USFWS)	1,469	0.3	5
State of Wyoming[2]	13,343	2.8	88
Private/Fee[2]	203,151	42.7	1,078
Total	476,261	100	1,861

[1] Acreages estimated from 2005 GIS coverage and total acreage described in the *Expanded Moxa Arch Natural Gas Development Project*, June 1996

[2] Well counts for state and fee lands are estimates only.

DESCRIPTION OF OPERATIONS

The following description of operations applies to federal surface and/or federal minerals only. Development activities proposed on fee and State of Wyoming mineral interests will be approved by the WOGCC. Construction or surface disturbing activities will occur only after approval of an Application for Permit to Drill (APD) by the BLM and/or the WOGCC is obtained. These sections summarize pre-construction activities, construction, drilling and completion operations, production and maintenance operations, abandonment and reclamation procedures, a summary of anticipated surface disturbance associated with the project, and Operator-committed environmental protection measures. The described construction techniques and procedures are intended to be generally applicable to all access road construction, well pad construction, and well drilling in the Project Area; however, individual operators may use techniques and procedures that vary somewhat from those presented here.

Construction Operations

Surveying and Notice of Staking or Application for Permit to Drill

Prior to the start of construction activities, the Operators will:

- Submit site-specific applications [Notice of Staking (NOS)/APD/Sundry Notice/ Right-of-Way (ROW) application];
- Survey and stake the location;
- Participate in an onsite evaluation;
- Submit detailed construction plans, as needed; and

- Perform cultural resource, biological, and/or other surveys, as required.

For wells on federal minerals, the operator must obtain a permit from the BLM before ground disturbance can take place. To initiate the permitting process, the operator files either an NOS or an APD with the BLM. These documents are filed with the Kemmerer FO. The BLM processes applications to determine if they meet requirements.

A technically and administratively complete APD normally consists of a Surface Use Plan, Drilling Plan, evidence of bond coverage, and other information that may be required by the BLM. A Surface Use Plan contains information describing construction operations, access, water supply, well site layout, production facilities, waste disposal, and restoration/revegetation or reclamation associated with the site-specific well development proposal. The Drilling Plan typically includes information describing the technical drilling aspects of the specific proposal, including subsurface resource protection. Determination of the suitability of an operator's design, construction techniques, and procedures is made by the BLM during the permitting process.

Pre-construction Activities and Construction Initiation

Prior to APD approval but after the proposed drill pad and access road are surveyed and staked, onsite inspections are conducted to assess potential impacts, and methods to mitigate impacts and establish them as Conditions of Approval (COAs) to the APD are determined. The BLM notifies the operator of a date, time, and place to meet to perform an onsite inspection. The objective of the onsite inspection is to review the pad location, well access road, and pipeline route in consideration of topography, location of topsoil/subsoil stockpiles, natural drainage and erosion control, flora, fauna, habitat, historical and cultural resources, paleontological resources, and any other surface issues that may become apparent during the onsite inspection. The attendees of the onsite inspection may include representatives of the Operator, survey crew, the private landowner (if applicable), and the BLM. Survey stakes indicate the location of the new access road and the orientation of the well pad. Appropriate changes or modifications then are made if needed to avoid or mitigate impacts to such resources as drainages, archaeological sites, threatened and endangered species, and/or big game calving areas/seasonal restrictions. Excess cut and fill and other issues are also addressed, as appropriate.

During the onsite inspection, the BLM gathers information needed to develop site-specific COAs, which are incorporated into the approved APD. These environmental protection measures address all aspects of oil and gas development, including construction, drilling, production, and reclamation and abandonment.

Construction or surface disturbing activities will occur generally during daylight hours only and only after approval of an APD by the BLM. Infrequent circumstances may require construction to occur on either side of daylight hours. To minimize new construction, the Operators will utilize the existing ancillary facility infrastructure within the Project Area,

where possible, including gas compression facilities, power lines, water disposal and treatment facilities, and gas gathering pipelines.

Access Roads

Access to the Project Area will include I-80 in the south, U.S. Highway 30 through its center, U.S. Highway 189 in the northwest, and State Highway 372 in the northeast. Access within the Project Area boundary will be via the existing road network, which consists of arterial roads and individual well access roads.

The BLM and the Operators are cooperatively developing long-term management plans (Transportation Plans) for existing and future roads. The plans are long-term efforts intended to minimize resource conflicts and development costs within the Project Area. Plan objectives include:

- Facilitate identification of roads not needed for operations;
- Maximize use of the existing road system;
- Minimize the number of loop roads;
- Minimize the crossing of side slopes greater than 40 percent;
- Minimize profile grades; and
- Minimize drainage crossings, with emphasis placed on drainages with potentially large runoff flows and floodplains.

The new roads are expected to cross federal, state, private surfaces. The exact location of well access roads will be determined at the time of the onsite with the appropriate surface management agency.

New roads may be built in order to move a drill rig and well-service equipment from one site to another and to allow access to each site. The BLM has developed road construction standards in its *Surface Operating Standards for Oil and Gas Exploration and Development, 4th Edition* (Oil & Gas Gold Book) (BLM and USFS, 2005) and in BLM Manual 9113. Construction of new roads and well sites will conform to standards described in the Gold Book. Bulldozers, graders, and other types of heavy equipment are used to construct and maintain the road system. Standard cut-and-fill construction techniques are used. The roads are crowned and ditched except where the BLM determines that the road can safely be constructed using less disruptive techniques. Major roads in the Project Area are normally limited to one main route to serve the leases in a geographic area with a maintained side road (access road) to each well. The amount of surface area needed for roads is dependent on topography and loads to be transported over it. Road ROWs in the Project Area are typically 50 feet. Generally, the running surface of the main roads is 20 to 24 feet wide, and the running surface of access roads is 14 to 18 feet wide. These dimensions are for the driving surface of the road, not the maximum surface disturbance associated with ditches, back cuts, or fills. Access road lengths will vary according to the location of a specific well and its relation to the

existing road network.

Roads will be built and maintained to provide year-round access. All construction materials for project access roads will consist of native borrow and soil accumulated during road construction. If required by the Authorized Officer (AO), the access road will be surfaced with gravel or crushed rock per BLM specifications. Gravel and rock will be obtained from existing permitted or private sources. Road construction will utilize standard grading techniques. Road crossings will incorporate culverts, as needed and/or required. Drainage ditches and culverts will be designed to prevent the accumulation of silt or debris and will not be blocked by the roadbed. Water will be diverted from the roadway at frequent intervals. Travel during construction will be restricted to the 50-foot ROW unless modifications must be made to accommodate slope conditions.

Existing roads that require upgrading will meet standards appropriate to the anticipated traffic flow and all weather road requirements. Upgrading may include ditching, drainage, graveling, crowning, and capping the roadbed as necessary to provide a well-constructed, safe roadway. Upgrading will not occur during muddy conditions.

Well Pads

The traditional single-well location design has been utilized in the Moxa Project Area in the past almost exclusively and will continue to be the predominant drill site design in this proposal.

Operators will determine the location of a proposed well by the location of the subsurface reservoir, the topography of the area, and WOGCC spacing rules. The size of a drill pad will depend on topography and specific well needs. Well pads will be constructed from the native sand/soil/rock materials present. Mineral materials will not be required. Topsoil and native vegetation are removed and stockpiled for use in the reclamation process. Locations will be leveled by balancing cut and fill areas. Construction practices may include blasting or ripping to achieve a level pad. Blasting may be required when bedrock is near the surface. Cut-and-fill slopes will be designed to allow for retention of the topsoil during reclamation and subsequent re-establishment of vegetation.

Typically a well pad will include a 6 to 8-foot wide cellar to allow access to casing heads, mouse and rat holes adjacent to the well bore to accommodate drilling operations, a flare pit, and a reserve pit. A fenced reserve pit, approximately 10 to 12 feet deep, will be excavated within the pad to temporarily store drilling fluids, cuttings, and produced water. The dimensions of the pit vary according to well depth and size and shape of location. In non-environmentally sensitive areas and when a fresh water-based drilling mud is used, the reserve pit may be unlined pending completion of a soils survey that includes evaluation of the distance to surface water, depth to useable ground water, soil type and permeability, and anticipated types of fluids that would be contained in the pit. A reserve pit will be

lined if so specified in the APD after the onsite evaluation. It will also be constructed in a way that minimizes the accumulation of surface runoff into the pit through the use of strategically placed subsoil/topsoil storage areas and/or the construction of berms and diversion ditches.

Both the access road and well pad are typically constructed within 3 to 7 days, depending on terrain and site limitations. Depending on availability of equipment and specific well construction requirements, from 2 to 8 individuals may be present on location during construction activities at any given time. Personnel will access the location using an average of 3 light trucks each day during construction of the access and well pad. Construction equipment may include bulldozers, motor graders, scrapers, backhoes, and trenchers.

A single well pad size will vary depending on the size of the drilling rig used but will average approximately 2.75 acres based upon a 300 foot by 400 foot drilling site. Long-term disturbance will be the amount of surface remaining on the well pads after the reserve pit and other areas unnecessary for ongoing and future operations are reclaimed. After interim reclamation, long-term disturbance associated with an average well pad will be approximately 1.0 acre.

Drilling and Completion Operations

Drilling

Drilling operations will be conducted in compliance with all federal regulations including federal Oil and Gas Onshore Orders, all WOGCC rules and regulations, and all applicable local rules and regulations. The Operators anticipate that the drilling rig count within the Project Area would range from 5 to 15 rigs, with an average of 10 rigs operating at any particular time in order to achieve development objectives.

Following construction of the access road and well pad, a drilling rig will be transported to the well site and erected on the well pad. Wells will be drilled utilizing a conventional, mechanically powered mobile drilling rig. The rig will be erected at the drill site after the conductor pipe has been set. Drilling operations will typically consist of drilling surface hole, running and cementing surface casing, drilling production hole, and running and cementing production casing. Occasionally intermediate casing will also be run. The rig will then be dismantled and demobilized from the location.

Fresh water used for drilling purposes will be obtained from approved appropriations from the Black's Fork, Hamm's Fork, and Green rivers as a result of water appropriation permits obtained from the State of Wyoming (State Engineer's Office) and from commercial or privately owned water source wells. Water may be recycled for use in drilling, completion, work over, well abandonment, and hydrostatic pipeline testing operations.

Drilling fluids will consist of a fresh water/gel mixture with water being the main constituent. In order to achieve borehole stability and minimize possible damage to the gas producing formations, certain formation stabilizing and hole cleaning materials may be added to the drilling fluid. No hazardous substances will be placed in the reserve pit. Reserve pits will be constructed so as not to leak, break, or allow discharge and in accordance with APD COAs. The reserve pit will be fenced on 3 sides during drilling operations and on the fourth side when the rig moves off the location. Fences will be constructed according to BLM requirements and as described in Onshore Order No.7.

During drilling operations, a blow out preventor will be installed on the surface casing to provide protection against uncontrolled entry of reservoir fluids into the well bore should reservoir pressures exceed the hydrostatic pressure of the well bore fluid. In addition, a flow control manifold consisting of manual and hydraulically operated valves will be installed at ground level.

Prior to setting production casing, open hole electric electric and radioactive logs may be run to evaluate production potential. If deemed economically justified, steel production casing will be run and cemented in place in accordance with the well design and as specified in the APD and COAs. Evaluation logs may be run subsequent to setting and cementing production casing in some cases, especially in the flank area.

The types of casing used and the depths to which they are set will depend upon the physical characteristics of the formations that are drilled and the pressure requirements anticipated during completion and production operations. All casing will be new or reconditioned and tested, in accordance with applicable regulations.

Duration of drilling operations on a given well can vary significantly depending on depth and conditions encountered while drilling, but days on location in the Project Area can range from approximately 10 to 20 days. Drilling operations require approximate 8 to 10 individuals and 6 vehicles on location at any given time each day during normal operations. An additional 10-15 men and 6 vehicles would be required on location during the running and cementing of production casing. Approximately 10,000 barrels of water are needed to perform drilling operations; however, when appropriate and approved by the appropriate regulatory authority, some water may be conserved by the reuse of some or most of the drilling fluids in subsequent drilling operations.

Materials Management

A variety of chemicals, including lubricants, paint, and additives, are used to drill and produce a well. Some of these chemicals can contain constituents that are hazardous. Hazardous materials include some greases or lubricants, solvents, acids, paint, and herbicides, among others. Potentially hazardous substances used in the development or operation of wells will be kept in limited quantities on well sites and at the production facilities for short periods of time. Materials will not be stored at well locations during drilling operations. The transport, use, storage and handling of hazardous materials will follow the procedures specified by the Occupational Safety and Health Act and by the

Department of Transportation (DOT) under 49 CFR, Parts 171–180. DOT regulations pertain to the packing, container handling, labeling, vehicle placards, and other safety aspects.

None of the chemicals that will be used meet the criteria for being an acutely hazardous material/substance or meet the quantities criteria per BLM Manual 1703. Chemicals subject to reporting under Title III of the Superfund Amendments and Reauthorization Act (SARA) in quantities of 10,000 pounds or more will not be used, produced, stored, transported, or disposed of annually during the drilling, completion, or operation of any well in the Project Area. In addition, no extremely hazardous substance, as defined in 40 CFR 355, in threshold planning quantities, will be used, produced, stored, transported, or disposed of while producing any well.

Solid and Hazardous Wastes

Most wastes that will be generated at project locations are exempt from regulation by the Resource Conservation and Recovery Act (RCRA) under the oil and gas exploration and production exemption. Exempt wastes include those generated at the wellhead through the production stream and gas plant. They include produced water, drilling mud, well completion/workover fluids, and soils affected by these exempt wastes. Non-exempt wastes may include spent solvents, discarded lubricants, paints or other substances that contain hazardous materials as defined by RCRA.

Spills and releases can result in soils that are contaminated by produced water, petroleum products, or chemicals. The Operators will develop and maintain Spill Prevention Control and Countermeasure Plans for wells in the Project Area as required by regulation.

Completion and Testing

A typical cased well bore in the Project Area consists of conductor pipe, surface casing, and production casing. The surface and production casing/cementing programs will be designed to isolate and protect shallower formations and aquifers from the production stream and to minimize the potential for migration of fluids and pressure communication between formations.

The BLM, in cooperation with the WOGCC, the Operators, and the Petroleum Association of Wyoming, has issued a cementing policy for the Project Area. The policy ensures the protection of fresh water and other minerals during the drilling and production phases of well development. Wells drilled in the Project Area will adhere to one or more of the following conditions:

1. Production casing will be cemented from total depth to the surface or to 250 feet inside the surface casing.

2. If production casing is not cemented as described in #1, a cathodic protection system will be installed. This protection system will be designed to ensure casing protection to whichever of the following depths is the shallowest:

    a. Top of the Hilliard Shale;

    b. Below any zone with less than or equal to 10,000 parts per million of total dissolved solids; or

    c. Top of cement.

3. If an Operator elects to not follow #1 or #2, it may elect to run corrosion logs on selected wells on a periodic basis. The Operator must inform the BLM which wells the logs will be run on, what logs will be run, and at what periodic interval.

4. In addition to adhering to #1, #2, or #3, above, all wells drilled within a 6-mile buffer zone bounding the Known Sodium Leasing Area will set surface casing 100 feet into the Wasatch Formation and cement back to surface (all strings).

The BLM has the authority to modify the above requirements as necessary. Operators can request waivers on a well-by-well basis.

Once production casing has been cemented in place, the drilling rig will be released and completion operations will commence utilizing a well servicing rig or coiled tubing unit. Initial completion operations may also be conducted "rigless," utilizing cased hole wireline equipment rather than a well servicing unit or coiled tubing unit, until such time that production tubing is installed in the well or other operational requirements dictate the use of a well servicing rig. In general, the completion of the well will consist of perforating the production casing, productivity and/or formation pressure testing if deemed necessary, stimulation of the formation(s) utilizing hydraulic fracturing technology, flow back of fracturing fluids, flow testing to determine post fracture productivity, and installation of production equipment to facilitate hydrocarbon sales.

Hydrocarbons and water are typically quantified and flared during testing operations, which are conducted on an as needed basis. Hydraulic fracture stimulation is required on the majority of wells in the Project Area in order to enhance productivity. Numerous combinations of fluids and proppants have been used historically in the Project Area in the effort to optimize stimulation results. Currently, the most common stimulation technique utilizes gelled fresh water (with CO_2 and/or N_2 frequently added for reservoir protection and enhanced flow back) and fracture proppants to provide the bridging and increased permeability necessary for productivity improvement. Sand, resin-coated sand, ceramics, or bauxite can be used in the stimulation process, depending on the design criteria of individual treatments. Gels and other chemical additives are utilized to provide the fluid viscosity necessary to ensure successful stimulation. The fracturing fluid is pumped down the well bore through the perforations in the casing, and into the formation. Sufficient rate and pressure are reached to induce a fracture in the target

formation. No diesel is used in this process. The proppant carried in the fluid serves as a bridge to keep the created fracture open and to provide a flow path that allows reservoir fluids to move more readily into the well bore. Water used for stimulation purposes generally comes from approved appropriations from the Green, Hamm's Fork, or Black's Fork rivers or from water supply wells. Stimulation fluids recovered during flow back and subsequent production operations are temporarily contained in the reserve pit or in tanks on location.

Post stimulation flow tests allow for recovery of stimulation fluids and evaluation of well productivity. Duration of the tests will vary depending on individual well performance but typically are conducted only long enough for fluid rates to drop to a level that permanent production equipment can safely process. During completion operations, efforts are made to avoid flaring by routing as much gas as possible to sales pipeline system in order to minimize emissions to the atmosphere and conserve the resource. If gas is flared, it occurs during the flow back process. The flared gas is measured using choke nipple calculations or through a temporary flow test separator and metering facility. Flaring takes place at the end of a horizontal flow line placed at a temporary pit designed for that specific purpose or at a vertical flare stack. Flaring occurs at a distance from the wellhead that ensures equipment and structure protection and personnel safety. Following the initial flow period, the well will be shut in until facilities are in place to allow the well to be placed on sales. In some cases, production facilities will be installed prior to completion in order to provide the capability of turning the well to sales immediately following testing. Fluids, primarily water, recovered during flow back operations are contained in the reserve pit or tanks on location until they are disposed of at evaporation pits or disposal wells.

Completion and testing operations require approximately 3 to 10 days to perform, 2 to 30 individuals, and 1 to 20 vehicles on location. Approximately 2,500 barrels of water are needed to perform completion and testing operations on wells drilled to the Dakota Formation. Water needed for completion and testing operations on wells drilled to the Frontier Formation ranges from 2,500 to 5,000 barrels.

In the event a well proves to be uneconomic, the Operator will plug and abandon the well in accordance with federal and state regulations.

Interim Reclamation

On producing wells, the reserve pit will be reclaimed per the requirements specified in the approved APD after the pit is dry or the fluids have been removed. Plastic liners, if used, will be handled according to BLM standards before backfilling the reserve pit. The reserve pit, that portion of the location and access road not needed for production operations, and pipeline corridors will be rehabilitated according to the requirements specified in the approved APD and COAs.

Production and Maintenance

Well Production Facilities

Well production facilities will be installed as shown on the approved APD, with secondary containment structures built to conform to BLM, state, and federal requirements. Facilities on the well pad may include wellhead valves and piping, separation, dehydration, metering equipment, oil and water production tanks, a dehydrator condensation catchment container, a methanol storage tank and pump, and telemetry equipment. Power lines will not be required to operate wells or facilities. Production equipment will be powered by natural gas, and equipment requiring electricity will be powered by solar panels. All gas will be measured electronically. Telemetry equipment is currently used or planned for use by most Operators to improve well evaluation, operational efficiency, and to minimize well visits. Production pits will not be used.

Plunger lift equipment is typically installed to provide artificial lift when production volumes drop to a level that prevents efficient removal of liquids from the well bore using reservoir energy alone. Other types of artificial lift may be considered during the approval of an APD or subsequent to putting a well on production, including types that may result from new technologies.

Some reportable chemicals under SARA Title III, such as ethylene glycol and methanol, may be used during production operations, and if their storage triggers reporting requirements, reports will be filed as required by regulation.

All constructed or installed permanent structures (on site 6 months or longer) will be painted a flat, non-reflective earth-tone color as specified by the BLM.

Pipelines

The Operators will continue to utilize the several natural gas transmission lines that serve the Project Area. Construction of additional transmission lines may be required, depending on production volume growth.

Gathering lines made of steel or other durable materials will be installed below the surface to transport the produced gas from the new wells to the pipeline system. The gathering lines will consist of pipes with a 3 to 4-inch outside diameter. The gas production lines will be located adjacent and parallel to well access roads where possible to minimize surface disturbance. The exact location of a gathering line will be determined at the time of the onsite with the appropriate surface management agency. The new pipelines are expected to cross federal, state, and private surfaces in a route developed to minimize resource conflicts and development costs within the Project Area.

Pipeline construction consists of trenching, pipe stringing, bending, welding, coating, lowering pipeline sections into the trench, and backfilling. Construction operations will be confined to the ROW corridor approved in the ROW application. In general, ROW widths

will be 50 feet when not adjacent to a road and as narrow as 30 feet when adjacent to an existing or new road. The pipeline trench will be mechanically excavated with a backhoe or trencher to a minimum depth of 48 inches. The trench will be approximately 18 to 20 inches wide. Newly constructed pipelines will be hydrostatically tested to ensure structural integrity. Drilling water may sometimes be used for hydrostatic testing. Approximately 2,700 gallons of water will be required to test one mile of 4-inch pipeline. Hydrostatic test water that is not used in drilling operations will be disposed of as approved by the BLM and/or the state. The Operators will reclaim the pipeline route as specified in the ROW authorization. Pipelines installation will result in short-term disturbance until reclamation is considered complete.

Compression, Gas Treatment, and Ancillary Facilities

The Operators will utilize the existing ancillary facility infrastructure within the Project Area to the extent possible, including power lines, water disposal and treatment facilities, and gas gathering and transmission pipelines.

The existing compression infrastructure, however, will be unable to provide sufficient capacity to compress the additional gas volumes anticipated from the proposed wells. Additional compression will also be required if the Operators conclude that a reduction in gas gathering system pressure is needed at some point during the life of the project. Additional compression in the Project Area could range from 17,000 hp (horsepower) to 50,000 hp. The additional compression will be added to existing compression infrastructure at central facilities in stages over the 10-year period after project implementation. Peak production is expected to occur in the 10^{th} year after project approval. As many as three additional compressor sites at 10 acres per site could be required to accommodate the maximum anticipated compression growth.

Well site compression is utilized infrequently in the Project Area; however, individual well site compression may be needed to a limited extent and will be applied for on a case-by-case basis. Installation of well site compression is expected to range from ten 125 hp± 2-stage compressors to ten 200 hp± 2-stage compressors. These compressors would be installed on the well pad at most locations, resulting in no additional disturbance; however, in a few cases, it may be necessary to expand a well pad in order to install compression at a well site. Possible additional disturbance from well pad expansion is estimated to be 10 acres.

Produced Water Disposal

Produced water may be confined to a storage tank prior to transport by water hauling trucks to disposal facilities. Produced water will be disposed of via subsurface injection, surface evaporative pits, or will be used in subsequent drilling operations. Disposal facilities, including injection wells and evaporative ponds, requiring new construction are anticipated to be built outside of the Project Area.

Maintenance

New wells will typically be visited daily but possibly less frequently after well performance has stabilized and telemetry equipment is installed.

Road travel will be restricted to the width of the running surface of the road. Maintenance on project roads during drilling and construction will be the responsibility of the Operators and would be consistent with the Transportation Plan, annual road plan, well-specific project plan, and BLM specifications. During the duration of the proposed project, the Operators will monitor the project roads and perform appropriate repairs. Repairs may be necessary to correct excessive soil movement, rutting, braiding around problem areas, and/or damage to cattle guards or gates.

Workovers

Periodically, a workover on a well may be required. A well servicing rig is generally utilized during workover operations to perform various tasks such as well bore or surface equipment repairs, reservoir evaluation, formation evaluation by wireline, or stimulation treatments to restore or enhance well performance. Workover operations are typically performed during daylight hours and are of short duration; however, depending on the scope of the work to be performed, workover operations can sometimes take from several days to several weeks to be competed. Unless fracture stimulation is necessary, workover operations would typically require from 5 to 10 workers on location at any given time. During fracture treatments, an additional 10 to 20 individuals could be present on location. Additional surface disturbance is rarely necessary to conduct workover operations; however, temporary pits may occasionally be utilized to store fluids. Approval from the BLM AO would be requested should the need for new surface disturbance arise.

Geophysical Operations

Seismic surveys have been conducted on some portions of the Moxa Project Area in the past. Although additional seismic surveys are not currently planned, the Moxa Operators may determine that future seismic surveys are needed to order to further define the subsurface to facilitate the extraction of leased oil and gas resources. Seismic surveys, if they occur, are not included in this Proposed Action.

Abandonment and Reclamation

Abandonment of the well and its facilities will be performed in compliance with applicable federal and state regulations as well as the COAs to the APDs. Seed mixtures applied during rehabilitation operations will comply with the specifications of the appropriate surface management agency. The Operators will cut off the casing at the base of the cellar or 3 feet below the final graded ground level, whichever is deeper, and cap the casing with

a metal plate a minimum of 0.25 inch thick. The cap will be welded in place with the well name and location engraved on the top. The cap will be constructed with a weep hole and placed three feet below ground level or to BLM specifications.

All surface equipment will be removed from the site. The surface will be recontoured to its original appearance, to the extent possible. Topsoil that was stockpiled during location construction will be distributed on the surface of the former location to blend the site in with its natural surroundings. All surface disturbance will then be planted with a seed mixture of native grass and plant species as specified by the appropriate surface management agency.

SURFACE DISTURBANCE SUMMARY

The Moxa Operators estimated projected surface disturbance using assumptions based on past experience and anticipated activities; however, additional data are currently being collected that may modify the assumed quantities. After the data are analyzed, changes may be made to the assumptions where appropriate.

Project development will result in disturbance to the federal, state, and private lands upon which the project wells will be drilled. Disturbance of the land will result from the construction and use of new roads, the construction of well pads, the installation of subsurface pipelines, and the construction or expansion of compressor facility sites or other associated facilities. Short-term disturbance refers to initial disturbance prior to interim reclamation of the reserve pits, unused portions of the location and roads, and reclamation of the pipeline route. Long-term disturbance refers to disturbance of the surface associated with the life of a well in addition to the running surface of its access road.

For analysis purposes, the following assumptions were made:

- Average access road length will be 0.5 mile.
- Road ROW width will be 50 feet, reclaimed to a running surface of 28 feet.
- Initial disturbance associated with each well will be approximately 2.75 acres.
- Long-term disturbance associated with each well pad will be approximately one acre.
- Average pipeline length will be 0.5 mile.
- Pipeline ROW width will be 50 feet, and reclamation will be initiated after construction.
- All new compression facilities would be constructed on BLM surface.

Average road length was estimated by reducing the value assumed for average road length in the 1997 Moxa EIS. Additional wells have been drilled during the last 8 years, and the proposed wells will be infill wells. Operators will be using their Transportation Plans to minimize construction of new roads; therefore, it is reasonable to assume that most new access roads will be constructed as laterals off existing roads. Consequently, the average new access road length will be shorter than 0.6 mile assumed in 1997 and

was conservatively estimated at 0.5 mile. After the additional data are analyzed, it is likely that the average road length will be reduced from 0.5 mile.

The Operators intend to construct and install pipelines adjacent to well access roads; however, it may be necessary to construct a pipeline route cross-country at some locations. Approximately 80 percent of the pipelines that will be installed were estimated to follow the new access roads. Pipelines that may require cross-country construction would not necessarily be longer than those constructed adjacent to roads. Therefore, the average new pipeline length was assumed to be 0.5 mile per well. Reclamation operations on pipeline routes will be initiated as soon as practicable after pipeline construction. Surface disturbance resulting from pipeline construction is intended to be short-term, depending on weather conditions conducive to successful reclamation. Long-term disturbance associated with pipeline construction is expected to be zero after reclamation is complete.

Although disturbance from the construction of new compression facilities was assumed to occur on BLM surface, it is likely that one or more of these facilities will be constructed on non-federal lands.

A summary of project-related disturbance is shown in Table 2.

Table 2: Surface Disturbance Summary

Type of Disturbance	BLM	USFWS	BOR	State of Wyoming	Private/ Fee	Total	Percent of Project Area
Number of Wells	618	5	72	88	1,078	1,861	---
Acres of Disturbance							
Roads	1872.7	15.2	218.2	266.7	3266.7	5639.4	1.2
Well Pads	1699.5	13.8	198.0	242.0	2964.5	5117.8	1.1
Pipelines	1872.7	15.2	218.2	266.7	3266.7	5639.4	1.2
Gas Treatment Facility	40.0	0.0	0.0	0.0	0.0	40.0	0.0
Total – Short-Term Disturbance	5475.0	44.1	634.4	775.3	9497.8	16396.5	3.4
Reclaimed Road ROWs	824.0	6.7	96.0	117.3	1437.3	2481.3	0.5
Reclaimed Well Pads	1081.5	8.8	126.0	154.0	1886.5	3256.8	0.7
Reclaimed Pipeline ROWs	1872.7	15.2	218.2	266.7	3266.7	5639.4	1.2
Total – Long-Term Disturbance[1]	1696.7	13.5	194.2	237.3	2907.3	5059.1	1.1
Percent of Long-Term Disturbance with Respect to Surface Ownership	33.8	0.3	3.9	4.7	57.9	100.0	

[1] Long-term disturbance = short-term disturbance less reclaimed portions of the well pad, reclaimed portions of road ROWs, and all pipeline disturbance

Short-term disturbance associated with project development was estimated to be approximately 16,397 acres. Most of the disturbance will occur on private lands, with road and pipeline construction being the largest contributors. Approximately 3.4 percent of the Project Area will be affected by short-term disturbance.

Total long-term disturbance associated with project development was estimated to be approximately 5,049 acres. Approximately 1,697 acres would be disturbed on BLM surface, 14 acres on BOR land, 194 acres on USFWS land, 237 acres on state land, and 2,907 acres on private surface. Approximately 0.7 percent of the BLM lands in the Project Area will be affected by project well development. Within the entire Project Area, approximately 1.1 percent of the surface will be disturbed as a result of project development for the lives of the wells.

Initial disturbance from the construction of roads, pipelines, and well pads appears to be roughly equivalent. Pipelines, however, will be reclaimed. If the average access road length approaches 0.5 mile, as assumed, most of the long-term disturbance to the Project Area will result from the construction of roads.

The Operators will continue to limit long-term surface disturbance as much as possible through the implementation of a road network that minimizes the construction of new access roads and by reclaiming as much of the short-term disturbance associated with roads and locations as is reasonable without limiting the requirements for ongoing and future production operations.

APPLICANT-COMMITTED ENVIRONMENTAL PROTECTION MEASURES

The Operators will adhere to all conditions included with their leases in addition to all federal and state laws and regulations. According to BLM IM No. 2004-194, best management practices to be considered in nearly all circumstances include the following:

- Interim reclamation of well locations and access roads soon after the well is put into production;
- Painting of all new facilities a color which best allows the facility to blend with the background, typically a vegetated background;
- Design and construction of all new roads to a safe and appropriate standard, "no higher than necessary" to accommodate their intended use; and
- Final reclamation recontouring of all disturbed areas, including access roads, to the original contour or a contour that blends with the surrounding topography.

The Operators commit to performing these environmental protection measures during the implementation of their Proposed Action.

Attachment

B

Directional Drilling Paper

Using Directional Drilling to Extract Natural Gas from the Moxa Arch Area Southwestern Wyoming

Introduction

The objective of this paper is to discuss the technical and economic merits of vertical and directional drilling scenarios that oil and gas exploration and production companies (Operators) could employ to extract natural gas from beneath the Moxa Arch area in southwestern Wyoming. The discussion and analysis of vertical and directional drilling that follows is based upon currently available technology and on the methodology, experiences and economics of one Operator in the Moxa Area. Some variation in the methods and economics would be expected between Operators but it is believed that this discussion presents a reasonable representation of vertical and directional drilling within the Moxa Arch area as these techniques are currently employed.

The Operators have traditionally drilled vertical well bores to produce gas from the Moxa Arch area. Directionally drilled wells in the Moxa Arch area have resulted from consideration of topographic or environmental factors. In response to increased public concerns over the protection of environmental resources, the Operators examined the use of directionally drilled well bores to explore and develop hydrocarbons from the Dakota and Frontier formations. The application of directional drilling is evaluated by individual companies utilizing current economics, available technology, environmental, and other factors. An Environmental Impact Statement (EIS) is currently being developed to analyze infill drilling impacts in the Moxa Arch area.

Project Overview

Collectively, the Operators propose to drill approximately 1,861 wells in addition to wells that currently exist in the Moxa Arch area. They anticipate drilling infill wells to the Frontier and Dakota formations at varying densities ranging from 160 to 53 acres per well in the proven production area (core) and 320 acres per well in the area outside of the core (flank). The Operators' long-term plan of development is to drill wells at the rate of approximately 186 wells per year or until the resource base is fully developed. The average life of a well is expected to be 40 years.

The Moxa Arch area is located in the mixed ("checkerboard") land ownership area of western Sweetwater, southeastern Lincoln, and northeastern Uinta counties, west of the Green River. It includes approximately 476,261 acres of mixed federal, state, and private lands. The BLM manages approximately 231,380 acres, the Bureau of Reclamation manages approximately 26,903 acres, the U.S. Fish and Wildlife Service manages approximately 1,469 acres, the State of Wyoming owns approximately 13,343 acres, and private landowners own approximately 202,943 acres. The Moxa Arch area where the

proposed wells would be drilled is generally located within Townships 15 through 23 North, Ranges 111 through 113 West, 6th Principal Meridian.

Project Area Subsurface Geology

The Moxa Arch is located in the western Greater Green River Basin, a complex of depressions separated by uplifts and ridges, primarily in southwestern Wyoming, but extending into Utah and Colorado. During uplift, crystalline Precambrian basement rocks were thrust to the surface in the western part of the Greater Green River Basin. In other areas, basement rocks were warped into broad, deep-seated highs along with the overlying sedimentary rocks. The total sediment thickness in the Greater Green River Basin is as much as 32,000 feet in its northern part (Gibson, 1997).

The Moxa Arch area is a broad, deep-seated, south-plunging anticline extending 120 miles from the LaBarge Platform in the north to the Uinta Mountains in the south. The Moxa Arch consists of generally shallow, southward dipping strata, gently folded into an arch with dips to the east and west along the flanks of the arch. Large oil and gas accumulations on the Moxa Arch are a combination of structural and stratigraphic traps (Gibson, 1997).

The formations below the west-central portion of the Green River Basin and Moxa Arch area are shown in Figure 1. Project wells will be drilled to the Frontier and Dakota formations; thus, the following discussion describes Quaternary and Tertiary deposits at the surface through the early Cretaceous Dakota.

Rocks exposed at the surface are largely composed of unconsolidated Quaternary deposits consisting of alluvium, terraces, colluvium, gravels, pediments, and glacial deposits. Alluvial deposits are generally associated with alluvial valleys of the Green River and tributaries. The Tertiary Eocene is represented by the Green River and Wasatch formations. The Green River Formation is mainly composed of sandstones, shales, marlstone, and trona. The Wasatch Formation is generally composed of green and red mudstone interbedded with variegated sandstone. The Mesaverde Group is a designation for widespread upper Cretaceous sedimentary rocks in the Greater Green River Basin that consists of sandstone, carbonaceous shale, and coal. Below the Mesaverde Group, the Baxter Shale may be up to 3,000 feet thick and consist of gray/black shale with silt and sand progressively increasing higher in the section (BLM, 2003).

Moxa Arch wells produce primarily from the Frontier Formation, which consists of shallow to off-shore deposited sands and shales, overlain by fluvial deposited sands and shales (Gibson, 1997). Both the non-marine and marine sections of the Frontier Formation are productive gas reservoirs (Ford, 2006). Reservoir properties can vary considerably for each sequence creating reservoir heterogeneity and

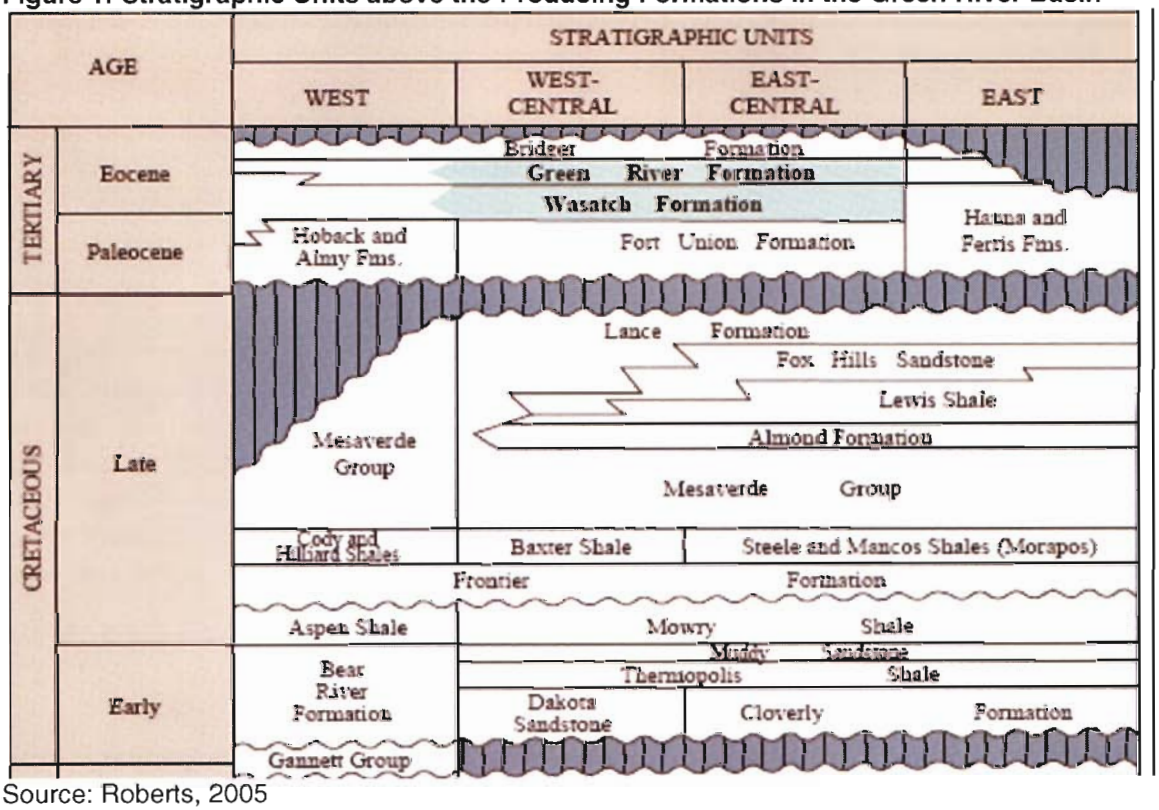
compartmentalization. This results in scattered dry holes and marginal producers in many Frontier fields (Law, 1995).

Below the Frontier Formation, the Mowry Formation consists dominantly of interbedded black shales and thin siltstones (Ford, 2006).

The Lower Cretaceous Muddy and Dakota sands were formed from sediments shed off a rapidly rising western upland that were carried eastward and northward by complex braided streams toward a shallow sea in the north (Gibson, 1997). Dakota reservoirs are primarily marine shoreline deposits in the northern part of the Moxa Arch area and fluvial sandstones in the southern part (Snoke et al, 1993). Dakota traps are primarily stratigraphic, sometimes subtly enhanced by structural controls in the central part of the Moxa Arch.

The Dakota, Muddy and Frontier sands can have excellent reservoir qualities, including porosities of 5 to 20 percent. They are typically considered tight gas sand reservoirs with permeabilities in the tenths of millidarcies. Permeability in all reservoirs appears to be enhanced along the crest of the arch as compared to the flanks, possibly due to fracturing (Law, 1995). Reservoir permeability may be enhanced by natural or artificial fracturing. Originally, virgin reservoirs in the Moxa Arch area were overpressured with a 0.56 psi/ft gradient, but presently they are normal to slightly underpressured (Ford, 2006).

Figure 1: Stratigraphic Units above the Producing Formations in the Green River Basin



Source: Roberts, 2005

Drilling Overview

Drilling a Vertical Well

To drill a vertical well, the surface location is located directly above the target bottom hole location (BHL). Most wells in the Moxa Arch area are permitted and drilled vertically because drilling vertical well bores is efficient and economic. The advantages to drilling vertically include the ability to:

- Reach the objective in minimal time;
- Minimize drilling costs;
- Use "straight-hole" drilling tools and techniques; and
- Reduce emissions to the atmosphere.

Drilling vertical well bores to the Frontier Formation in the Moxa Arch area requires the installation of surface casing and production casing. Typically, 8-5/8" surface casing is set to an approximate depth of 1,500 feet in an 11-inch hole drilled using water as the circulating fluid. After cementing surface casing, a 7-7/8" polycrystalline diamond compact (PDC) bit and positive displacement mud-motor (PDM) are used to drill the production well bore to total depth (TD) in one run. This 7-7/8" production hole is usually drilled using water through the Mesaverde and Baxter formations. Near the top of the first Frontier, the well bore is drilled using a light mud, up to 9.6 to 9.8 pounds per gallon, as the circulating fluid. On reaching TD, typically between 11,000 and 12,000 feet, a short trip is made to condition the hole for running wireline logs. After running the wireline tools and evaluating the logs, a conditioning trip is made back to TD in preparation for installing production casing. The drill string is laid down on the trip out of the hole, and a long string of 4-1/2" production casing is installed and cemented from TD to surface.

Over the 12 months from June 2005 to May 2006, a Moxa Arch area operator drilled 29 vertical wells in the area, in and around the Whiskey Buttes Unit. The average TD on these wells was 11,300 feet, requiring an average of 8.5 days of drilling rig time. Normalized for well depth, the mean well duration was 7.5 days per 10,000 feet at an average casing point cost (CPC, similar to "dryhole cost") of $481,000. A total of 400 hours of "non-productive time" (NPT) was recorded for all 29 wells, representing just under 7 percent of the total drilling time. NPT resulted from mechanical equipment failures, well bore problems, and other unplanned events.

Drilling a Directional Well

Directional drilling can be used to access minerals where the surface location is offset from the desired BHL. The majority of directionally drilled wells in the Moxa Arch area result from consideration of topographic or environmental factors.

Directional drilling increases well construction costs, introduces increased levels of risk and uncertainty to drilling operations, and can produce increased levels of environmental impacts. More specifically:

- Directional wells take longer to drill than an equivalent vertical well. Virtually every piece of equipment necessary to drill a well and men to operate the equipment are contracted for a daily operating cost, additional days to drill result in increased costs;
- The increased drilling time presents an increased exposure to potential drilling problems. Downhole problems that are relatively rare in vertical wells can occur more frequently in directional wells. Examples include borehole instability, tight hole, stuck pipe, and the inability to run open hole wireline logs;
- Specialized downhole steering and guidance equipment is needed to drill a directional well. Specially trained operators supervise these tools, resulting in additional costs to drill a directional well; and
- Increased drilling time, increased traffic, and increased load factors associated with directional drilling result in increased air emissions compared to a conventional vertical well.

Directional Drilling in the Moxa Arch Area

The casing program for directional wells in the Moxa Arch area is similar to that of vertical wells. Surface casing is increased from an 8-5/8" to 9-5/8" outer diameter (OD) pipe. The larger size provides greater wall thickness and more resistance to casing wear, which is more problematic in a deviated well. Greater wall thickness is needed to provide greater resistance to an elongated drill string and the greater weight associated with it. Drill pipe in a directional well bore is not centered in the well bore and wears the casing at the point of contact.

From June 2005 to May 2006, an operator drilled four directional wells in the Moxa Arch area. The same drilling rig was used to drill all but one of the 29 vertical wells and four directional wells, greatly reducing any differences resulting from use of different drilling rigs. Although the four directional wells were successfully drilled and completed, each was considerably more technically challenging and more costly than expected (Mallary, 2006).

The operator's planned step-outs (the lateral distance from surface location to bottom hole location), ranged from 335 feet to 1,018 feet, compared to well depth. The average TD was 11,300 feet, and the average drilling duration was 18.1 days. Normalized for well depth, the mean well duration was 16.1 days per 10,000 feet at an average casing point cost (CPC, similar to "dryhole cost") of $784,000. Total NPT for the four wells was 350 hours. The NPT for the four directional wells represents 23 percent of the total time required to drill the wells.

The following lessons were learned from drilling the four directional wells in the Moxa Arch area:

- Slide-drilling, known as "steering the well," is inefficient and time-consuming below the top of the Mesaverde (approximately 6,000-foot total vertical depth) because of the aggressive PDC bits employed, the variable formation lithology composed of sand/shale sequences, the high torque output of the PDMs, and the small OD of the 4½-inch drill pipe.
- Shallow-angle inclinations (12° or less) are difficult to maintain in the 7-7/8-inch interval. The drilling tools will not "lock in" to the intended course and must be constantly steered to keep the hole pointed to the target.

Analysis of the drilling data show that the optimum directional profile in the Moxa Arch area is an 'S' curve (build – hold – drop) with the build and hold completed prior to penetrating the Mesaverde formation. Figure 2 illustrates a typical well bore profile for a directional well. This strategy places most of the slide-drilling in the shallow section of the well where rate of penetration is well over 200 feet per hour. The dropping section will occur in the Mesaverde and Baxter formations, both of which exhibit a naturally tendency to come back to vertical without steering.

Completion in the Moxa Arch Area

Directionally drilled wells within the Moxa Arch area would not be expected to adversely impact well completion or production operations unless well bore angles were severe enough to restrict the ability of the Operator to utilize down hole equipment such as bridge plugs, packers, fishing tools, rod strings and plunger lift. Plunger lift is used in production operations to remove liquids from wells that have insufficient gas flow and/or reservoir pressure to produce liquids without mechanical intervention. Plunger lift equipment is widely used in the Moxa Arch area as the preferred method of artificial lift and could be impractical where deviation inclination (dog leg) angles are large enough to restrict plunger travel.

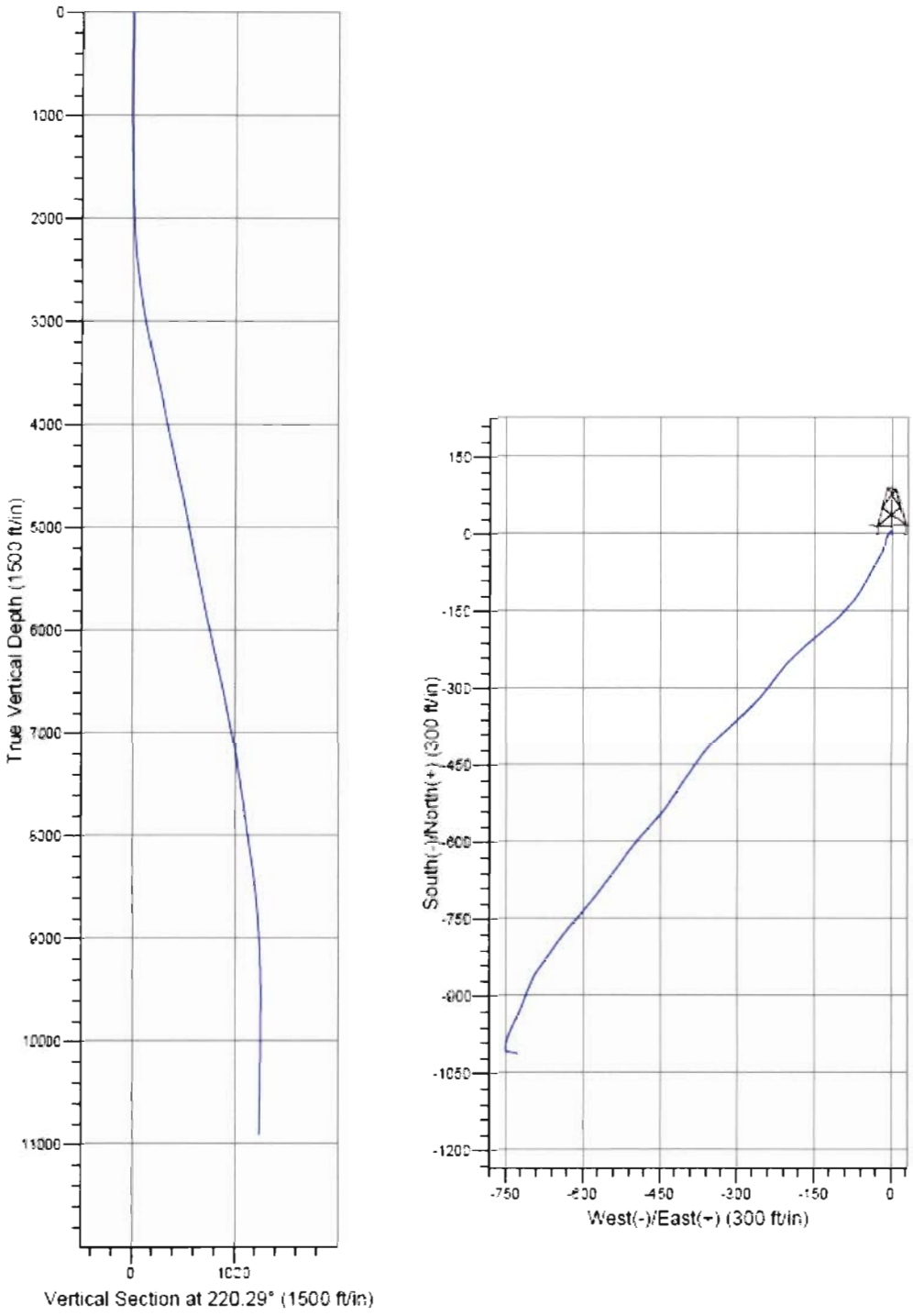


Figure 2: Typical S-curve for a Directionally Drilled Well in the Moxa Arch Area

Comparison between Vertical and Directional Drilling

Total drilling time and NPT increases significantly for directional wells. Total NPT for the four directional wells was 350 hours, almost equaling the total NPT of 400 hours for the 29 vertical wells. The NPT for directional wells comprises a larger proportion of the time required for drilling, 23 percent for an average directional well and 7 percent for an average vertical well. A comparison of NPT and time required for drilling average vertical and directional wells in the Moxa Arch area is shown in Table 1. Note that the total measured depth is nearly identical in both cases.

Table 1: Comparison of NPT and Drilling Time per Well Type

	Average for 29 Vertical Wells	Average for 4 Directional Wells	% Increase
Total Measured Depth (feet)	11,300	11,327	-
Total Time (days)	8.5	18.2	213
Days/10,000 Feet	7.5	16.1	188
NPT (hours)	13.8	87.5	634
% NPT	7	23	-
CPC ($, thousands)	481	784	163

The increased NPT for a directional well does not completely account for the approximate 188 percent increase in normalized drilling time required for a directional well compared to a vertical well to a depth of 10,000 feet. Figure 3 illustrates the relationship between well depth and number of days required to drill vertical and directional wells. In the figure, "step-out" is labeled "departure," as in departure from vertical. Figure 3 indicates that the average vertical well requires much less time to drill than a directional well to a nearly equivalent depth. Although a greater step-out seems to indicate that a longer time would be need to drill, problems associated with specific wells can prolong drilling such that this generalization may not always hold true.

Figure 3
Moxa Arch Area
Days Versus Depth, Vertical & Directional Wells

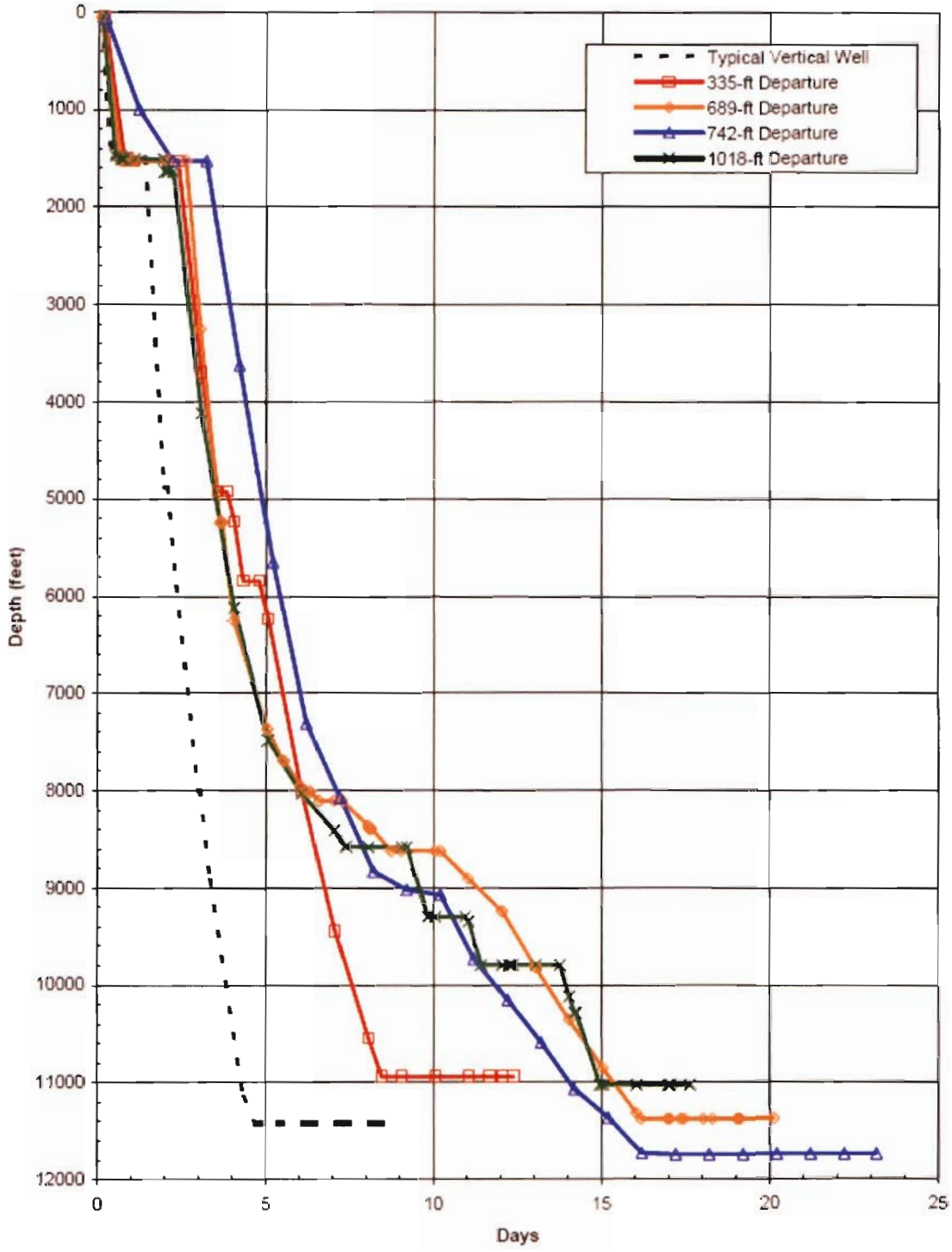


Figure 4 presents the data relating step-out to drilling time as normalized curves illustrating the number of days required to drill to a depth of 10,000 feet. The time required for an average vertical well is presented in relation to data for the four directional wells drilled in the Moxa Arch area. Figure 4 shows that the anticipated drilling time for a directional well will always be greater than that of a vertical well. An 80 percent confidence level is depicted by P90 and P10 curves. The "expected value" is shown by the "mean" curve.

Figure 4
Normalized Drilling Time as a Function of Step-out Distance

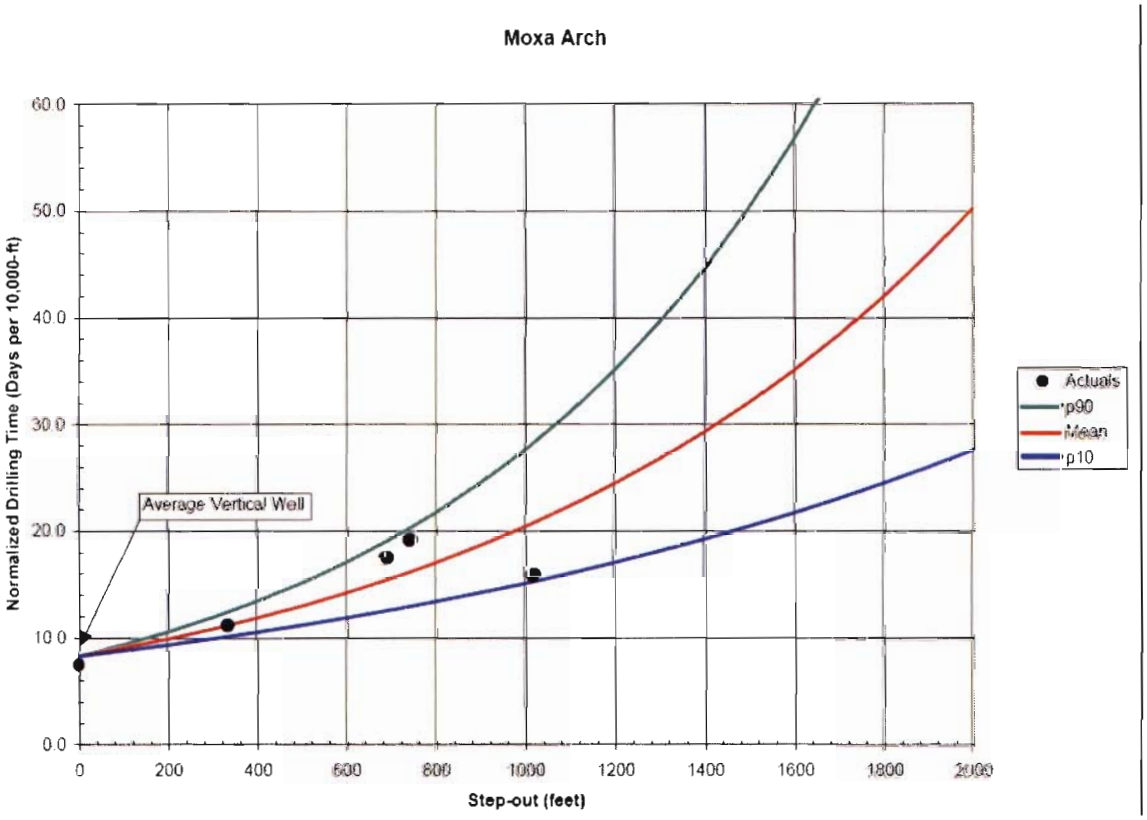


Figure 5 illustrates the expected cost of drilling a directional well as a function of well step-out. The data were developed from the same 29 vertical wells and four directional wells. Figure 5 also depicts an 80 percent confidence level and the mean curve. The actual CPC of the 29 vertical wells and each of the four directional wells in the data set is also displayed in this chart.

Examination of the chart in Figure 5 indicates that:

- Well cost does not vary linearly with step-out, except for very low departures, less than 300 feet.
- The range of uncertainty about the mean increases with step-out.

Conclusion

Consideration and evaluation of the subsurface geology of the Moxa Arch area does not preclude the use of directional drilling to produce natural gas from the Frontier and Dakota formations. Directional drilling in the Moxa Arch area is technically feasible.

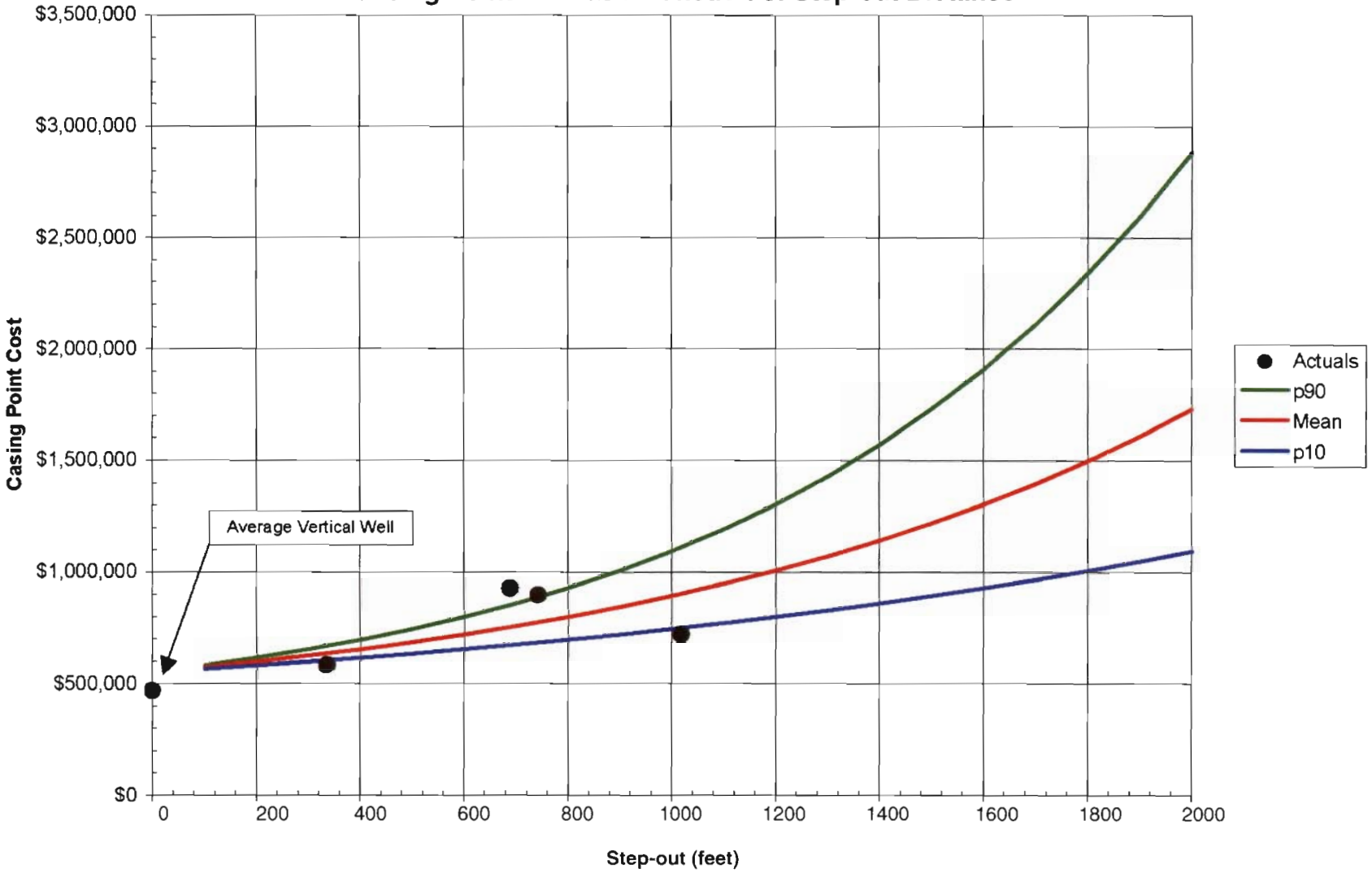
Directional drilling to reach a 40-acre location from an adjacent 40-acre location or from 80-acre location could require an offset that ranges from 1,320 feet to 1,475 feet.

Figure 4 indicates that the anticipated drilling time for a well with a 1,475-foot step-out would average 33 days, or approximately 24 days longer than the time needed to drill an equivalent vertical well. Approximately 10 percent of directional wells drilled to a 1,320-foot offset could require as much as 40 days to drill, and a 1,475-foot offset well could require as much as 54 days to drill. Figure 5 indicates that the CPC cost for a step-out of 1,320 feet would average $1,100,000, or approximately 2.2 times the dry hole cost for an equivalent vertical well. A well with a step-out of 1,475 feet would average $1,250,000, or approximately 2.5 times the dry hole cost for an equivalent vertical well. Approximately 10 percent of directional wells drilled to a 1,320-foot offset could incur a CPC of as much as $1,400,000. Approximately 10 percent of directional wells drilled to a 1,475-foot offset could incur a CPC of as much as $1,800,000. Table 2 compares drilling time and CPC for a vertical well to the two offsets.

Table 2: Comparison of Drilling Time and CPC to Offsets

Well Type	Vertical	Directional	% Increase	Directional	% Increase
Offset	0 feet	1,320 feet	-	1,475 feet	-
Drilling time (days)	9	28.5	317	33	367
CPC ($)	500,000	1,100,000	220	1,250,000	250

Figure 5
Casing Point Cost as a Function of Step-out Distance



The costs of drilling directionally in the Moxa Arch area are significantly higher than costs incurred by drilling vertically. As step-out from the vertical increases, additional costs increase non-linearly. In addition, the anticipated range of additional drilling time and costs become greater as step-out increases.

The rate of return is the measure of profitability of an investment, which in this case, includes the entire costs of drilling a directional well. An acceptable rate of return varies substantially from one Operator to the next and is largely a function of an Operator's ability to manage costs and financial risk. Directional drilling in the Moxa Arch area presents higher financial risks than drilling a vertical well, as shown in Figure 5. The present use of directional drilling will provide a lower rate of return than vertical drilling, resulting in increased financial risk to individual Moxa Arch Operators. The use of directional drilling cannot be presumed to be economically viable for the Moxa Arch Operators as a group or to any Moxa Arch Operator as an individual company. The application of directional drilling in the Moxa Arch area will be evaluated by each individual company utilizing current economics and available technology at the time of drilling, with appropriate consideration of topographic, environmental and other related factors.

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Attachment

C

WGFD Sage-Grouse Information

Brief Status of Sage-grouse Population Trends and Conservation Planning in Wyoming as of March 16, 2007

Tom Christiansen – Sage-Grouse Program Coordinator
Wyoming Game and Fish Department

Sage-grouse populations have declined in Wyoming and across the West over the last half-century. Figure 1 illustrates this decline as measured by the average number of males documented on sage-grouse leks in Wyoming from 1960-2006. Over the last decade however, the average size of leks has increased (Figure 2) reflecting a generally increasing population. The same is true for the most recent three-year period (Figure 3). Thus, there have been long-term declines but mid- and short-term increases in sage-grouse populations in Wyoming.

These trends are valid at the statewide scale. Trends are more varied at the local scale. Sub-populations more heavily influenced by anthropogenic impacts (sub-divisions, intensive energy development, large-scale conversion of habitat from sagebrush to grassland or agriculture, Interstate highways, etc.) have experienced declining populations or extirpation.

Figure 1.

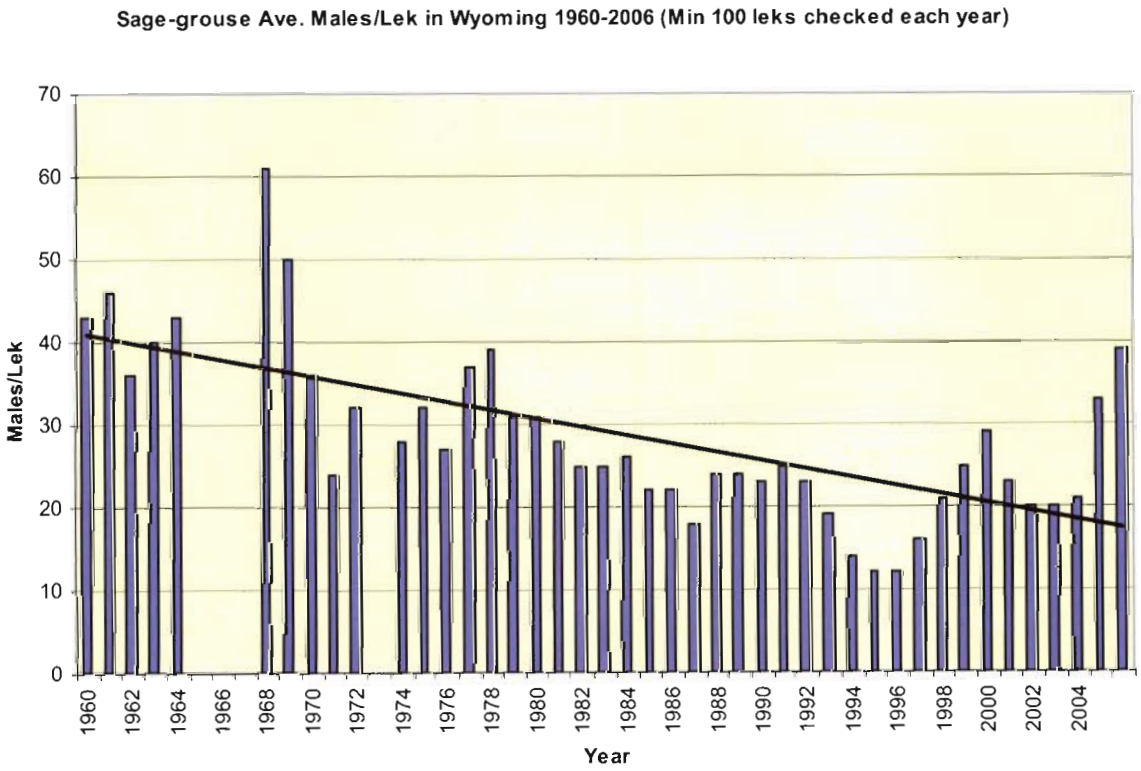


Figure 2.

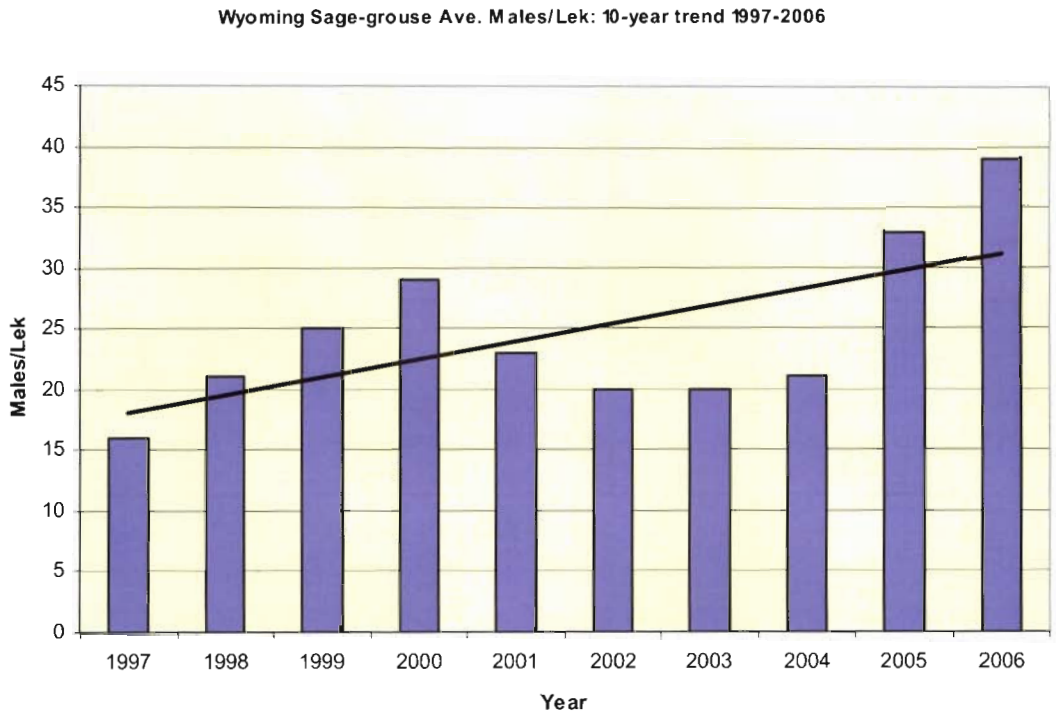
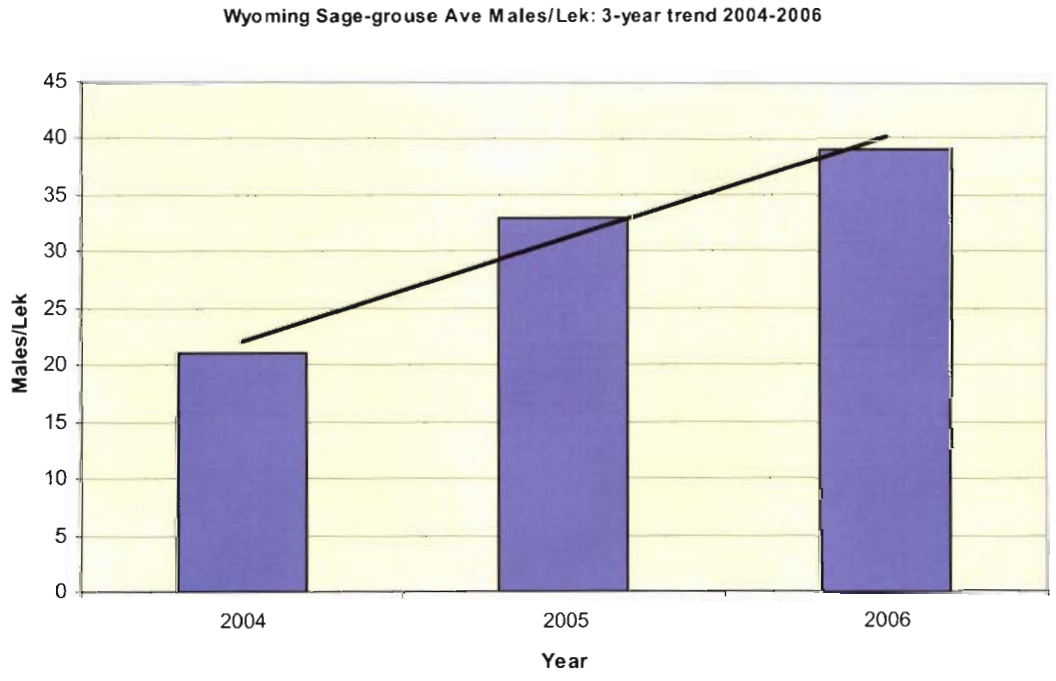


Figure 3.



The mid- and short-term trends in statewide populations are largely weather related. In the late 1990s, and again in 2004 and 2005, timely precipitation resulted in improved habitat

conditions allowing greater numbers of sage-grouse to hatch and survive. Drought conditions from 2000-2003 caused lower grouse survival leading to population declines. Weather and sage-grouse chick production data from 2006 suggest the average number of males observed on leks will decline in the spring of 2007 as drought conditions returned and chick survival decreased substantially in most areas of the state.

A statistically valid method for estimating sage-grouse population size does not exist. Monitoring population trends via annual lek counts and surveys is the accepted method for sage-grouse population monitoring at this time. Chapter 6 of The Conservation Assessment for Greater Sage-grouse and Sagebrush Habitats (Connelly et al. 2004) contains a more detailed discussion of long-term population trends in Wyoming.

The status of conservation planning for sage-grouse in Wyoming is outlined in Table 1. The Wyoming Greater Sage-Grouse Conservation Plan was completed in 2003. Eight local planning areas were established in 2004. One local plan was finalized in 2006. One additional plan was completed in early 2007. The remaining six plans are in the last stages of preparation and will be complete in the summer of 2007.

Table 1. Status of local sage-grouse conservation planning efforts as of March 16, 2007.

Local Working Group	**Plan Status**
Northeast Wyoming	Complete – August 2006
Bates Hole – Shirley Basin	Complete – January 2007
Upper Green River Basin	Public comment complete – preparing Final Completion anticipated prior to July 2007
South-Central Wyoming	Draft plan to public in April 2007 Completion anticipated prior to July 2007
Big Horn Basin	Draft plan to public in April 2007 Completion anticipated prior to July 2007
Southwest Wyoming	Draft near completion Completion anticipated prior to August 2007
Wind River/Sweetwater River	Draft near completion Completion anticipated prior to August 2007
Upper Snake River Basin	Draft near completion Completion anticipated prior to August 2007

Local Working Groups also implemented 20 sage-grouse conservation projects in 2005-2006 utilizing approximately $425,000 of a supplemental budget appropriation from the State of Wyoming. The LWGs are currently evaluating and/or implementing over 30 additional projects that will utilize another $1 million appropriation prior to the end of 2008. Projects include habitat treatments/restoration, improved range management infrastructure and grazing management plans, applied research, inventories, monitoring and public outreach.

-GF-

2007 sage-grouse hunting season proposal:

The WGF recommends the 2007 sage-grouse hunting season be September 20 – October 10 with a 2 bird daily bag limit (4 in possession) in most of the state. This recommendation results in 20-day season rather than the 11-day season offered in 2006. The bag limit is not recommended for change. The WGF also recommends closing the Hat Six and adjacent areas near Casper, Douglas and Lusk. This closure will add to those lands previously closed in southeast and northwest Wyoming.

Abbreviated rationale:

Sage-grouse populations have declined in Wyoming and across the West over the last half-century. Over the last decade however, the average size of leks has increased in Wyoming reflecting a generally increasing population. The same is true for the most recent three-year period. Thus, there have been long-term declines but mid- and short-term increases in sage-grouse populations in Wyoming.

These trends are valid at the statewide scale. Trends are more varied at the local scale. Sub-populations more heavily influenced by anthropogenic impacts (sub-divisions, intensive energy development, large-scale conversion of habitat from sagebrush to grassland or agriculture, Interstate highways, etc.) have experienced declining populations or extirpation.

Sage-grouse are a relatively long-lived species where survival outweighs reproductive output. This strategy is contrary to most upland and small game species long life and survival are sacrificed for high reproductive output. Sage-grouse demonstrate high over-winter survival which limits the applicability of the concept of compensatory mortality. Therefore, the biology of sage-grouse suggests conservative harvest management practices be implemented relative to species such as pheasants or partridges.

Sage-grouse management guidelines and Wyoming's state and local conservation planning efforts have recommended management practices that recognize these concepts. The WGF supports these guidelines and recommendations as reflected in the hunting season proposals.

The Wyoming Greater Sage-Grouse Conservation Plan (2003) was prepared by a citizen group that included representatives of the oil and gas industry. The plan's top three recommended management practices (RMPs) for hunting are:

1) In stable to increasing populations (based on lek count information) maintain a 2 to 4 week hunting season with a 3-bird bag limit beginning no earlier than September 15.
2) If populations are declining (for 3 or more consecutive years based on lek count information) implement more conservative regulations that might include: reduced bag limits, adjusted season dates, limited quota seasons or closed seasons.

3) Populations should not be hunted where less that 300 birds comprise the breeding populations. (i.e. less than 100 males are counted on leks)

The 2007 proposal is well within these recommendations and could in fact be justifiably criticized for not proposing a 3-bird daily bag. Continuing with the 2-bird bag in 2007 was based on the anticipated effects that deepening drought might have on chick production.

The recommendation to close the Hat Six and adjacent areas near Casper, Douglas and Lusk is a direct implementation of the State Plan's hunting RMP #3 that calls for not hunting sub-populations that do not exceed 300 birds (100 males counted on leks).

Based on recent research results (Holloran 2005, Naugle 2006) we could justify recommending more conservative hunting seasons in northeast Wyoming than the other open areas in the state. However, because hunter access is highly restricted in northeast Wyoming due to the lack of public lands, harvest in that area is minimal – a de facto more conservative hunting season that does not require additional regulation at this time. As development expands in Pinedale and Rawlins it is entirely likely hunting seasons will need to be made more conservative in those areas at some point in the future. Such regulation will not become necessary if the stipulations/mitigation/conservation plans/etc. succeed.

Other sage-grouse hunting issues:

- The U.S. Fish & Wildlife Service has stated that the Wyoming hunting season is not an issue from an Endangered Species Act standpoint. Recent comments from the USFWS (2007) on the Bates Hole – Shirley Basin Sage-grouse Conservation Plan did not include any criticism of the hunting practices recommended in that plan (which are consistent with the State Plan). The USFWS 12-month finding on sage-grouse (2005) states their expert panel "did not identify hunting as a primary threat factor for the greater sage-grouse." This panel ranked hunting 17 out of 19 threats considered. Most Wyoming local sage-grouse working groups have similarly ranked this issue. These rankings apply to current management strategies. Unregulated/market hunting undoubtedly contributed to sage-grouse declines at the turn of the 20th century.

EOG RESOURCES, INC.

MOXA ARCH DEIS COMMENTS

ATTACHMENTS D, E, AND F

Attachment

D

Taylor/Hayden-Wing Study

GREATER SAGE-GROUSE POPULATIONS AND ENERGY DEVELOPMENT IN WYOMING

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SYNOPSIS

Understanding how energy development affects greater sage-grouse populations is a management priority in Wyoming. There is broad interest in determining whether viable sage grouse populations and energy development can coexist and, if so, under what specific conditions. Some biologists have contended that oil and gas development at a density of more than one well per square mile will cause the extirpation of local sage-grouse populations, and that the standard protective stipulations applied by the Bureau of Land Management (BLM) on energy development activities are insufficient for maintaining viable populations in development areas. This has prompted State and Federal land and wildlife management agencies to apply significantly more stringent restrictions on energy development activities in sage-grouse habitat. We examined sage-grouse populations in several oil and gas fields in Wyoming to characterize population trends and to better understand the specific development scenarios under which impacts to sage-grouse populations are observed. We used publicly available databases from the Wyoming Game and Fish Department (WGFD) and the Wyoming Oil and Gas Conservation Commission (WOGCC).

We analyzed six oil and gas development areas with various degrees and ages of activity to determine population trends relative to the timing and intensity of oil and gas development in those areas. We compared these trends to trends in an area in which oil and gas activity is minimal and to trends state-wide.

The results show that: 1) sage-grouse population trends are consistent among populations regardless of the scope or age of the energy development field, and that population trends in the six development areas mirror trends state-wide; 2) application of the BLM standard sage-grouse stipulations appears to be effective in reducing the impact of oil and gas development on male-lek attendance; 3) male-lek attendance in areas that are not impacted by oil and gas development is generally better than in areas that are impacted (see below for definitions of impacted versus non-impacted leks); 4) displacement from impacted leks to non-impacted leks may be occurring; research is needed to assess displacement and its implications for developing conservation strategies; 5) lek abandonment was most often associated with two conditions including high density well development at forty acre spacing (sixteen wells per square mile) and, regardless of well spacing, when development activity occurred within the quarter mile lek buffer; 6) extirpation of sage-grouse populations has not occurred in any of the study areas; and 7) like many wildlife populations, long-term fluctuations in sage-grouse population trends in Wyoming likely reflect long-term processes such as precipitation regimes rather than energy development activity; however, energy development can exacerbate fluctuations in sage-grouse population trends over the short-term.

BACKGROUND

Energy development can negatively impact greater sage-grouse populations through direct loss of habitat, habitat fragmentation due to road and pipeline construction, overhead electric lines, noise interference with courtship behaviors and brood rearing, and support of predator populations through augmentation of food sources and perch sites. (Doherty et al. 20XX, Lyon

2000, Holloran 2005, Kaiser 2006, Walker et al. 20XX). In Wyoming there is broad interest in maintaining viable sage-grouse populations while assuring productive oil and gas fields. Some research has suggested that extirpation of sage-grouse populations is imminent in areas affected by oil and gas development, and that BLM stipulations are ineffective in conserving populations (Aldridge 2005, Doherty et al. 20XX, Holloran and Anderson 2006, Walker et al. 20XX).

Clearly, no wildlife population can persist if habitat is altered to an extent that exceeds the capacity of individuals to adapt. But critical questions remain about whether viable sage-grouse populations and energy development can coexist and, if so, at what thresholds would development exceed the capacity for population persistence. Further, the assertion that BLM stipulations have limited conservation value is premised on the notion that any impact to sage-grouse is evidence that the stipulations are ineffective.

The Council for Environmental Quality (CEQ) regulations (2007) state there are various expectations of applied mitigation measures; these are avoidance of impact and reduction of impact. The Bureau of Land Management spatial and temporal stipulations for greater sage-grouse are intended to reduce the impact of the activity, not to eliminate impacts altogether; this clarification is found in the CEQ National Environmental Policy Act (NEPA) regulations at 40 CFR 1508.20,mitigation may include one or more of the following:

> *(b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.."*

The objective of this report is to characterize sage-grouse population trends in Wyoming qualitatively in an effort to advance our understanding of whether there may be conditions of development under which the coexistence of viable sage-grouse populations and productive oil and gas fields would be feasible.

METHODS

DATABASES – We used publicly available databases in the analysis. Sage-grouse observation and location data were from the Wyoming Game and Fish Department (WGFD 2006), and spatial and temporal information on oil and gas development was from the Wyoming Oil and Gas Conservation Commission database (WOGCC 2006).

After assessing the WGFD and WOGCC data we developed criteria for including leks or wells in the analysis that were intended to facilitate reliable interpretation of the results:

- in many cases leks appear in the WGFD database even though there are no records of sage-grouse having been observed on them; we included only those leks at which sage-grouse have been observed
- among leks at which sage-grouse have been observed, we retained for the analysis only those for which sage-grouse were observed during the period 1980 to 2006.
- we considered cells in the WGFD database containing the number zero to represent a lek count that was conducted but for which no male was observed. This is a highly conservative measure; it is known that zeros in the database may also indicate that the lek count did not occur (i.e., zero was used as a placeholder; T. Christensen, WGFD, 2006, pers. com).
- we limited inclusion of wells in the analysis to those actually drilled through 2006; we excluded those with pending or expired permits.

LEK DEFINITIONS - We classified leks into five types and made qualitative comparisons among them. The metric used in the comparisons was the WGFD "average peak males in attendance".

- *Impacted leks* are those with more than 10 wells drilled within a two mile radius (slightly less than 1 well per square mile). Ten wells within the two mile radius corresponds with the condition identified by Holloran (2005) and Doherty et al. (20XX) as the maximum level of development that would allow the continued occupation of the area by sage-grouse,
- *Non-impacted leks* are those leks with 10 or fewer wells drilled within the two mile radius (i.e. those identified by previous authors as outside of development)
- *Field leks* are the combination of impacted and non-impacted leks in each study area,
- *Area leks* are all leks within the Game and Fish management area(s) surrounding and including the study area, and
- *State leks* are all leks known within the State of Wyoming and represent the statewide population.

In addition to examining individual leks, we examined impacted and non-impacted lek complexes in each study area. We used total males observed as the metric in this analysis. Population trends using average males or total males followed similar patterns. Lek complex definitions generally follow the WGFD nomenclature.

STUDY AREAS – We selected study areas that were representative of the variation that characterizes energy development in Wyoming. These areas differed in terms of the longevity of development, density and intensity of development, and production type (e.g., oil, gas or coal bed natural gas). Six development areas and a "control" area were selected (Figure 1):

- *Powder River Basin (PRB)*: Coalbed natural gas (CBNG) is in development and production stages throughout a large geographic area.
- *West of Casper:* This area includes a wide variety of field development areas.
- *Sagehen Creek:* This is the study "control" area; few oil wells (~60) have been drilled in the area making it a reasonable site for comparisons.
- *Wamsutter:* Initial development in the area began circa 1946 with renewed interest in the late 1970's.
- *Moxa Arch:* Development of the Moxa Arch natural gas field also began circa 1946 with renewed interest beginning around 1980.
- *Pinedale Anticline Participating Area (PAPA):* This area has been the focus of significant interest since development was renewed in 1998.
- *Bison Basin:* This is an old oil field area located northwest Wyoming.

VEGETATION BASE MAPS – We used the BLM sagebrush habitat map (BLM 2006) to characterize vegetation types in each study area except for PRB. In PRB, we used the Wyoming GAP analysis vegetation map (WY GAP 2006), given the extent of private land in PRB and the consequent lack of ground truthing in this area, the GAP data probably were more accurate than the BLM data.

LEK MAP SYMBOLS – We based lek map symbols on male attendance during the period 2004 through 2006. We used this three year period to reflect efforts by WGFD to survey each lek at least once every three years. The lek characteristics are illustrated on the maps as follows:

- The lek center is indicated by a ¼ mile radius circle illustrating the BLM lek buffer (breeding habitat) avoidance requirement.
- The size of the colored dot within the lek center indicates the relative size of the lek in terms of the peak male-lek attendance.
- A green dot in the lek center indicates that no sage-grouse was observed on the lek.
- An open circle in the lek center indicates that no count or survey was conducted.

Figure 1 - Statewide over view map of study areas

A 2-mile radius circle around the lek center represents the area of greatest concern for the protection of nesting and early brood rearing habitats as managed by the BLM through the use of seasonal (temporal) timing restrictions on surface disturbing activities.

WELL SYMBOLS - Well symbols are as follows:

- Black dots represent active wells,
- Grey dots represent plugged and abandoned wells,
- Well symbols in PRB are different; red dots indicate wells drilled on the federal mineral estate and blue dots indicate wells on state or private minerals (non-federal).

DATA SUITE COMPARISONS – We conducted the following qualitative analyses for each study area:

1. We determined average peak male lek attendance for each year using only those leks counted in that year; therefore, the sample size changed annually.
2. We made comparisons of average male-lek attendance among the following lek classifications: impacted, non-impacted, the defined study area, the affected WGFD management areas, and the State.
3. We did not make comparisons among study areas (i.e. PRB impacted leks are not compared to PAPA impacted leks) because each area differs in vegetation, topography, and

precipitation regimes, as well as in the density of residential housing. Livestock grazing, recreation, and hunting are generally consistent in all areas.

4. We also provide observations on the impact of the density of well development within the two mile radius of a lek.
5. In addition to evaluating individual leks, we examined impacted and non-impacted lek complexes to better understand the threshold at which development appears to negatively impact leks or lek complexes.

RESULTS AND DISCUSSION

POWDER RIVER BASIN (PRB)

Coal bed natural gas (CBNG) development in the PRB began in the early 1990's with significant development starting in 1997. Currently, CBNG is in the production stage in the eastern and central portions of the Basin with development occurring in the western portion. The CBNG activity occurs throughout a large geographic area; the largest coal producing basin in the United States. Early in the development of the PRB portions of the east side of the basin were drilled on 40-acre spacing (16 wells per square mile); subsequently, the majority of the basin has been drilled on 80-acre spacing, or 8 wells per square mile. By the end of 2006 there were approximately 25,000 wells drilled and producing gas. The size of the geologic structure and the intensity of activity make this a unique development area. Our analysis of the PRB included 195 impacted and 94 non-impacted leks; there are 493 leks in the northeast Wyoming management area. The study area is illustrated in Figure 2 .

The PRB, unlike most of the state of Wyoming and the other study areas included in this paper, is comprised primarily of private land (86%) underlain by federal minerals (63%). This land and mineral ownership pattern (commonly referred to as "split estate") leads to the inconsistent application of the standard BLM protective stipulations for greater sage-grouse. Early in the development of the PRB CBNG field, BLM underwent an extended period of field development planning, as required by NEPA. This long period of analysis prohibited development on federal minerals which resulted in the disproportional development of private and State of Wyoming owned minerals where wildlife protection stipulations are not applied. This early drilling activity was performed primarily on 40-acre spacing and occurred on the eastern edge of the Basin. Figure 2 also illustrates clearly that leks imbedded in CBNG development areas continue to be active even after upwards of ten years of gas development activity in the PRB.

As seen in Figure 3, declines in average male-lek attendance occurred in the PRB from 1989 to 1995 and from 2000 to 2002. These population declines are also observed range-wide (Figure 4; Connelly et al. 2004). It appears that the population in the PRB has not recovered fully from the population crash of 1989 to 1995 but that population growth, as indicated by male lek attendance, is occurring.

Figure 2: Powder River Basin study area

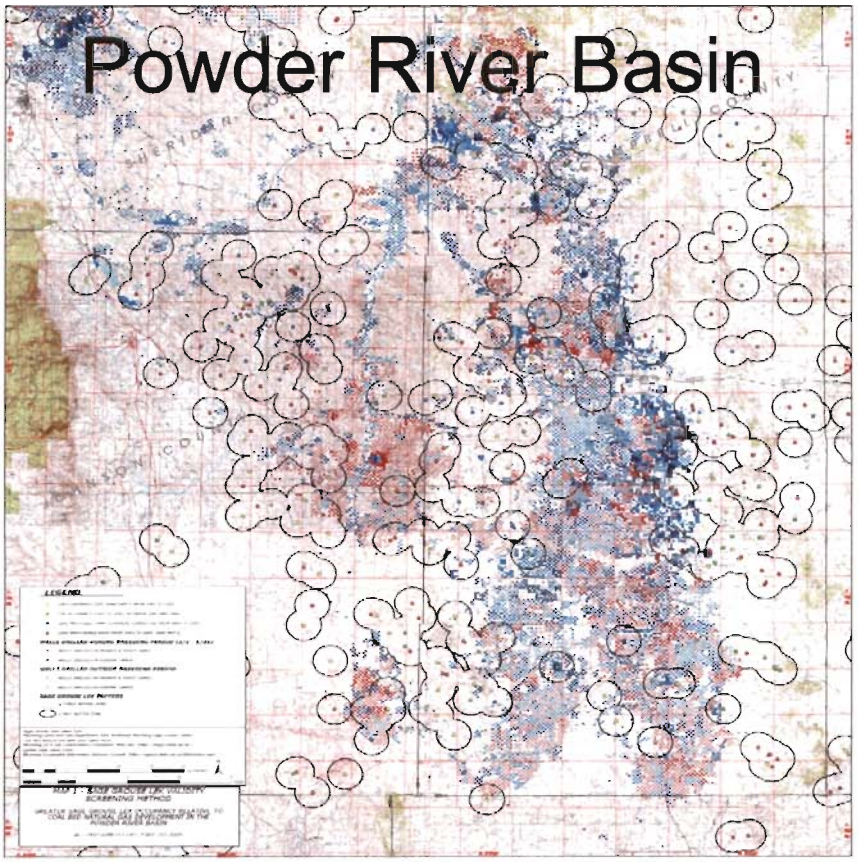


Figure 3: Average male-lek attendance in the PRB 1980 to 2006

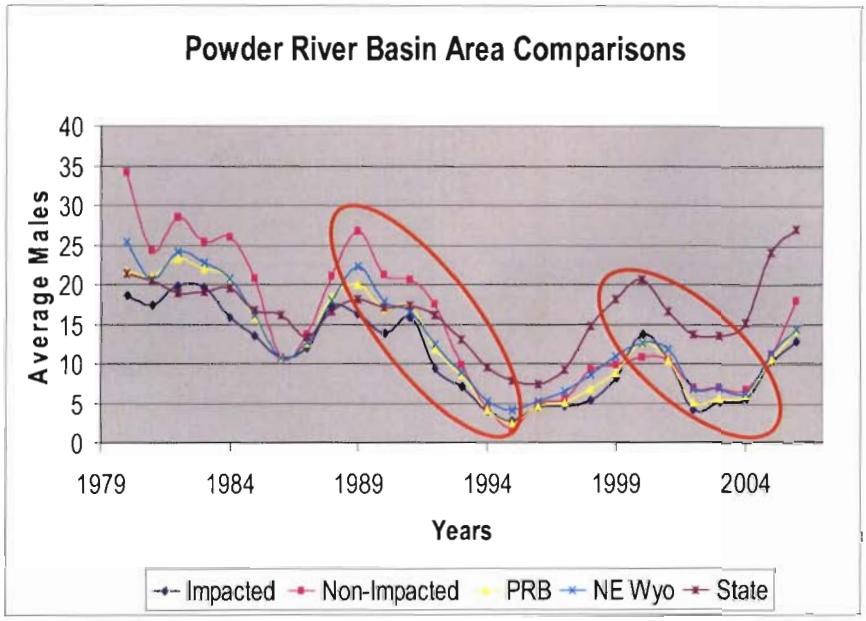


Figure 4: Connelly et al. 2004 Range-wide change in population index

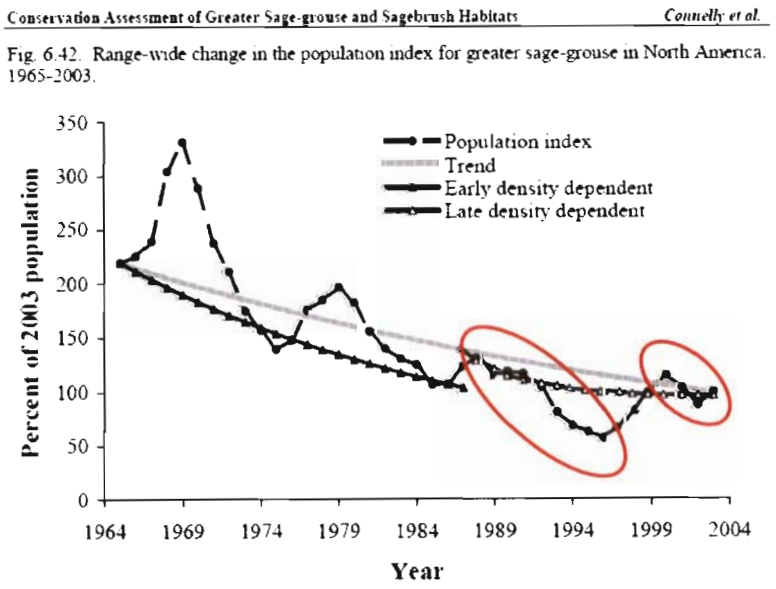


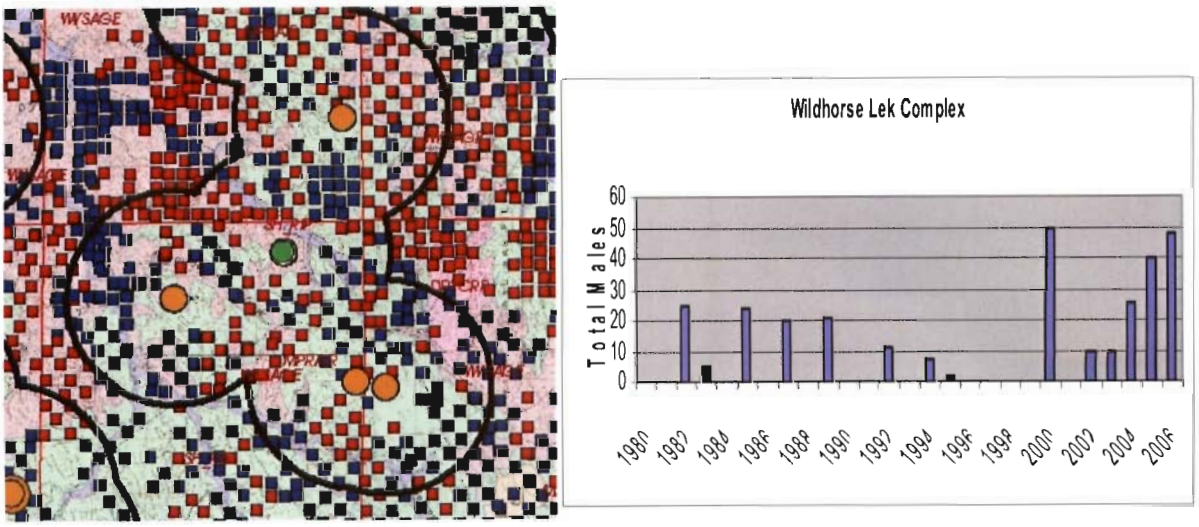
Figure 3 shows that impacted leks continue to be attended by male grouse in the PRB. The differential between impacted and non-impacted in male lek attendance is slightly larger in 2006 (1.9 males) than was evident before CBNG development began in 1997 (0.6 males), however both groups of leks continue to follow the same growth trends as seen for the state wide population.

For purposes of the analysis, determining the response of greater sage-grouse to energy development in the PRB, we investigated the status of the 89 leks in the WGFD data base currently identified as inactive. Sixty six of these leks became inactive during the 1989-1995 decline; that is, before significant CBNG development began in 1997. Twenty three of the 89 currently inactive leks in the PRB became inactive after the 1989-1995 decline; these leks might shed light on impacts of energy development. Of these 23 leks, 5 were eliminated by surface coal mining activity, 13 were impacted by CBNG development and 5 had no readily discernible impacting agent. Of the 13 leks impacted by CBNG, 9 were developed on 40-acre spacing, with as many as 200 wells drilled within the two mile standard stipulation radius, in addition to development activity within the BLM ¼ mile radius lek buffer. It is likely due to the private and state mineral ownership that the protective stipulations were not applied. It appears that this level of habitat modification from energy development exceeded the tolerance of sage-grouse and may have caused lek abandonment. In contrast, lek attendance in PRB was maintained, albeit at reduced numbers, under conditions in which wells were drilled on 80-acre spacing, 100 or fewer wells were drilled within the 2 mile radius, and development activity did not occur within ¼ mile of the lek.

We examined six lek complexes in a variety of development scenarios in the PRB CBNG field to better understand the impacts of 40- vs. 80-acre spacing; these complexes are discussed below.

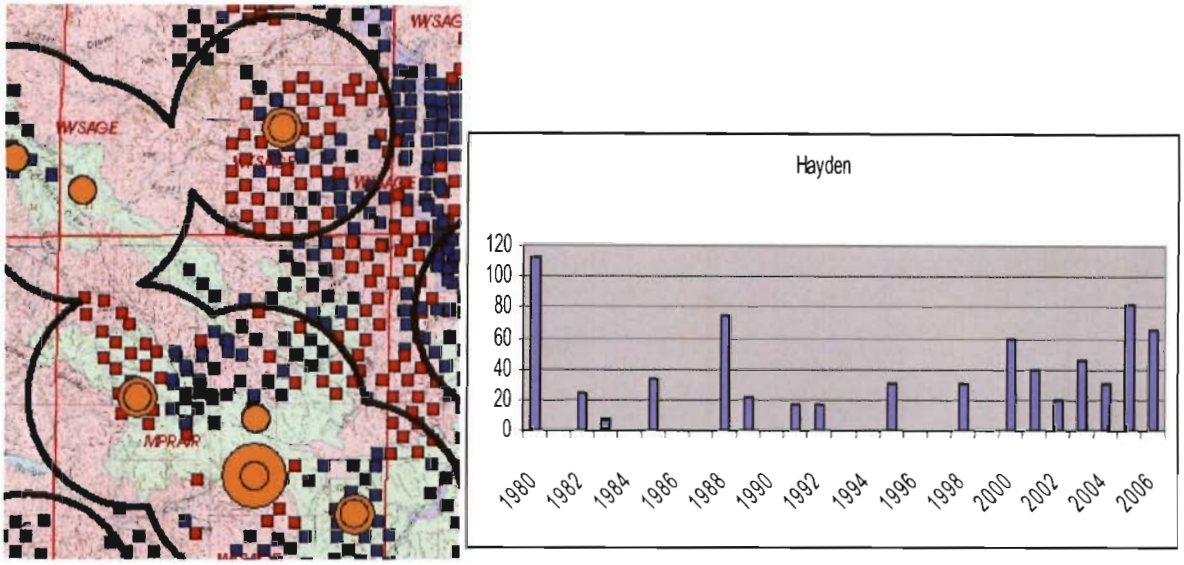
WILDHORSE COMPLEX - Since the year 2000, over 700 wells have been drilled on 40- and 80-acre spacing in the area surrounding the Wildhorse complex (Figure 5). As can be seen in the accompanying graph, the complex leks continue to be attended each spring, with the numbers of males observed increasing since 2002. Over 100 wells have been drilled within the two mile radius of each of the leks in the complex but the leks continue to be active.

Figure 5: Wildhorse complex



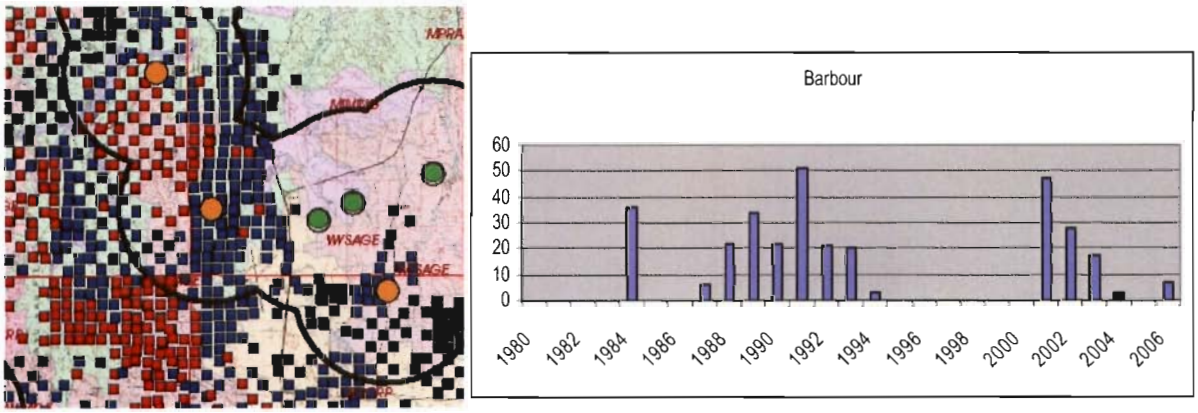
HAYDEN COMPLEX - The Hayden complex (Figure 6) lies west of the Wildhorse complex and is surrounded by CBNG development drilled primarily on 80-acre spacing. Development and production in this area has been ongoing since 1999 with over 200 wells drilled in the township. Again, the complex leks are active and male attendance has increased since 2002.

Figure 6: Hayden complex detail



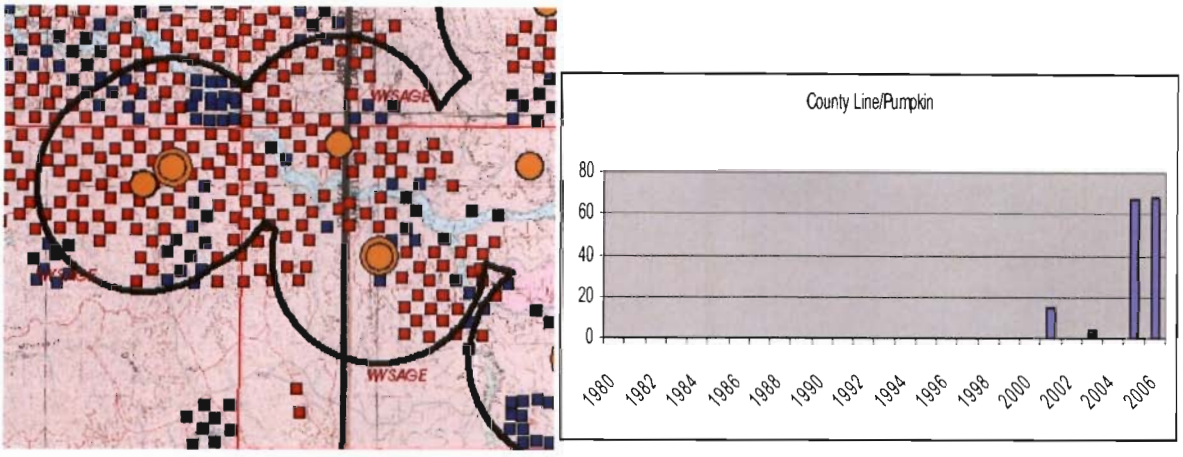
BARBOUR COMPLEX - The Barbour complex (Figure 7) is located on the eastern edge of the CBNG area of the PRB. This area was drilled primarily on 40-acre spacing beginning in 1999. Almost 600 wells have been drilled and are producing gas in the township surrounding this complex. The abandoned leks (green dots) to the east were destroyed by surface coal mining activity. The leks within the CBNG development areas continue to attract males but at very low numbers.

Figure 7: Barbour complex detail



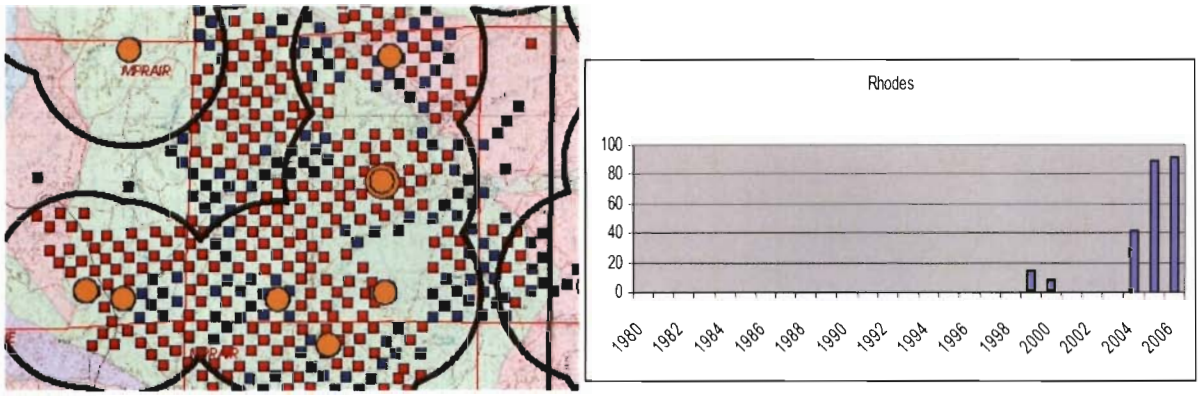
COUNTY LINE/PUMPKIN COMPLEX - The County Line/Pumpkin complex (Figure 8) is located in the south-central portion of the PRB. This area has been producing since 2004 although some initial exploratory work occurred as early as 2000. Approximately 240 wells have been drilled in the two townships surrounding this complex. Data are limited for this area because these leks were generally unknown before development began. Male attendance is currently robust.

Figure 8: County Line/Pumpkin complex detail



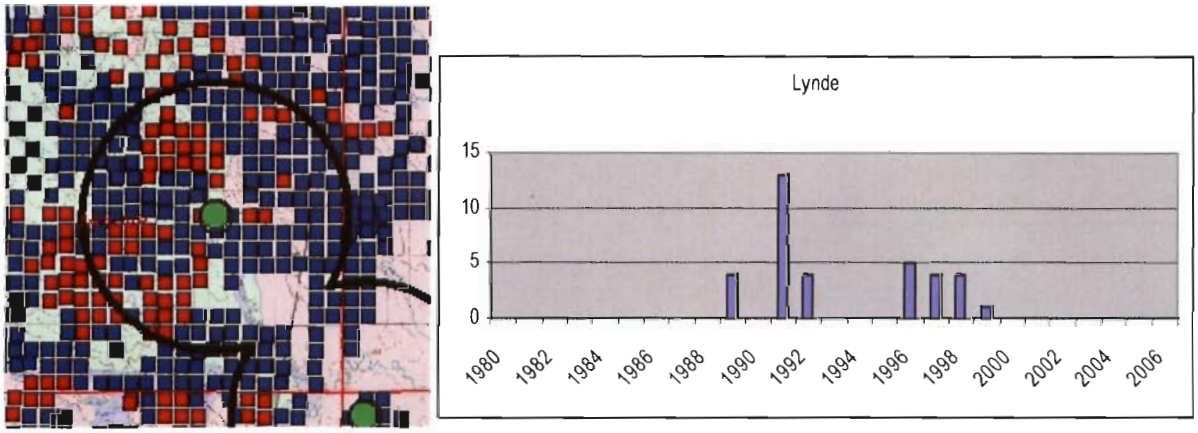
RHODES COMPLEX - The Rhodes complex (Figure 9) is located in what is currently the southwestern edge of CBNG development in the PRB. The complex is surrounded by approximately 300 CBNG wells drilled since 2004. In 1999 one lek in the area was surveyed; in 2006 seven leks were counted. In the three years since development began male attendance has increased. An important consideration is whether this increase simply reflects increased survey effort. Alternatively the increase could reflect improving habitat conditions from increased precipitation in the area over the same period of time.

Figure 9: Rhodes complex detail



LYNDE LEK - The Lynde lek (Figure10) is located on the eastern edge of the CBNG field in the PRB. CBNG development in the PRB began in this area in 1997 with approximately 480 wells drilled in the township surrounding the lek. This area was drilled on 40 acre spacing, averaging 13 wells per square mile. Wells in this portion of the field are now being plugged and abandoned with many more abandonments planned as the gas resource in this area is depleted. The Lynde lek became inactive in 2000; three years after intensive, high density development began.

Figure 10: Lynde lek detail



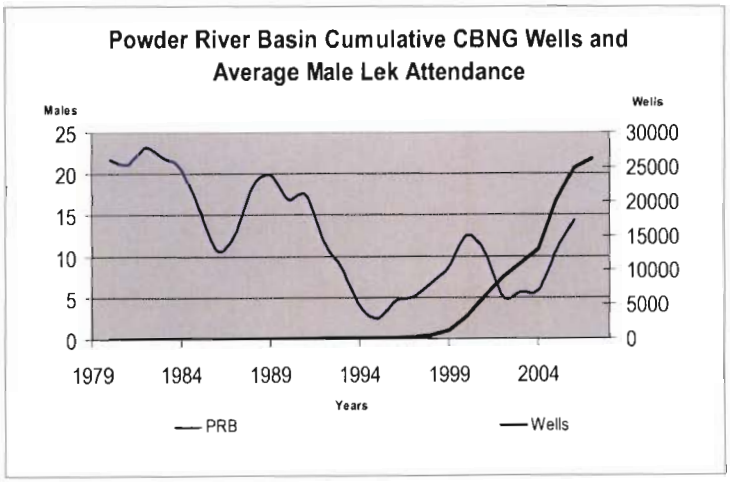
SUMMARY OF PRB FINDINGS - The Hayden and Wildhorse complexes demonstrate the continuation of male-lek attendance in areas of 80-acre spacing even after seven to eight years of development and gas production activity. The Lynde lek and Barbour complex analyses demonstrate that leks become inactive when surrounded by hundreds of wells drilled on 40-acre spacing. After three to four years of 80-acre development activity, the Rhodes and County Line/Pumpkin lek complexes show continuing growth of male attendance as opposed to the declines demonstrated by the leks impacted by 40-acre development. These findings suggest that lek abandonment is related to intensive development on 40-acre spacing whereas "buffered" leks surrounded by 80 acre development continue to be attended by males. Data from the Wildhorse and Hayden lek complexes show that 80-acre well spacing has not caused reduced male lek attendance over time and suggest that well spacing in an important component of development scenarios that could be managed to facilitate persistence of leks and local populations. Overall, trends in the PRB population call into question any assertion that lek abandonment and local extirpation are imminent consequences of energy development, and suggest that the relationship between development and population persistence is more complex than previous research has indicated.

Figures 3, 4 and 11 illustrate the following:

- The population decline of 1989 to 1995 occurred before the onset of CBNG development rendering any conclusion that this decline was a direct consequence of CBNG unsupported.
- Population declines from 2000 to 2002 are consistent with those seen state and range wide.
- The sage-grouse population in the PRB exhibits an increasing trend that is consistent with trends statewide

The PRB represents an important population in terms of sage-grouse conservation range-wide. However, this population accounts for less than 10% of sage-grouse in the state of Wyoming. Given differences in habitat and development conditions throughout the state, any contention that a single population such as PRB has a disproportionate influence on population trends state- or range-wide would be unsupported. Recent data (Thiele 2007) show that average male lek attendance in Northeast Wyoming was 18.8 males or 0.5 males per lek lower than the 2006 average. Of 517 leks surveyed, 38 or 7% were found to be inactive. Twenty newly identified leks were documented in the spring of 2007.

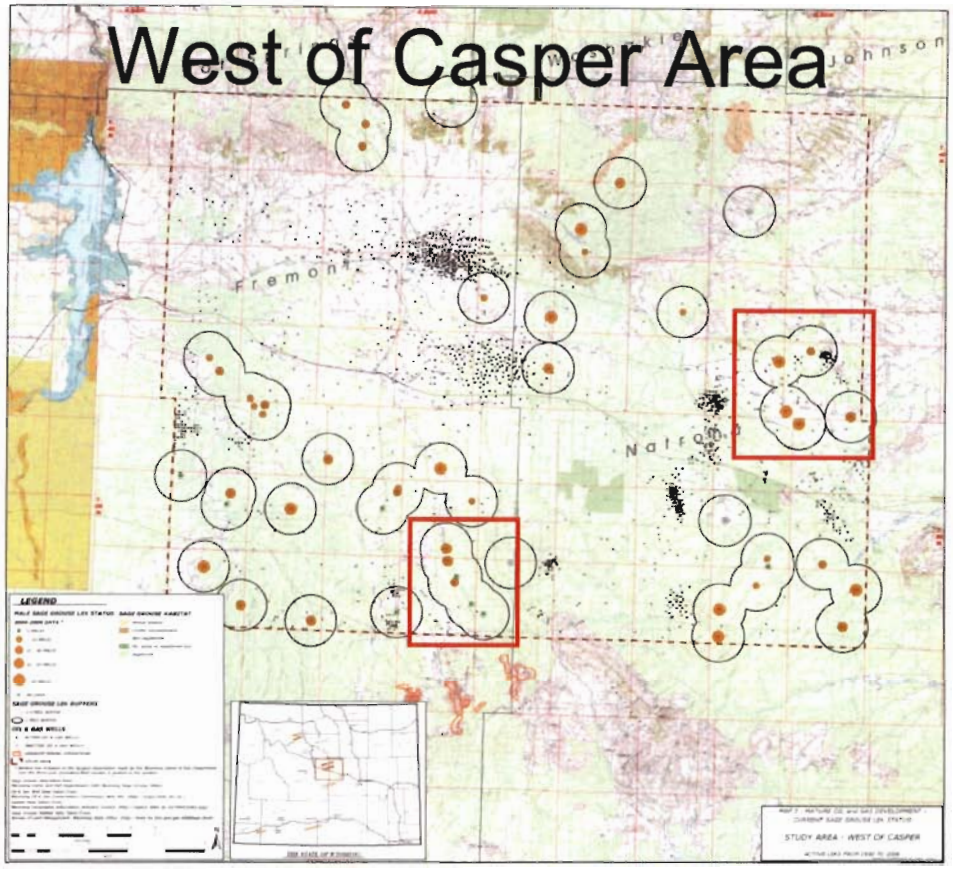
Figure 11: Average male-lek attendance contrasted with the cumulative number of CBNG wells drilled in the PRB



WEST OF CASPER

As illustrated in Figure 12, the area west of the City of Casper includes a number of field development areas, all relatively small in size, the largest encompassing a few townships. There is some gas, some oil, and fields range from almost 100 years of age to currently in development. Spacing is highly variable. The lek complexes in this analysis are indicated on the map by the red boxes. Our analysis of this area included 6 impacted and 48 non-impacted leks out of the 224 leks identified in the WGFD management area.

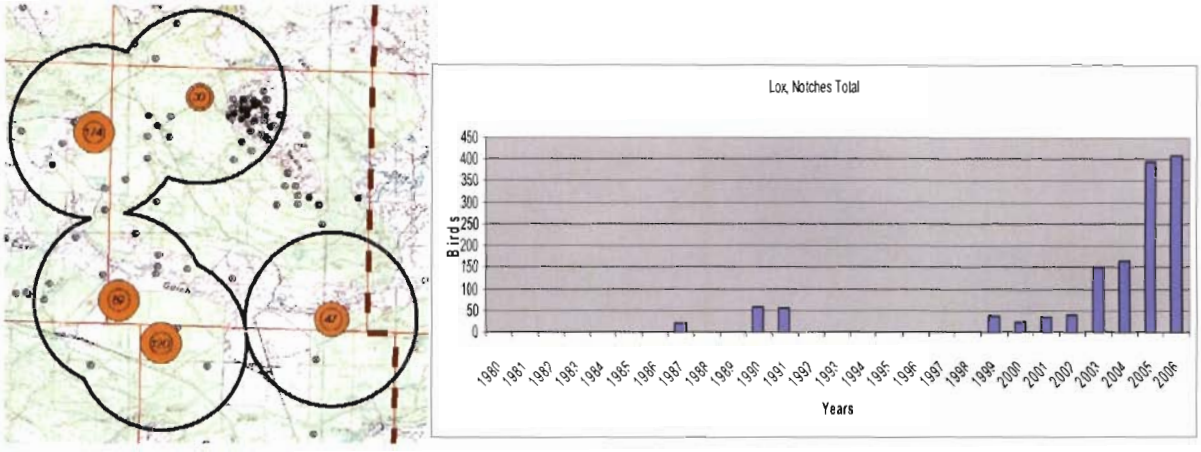
Figure 12: Leks locations and oil and gas development west of Casper



The area west of Casper is popular with sage-grouse hunters because there are many large leks (<75 males in attendance) which translates into excellent hunter success. A close evaluation of the two indicated lek complexes offers an appreciation for the population of grouse in the area.

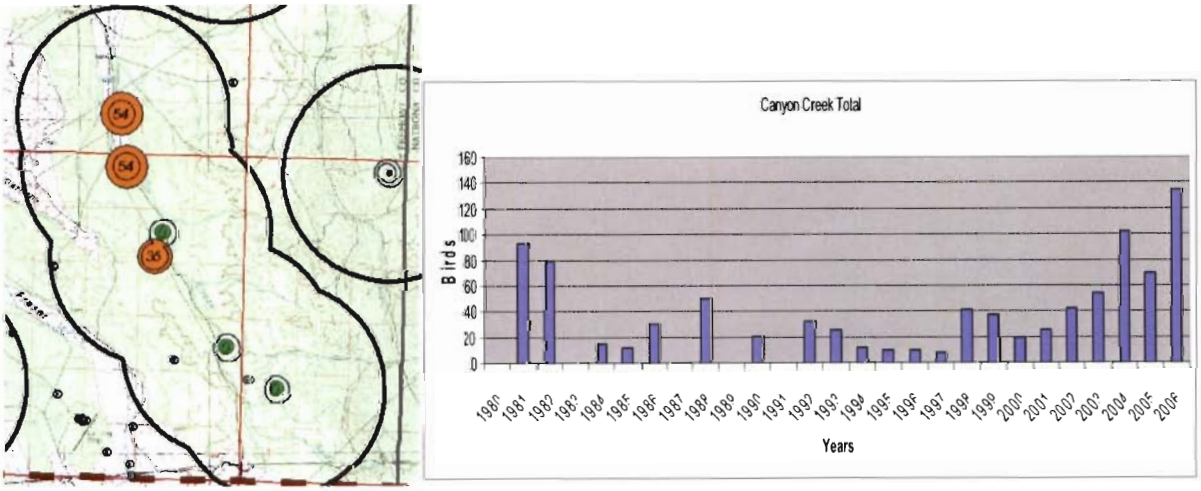
LOX NOTCHES COMPLEX - The Lox Notches complex (Figure 13) is located in the north eastern portion of the study area and is the location of the Notches oil field which has been producing oil since 1917 and pre-dates WOGCC spacing regulations. Steady growth in male-lek attendance from 1999 to current is seen.

Figure 13: Lox Notches lek complex



CANYON CREEK COMPLEX - The Canyon Creek complex (Figure 14) is located in the south central portion of the study area, the leks are scattered along a county road in eastern Fremont County and are just north of the Gas Hills uranium district. Three wells have been drilled and plugged in the area surrounded by the two-mile lek buffer of this complex. This non-impacted complex has seen a pattern of growth similar to the impacted Lox Notches complex.

Figure 14: Canyon Creek lek complex



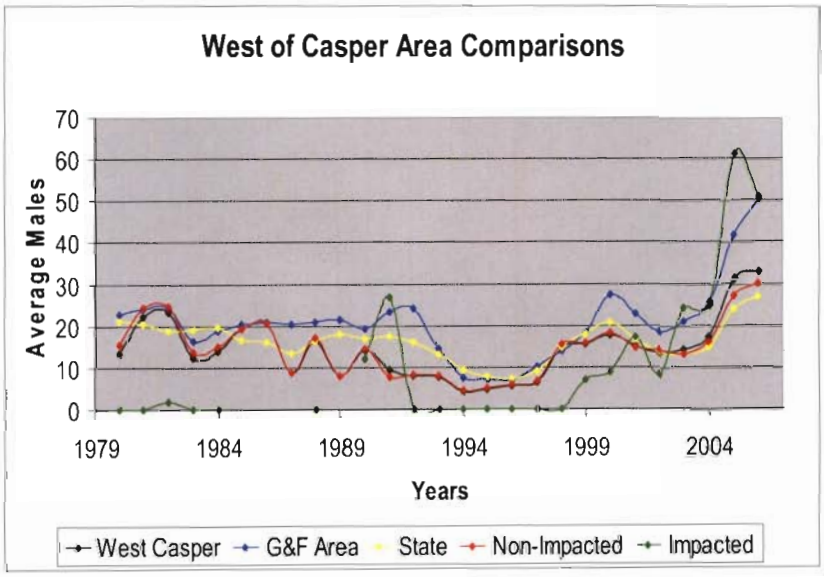
SUMMARY OF WEST OF CASPER FINDINGS - Analysis of the eight currently inactive leks in the West of Casper study area show the following:

- Seven have little or no energy development activity within the 2 mile radius,
- Seven are located immediately adjacent to county roads,
- One appears to have been drilled on or is located on a well site.
- Only one of the eight inactive leks has producing and plugged wells within the two mile radius.

The 2 leks in the study area with more than 10 wells drilled within the 2 mile radius continue to be active and show stable and increasing male-lek attendance.

Figure 15 supports these observations and illustrates that despite almost 1400 wells being drilled in the study area, male-lek attendance is increasing and impacted leks have increased the most in recent years.

Figure 15: West of Casper lek comparisons

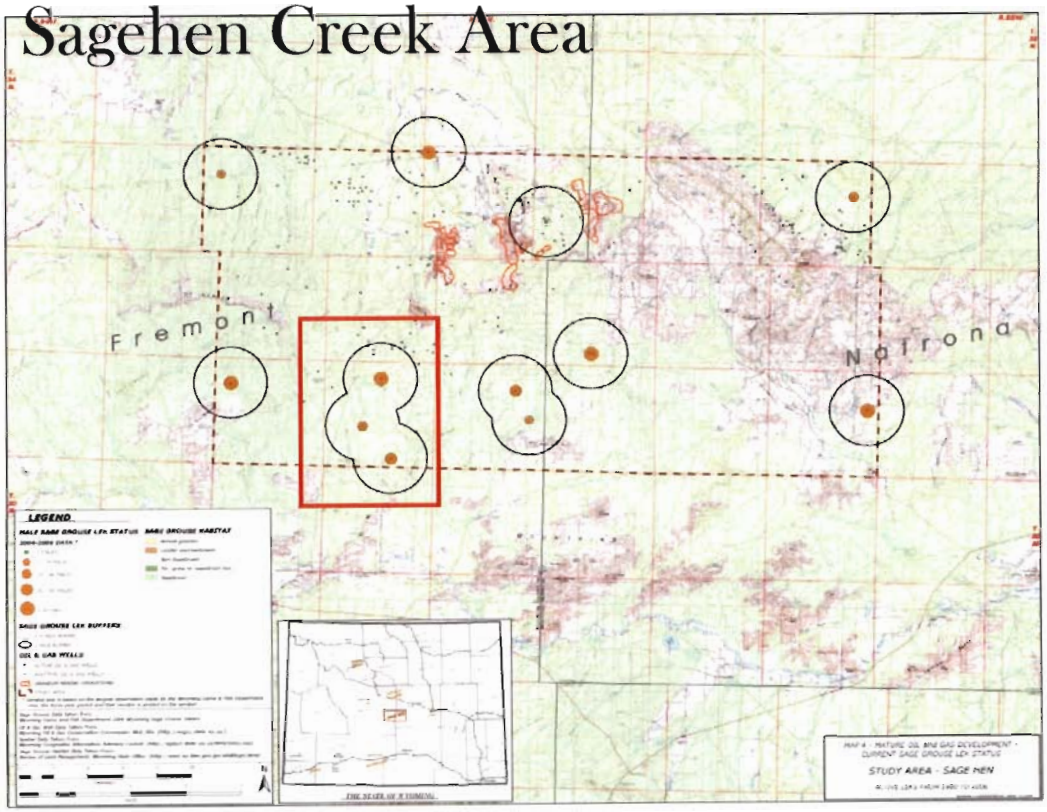


SAGEHEN CREEK

For purposes of this study Sagehen Creek represents the "control" area; few oil wells (~60) have been drilled in the area, most of which have been plugged and abandoned. As seen on Figure 16, the area has been impacted by the development of three major uranium mines (red polygons) all of which have been abandoned and reclaimed. Otherwise the area contains no towns and has extremely limited human habitation. Sagehen Creek is historically popular with sage-grouse hunters as it is known for excellent grouse productivity. Our analysis of this area included 12 leks, one of which was impacted by energy development; the WGFD management area includes 191 leks.

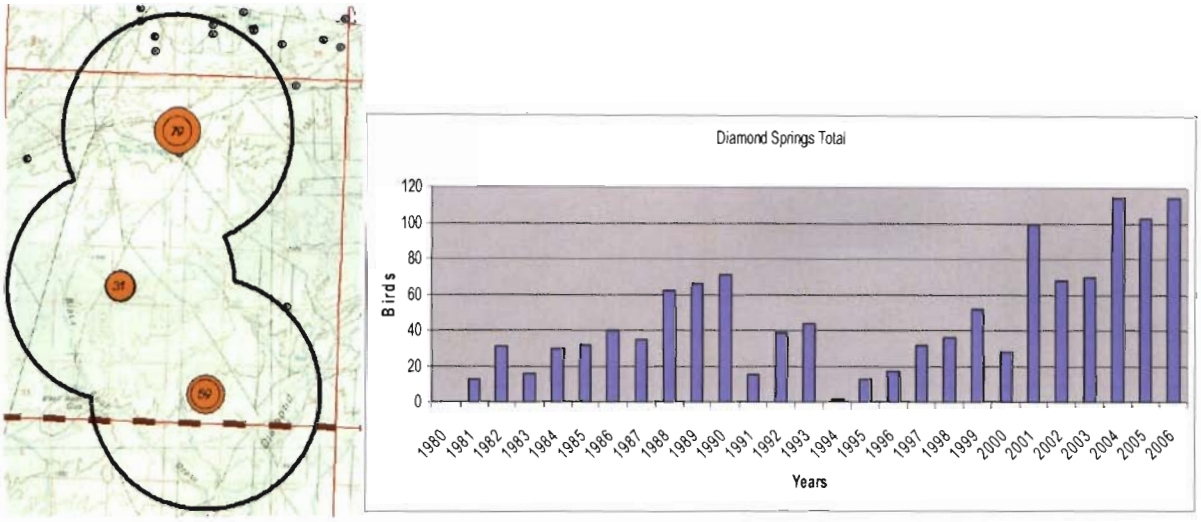
One lek in the area is currently inactive and is located between two reclaimed uranium mines. Reclamation activity in the area has been ongoing for many years and is now complete.

Figure 16: Sagehen Creek study area



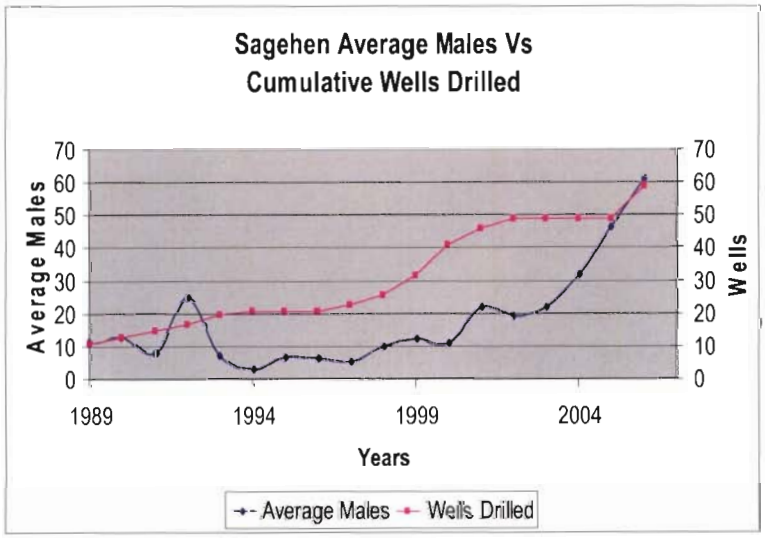
DIAMOND SPRINGS COMPLEX - The Diamond Springs lek complex (Figure 17) graph clearly illustrates the population decline of 1990 to 1994 and the growth of the population subsequent to that event, as does Figure 18 (average male-lek attendance for the entire area).

Figure 17: Diamond Springs Lek Complex



SUMMARY OF SAGEHEN CREEK FINDINGS - Figure 18 demonstrates the population of Sagehen Creek, using average male-lek attendance as a surrogate, has increased steadily since 1995. Sagehen Creek represents not only the "control" for this study but also an area perceived to represent extremely high quality sage-grouse habitat. No other area or sub-population analyzed shows such strong population growth.

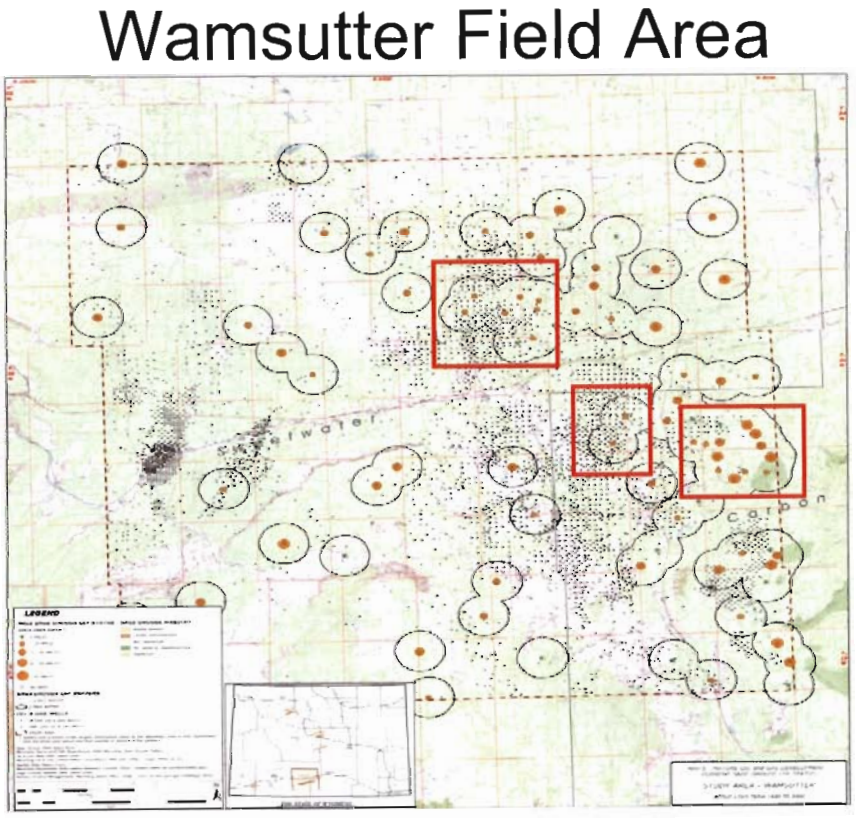
Figure 18: Sagehen Creek male-lek attendance and cumulative wells drilled



WAMSUTTER

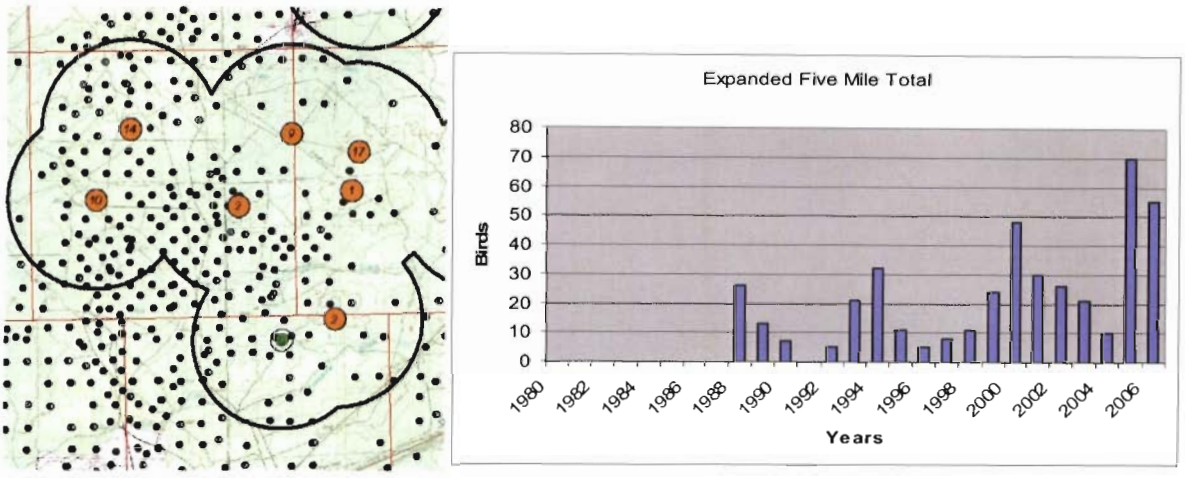
Limited development in the Wamsutter area of south-central Wyoming began in the 1940's. In the late 1970's development was re-initiated at a higher intensity. Development, gas production, and infill drilling have taken place in the area for the last thirty years. NEPA documents for the project (BLM 2000) indicate approved well spacing between 1 and 8 wells per section depending on the character of the gas reservoir being developed. The May 2000 NEPA analysis and Record of Decision completed for the Wamsutter field required the development and implementation of a sage-grouse impact mitigation plan. Additional NEPA environmental impact analysis is currently in progress, the proponent-suggested alternative proposes additional infill drilling to occur primarily from existing well pads. Figure 19 illustrates the location of the existing wells and sage-grouse leks within the study area as well as three lek complexes that are discussed in greater detail. Our analysis of the Wamsutter area included 47 impacted and 38 non-impacted leks; the WDGF management area includes 503 leks.

Figure 19: Wamsutter study area



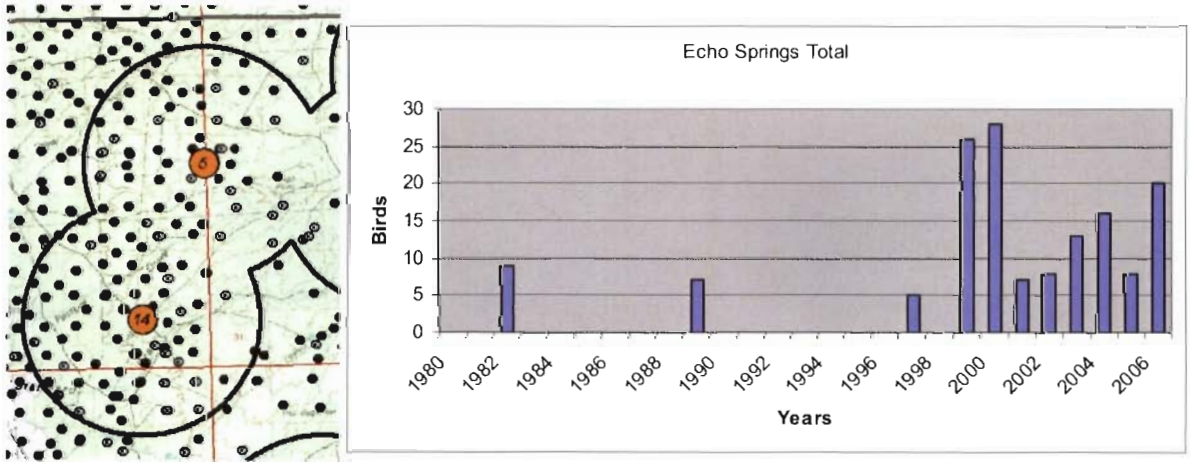
EXPANDED FIVE MILE COMPLEX - The Expanded Five Mile complex (Figure 20) represents an area of continued development and production from 1978 to 2006. Two hundred thirty one wells have been drilled in the townships surrounding the leks in the Expanded Five Mile complex. These wells were drilled on 80 acre spacing which represents 8 wells per square mile. While data on these leks are limited before 1989, they show a steady increase over time interspersed with moderate declines.

Figure 20: Expanded Five Mile complex detail



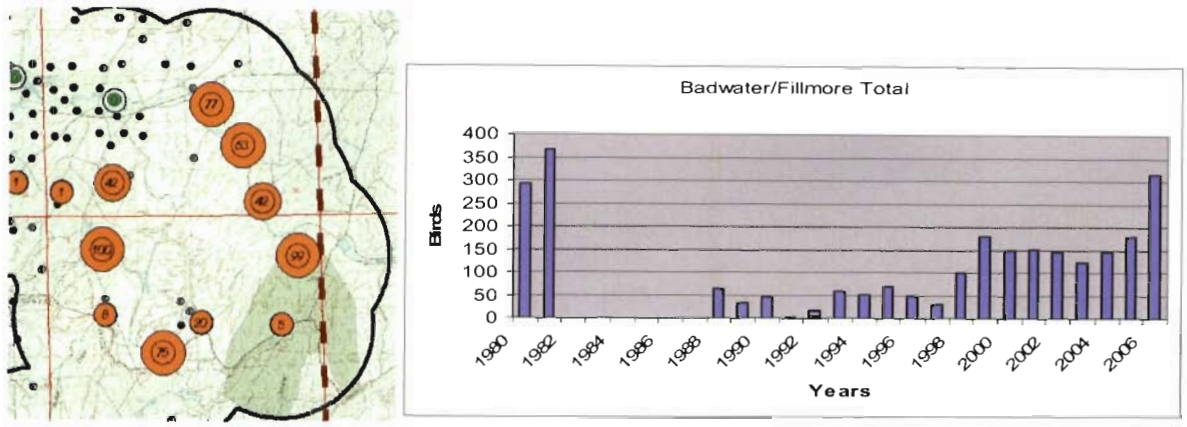
ECHO SPRINGS COMPLEX - The Echo Springs complex (Figure 21) also represents an area of continued development and production from 1978 to 2006 with 8 wells drilled per section. Approximately 250 wells have been drilled in this township since 1979 with activity continuing into 2006, some of the wells have been plugged but most are still producing gas. The graph indicates that even with the large number of wells drilled within the two mile radius of the leks within the complex the number of males in attendance shows a pattern of recent increase and long term stability.

Figure 21: Echo Springs complex detail



BADWATER/FILLMORE COMPLEX - We combined the Badwater/Fillmore complexes (Figure 22) due to the amount of overlap between the 2 mile lek radii. There are eleven leks within the two townships that encompass the complex; approximately 40 wells have been drilled within the area since late 1960's. In 1981 367 males were counted in this non-impacted lek complex while 316 were counted in 2006.

Figure 22: Badwater/Fillmore complex detail

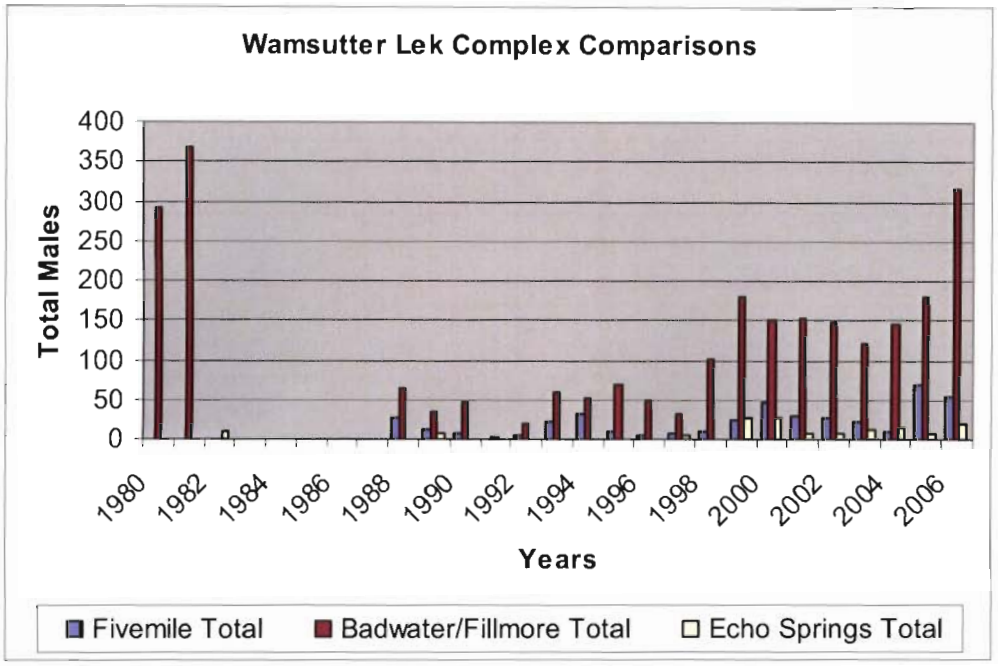


SUMMARY OF WAMSUTTER FINDINGS - Among these complexes we see similar trends of higher numbers of males in attendance in the 1980s than seen in the 1990s with an increase in males occurring again in the 2000s. The periods of decline seen in 1990, 1996 and 2002 at the Badwater/Fillmore complex are similar to those seen for the Expanded Five Mile complex. These are the same trends that are seen state-wide and may be more closely aligned with climatic influences such as precipitation than with energy development activity.

Does the Wamsutter study area map (Figure 19) suggest displacement of sage-grouse from impacted to non-impacted leks as illustrated by the size of the lek dot? Large lek indicators are generally located on the periphery of the field while smaller lek indicators are found within the field. An observation of displacement would be consistent with the findings of Kaiser (2006). In the Pinedale Anticline field Kaiser (2006) found displacement of young males from the development areas and overall low rates of mortality. While the displacement hypothesis would require research, the observable trends show long term stability with cyclical variation over time. It is not unreasonable to hypothesize that these fluctuations reflect the combined influences of several factors including development and precipitation. It is clear that after 30 years of development and production activity (10 generations of grouse), male sage-grouse continue to attend leks imbedded in the Wamsutter natural gas field. It can be assumed that males would not continue this activity if females were absent, or if suitable nesting and early brood rearing habitats were not available.

When we compare the lek complexes on the same graph (Figure 23) we see, as we do in Figure 24, the differential between impacted and non-impacted lek attendance was in place before development at Wamsutter began. The Badwater/Fillmore lek complex has traditionally had greater male attendance than either the Echo Springs or Five Mile complexes. This differential is also illustrated in Figure 25.

Figure 23: Wamsutter lek complex comparisons



In Figure 24, we included data starting in 1980 in an effort to view grouse response to activity in the early days of field development. This effort, though highly erratic before 1985, illustrates consistent trends in sage-grouse populations regardless of the influence of energy development activity. The field wide population (black line), based on average male-lek attendance, in 2006 is comparable to that seen in 1985.

Figure 24: Wamsutter area male-lek attendance comparisons

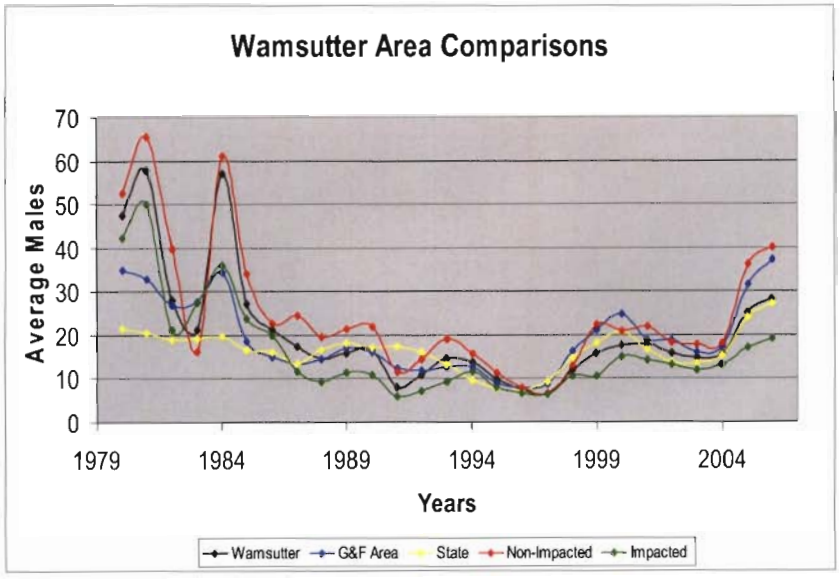
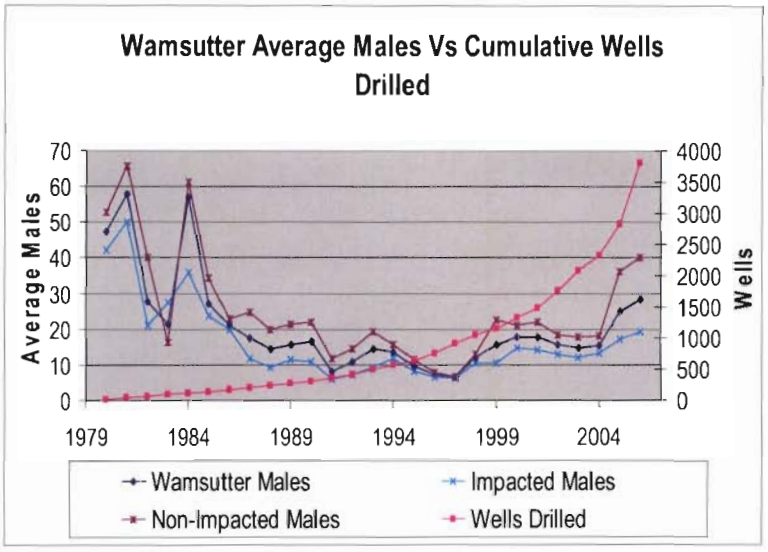


Figure 25 also shows that the suite of leks identified as impacted and non-impacted, based on 2006 well data, have had differential male-lek attendance dating back to the beginning of field development. The differential stays consistent with impacted leks having approximately 50% of the average male-lek attendance of non-impacted leks. It is this differential that raises questions about displacement and about the influences of habitat quality and lek survey protocols. Since 1980, approximately 3800 wells have been drilled in the Wamsutter natural gas field.

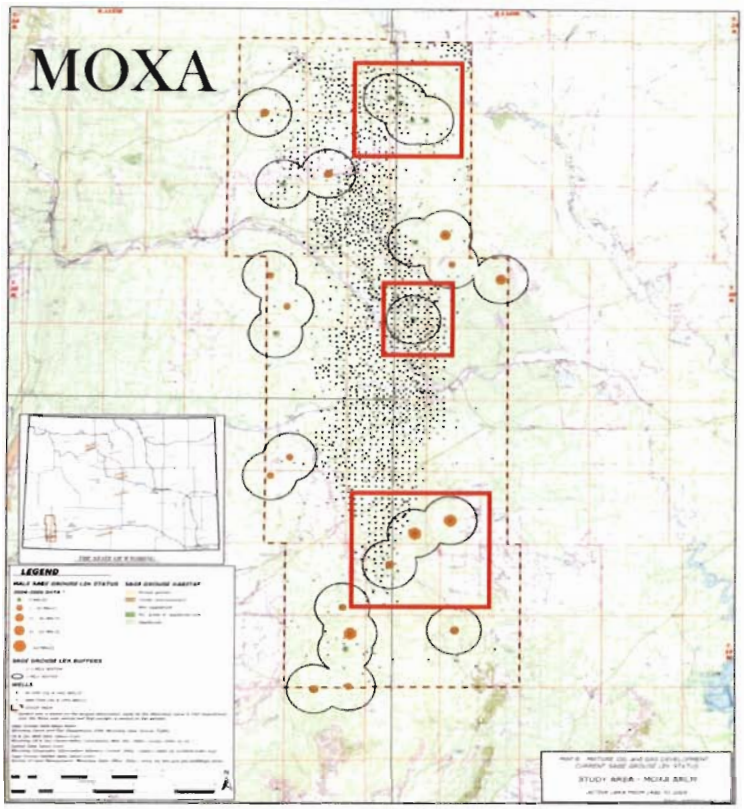
Figure 25: Wamsutter lek comparisons and wells drilled



MOXA ARCH (MOXA)

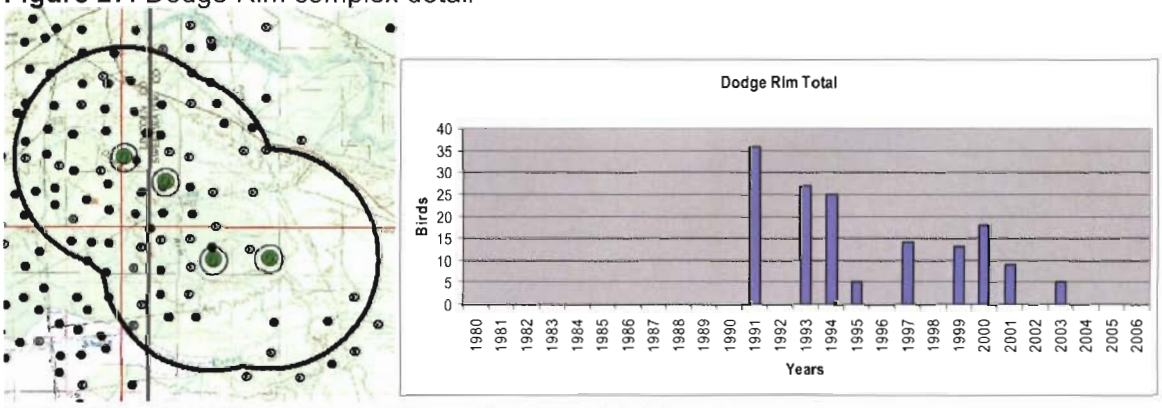
As with Wamsutter, development of the Moxa Arch natural gas field began circa 1980, Figure 26. This field was permitted at 80-acre spacing with some areas being drilled on 160's (4 wells per square mile). Development in Moxa is concentrated on a very well defined geologic structure. Infill development continues today with additional NEPA analysis currently underway. Unlike Wamsutter, Moxa did not have a large number of leks within the field development area before development. We see from Figure 26 that leks imbedded within the development area have significantly lower male-lek attendance when compared to non-impacted leks; in some cases lek abandonment has occurred. The WGFD management areas surrounding Moxa contain 241 leks; our analysis of the study area included 11 impacted and 15 non-impacted leks.

Figure 26: Moxa Arch natural gas field



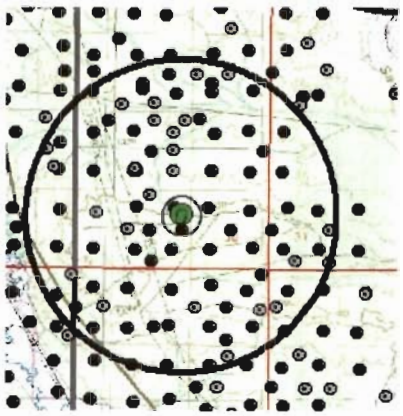
DODGE RIM COMPLEX - The Dodge Rim lek complex (Figure 27) is the northern most lek complex in the Moxa field. Approximately 250 wells have been drilled in the area surrounding this complex. Consistent lek surveys indicate the leks have become inactive since 2003. Three of the four inactive leks in the complex have wells drilled on or immediately adjacent to them. The fourth lek has a well drilled immediately outside the ¼ mile lek buffer. Information found in Holloran (2005) indicates noise and direction of the prevailing wind, in addition to road traffic are factors impacting sage-grouse lek attendance. Moreover, these findings have implications for the importance of stringent application of the BLM sage-grouse stipulations, specifically the ¼ mile lek buffer. The Dodge Rim complex might represent a good example of the conservation benefit of the BLM stipulations.

Figure 27: Dodge Rim complex detail



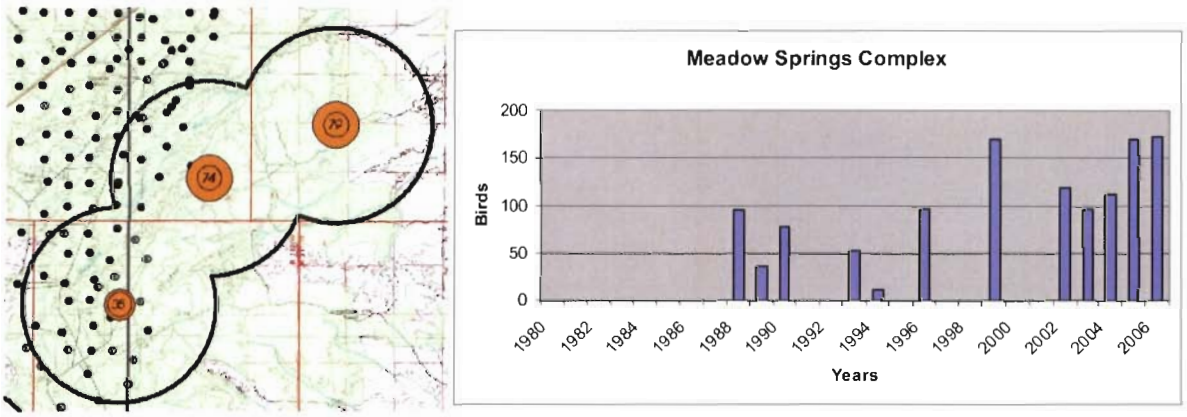
SEVEN MILE GULCH LEK - Seven Mile Gulch lek (Figure 28), located in the middle of the analysis area, appears to have been abandoned. Data are poor for this lek with only two surveys having been conducted, but this lek is heavily impacted by 80-acre spacing and the ¼ mile lek buffer has been directly impacted by two wells.

Figure 28: Seven Mile Gulch lek detail



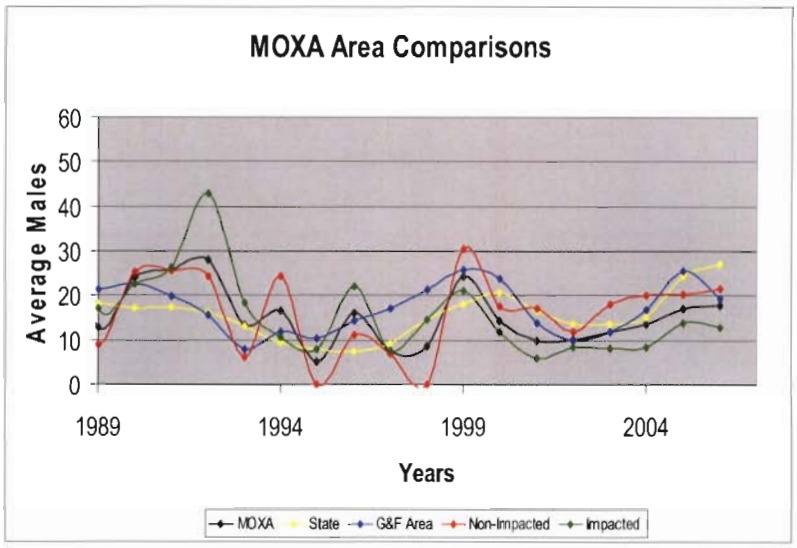
MEADOW SPRINGS COMPLEX - Only 43 wells have been drilled in the area west of the Meadow Springs complex (Figure 29), these wells are generally drilled on 160 acre spacing and none of the lek buffers are impacted by development. The leks continue to be active with attendance increasing over time.

Figure 29: Meadow Springs complex detail



SUMMARY OF MOXA ARCH FINDINGS - As seen in Figure 30, Moxa lek counts and surveys were erratic before 1999. While development appears to have significantly impacted individual leks within heavily developed areas of the field, the Moxa Arch sage-grouse population remains steady after more than 30 years of development and 1700 producing wells.

Figure 30: Moxa area lek comparisons



PINEDALE (PAPA)

The Pinedale Anticline natural gas field (Pinedale Anticline Project Area or PAPA) is currently in an intense drilling phase. Gas was initially discovered in this area in 1939 but not in quantities that justified additional development. Renewed interest in the area in 1997 was spurred by the prolific Jonah Gas Field, immediately to the south. The PAPA is a unique geologic feature that contains a number of tight natural gas formations. Development of this area must take place on close spacing to accomplish efficient recovery of the gas resource. A desire to minimize environmental impacts has spurred the development of new drilling and reservoir stimulation techniques. The successful use of directional drilling has made multiple well-pad drilling in the area possible with upwards of 30 wells per pad being proposed.

Concern about the impacts of high-density, high-intensity development on wildlife has prompted the initiation of ongoing research in the area (Lyon 2000, Holloran 2005, Kaiser 2006). Because nearly the entire PAPA overlies federal minerals, the opportunity to study sage-grouse under strict BLM control was afforded.

As a result of issues identified in Lyon (2000), the BLM Pinedale Field Office, industry partners, and the University of Wyoming initiated cooperative research on the effectiveness of the BLM standard sage-grouse stipulations. To test the effectiveness of the stipulations, BLM manipulated the impacts of gas development as follows:

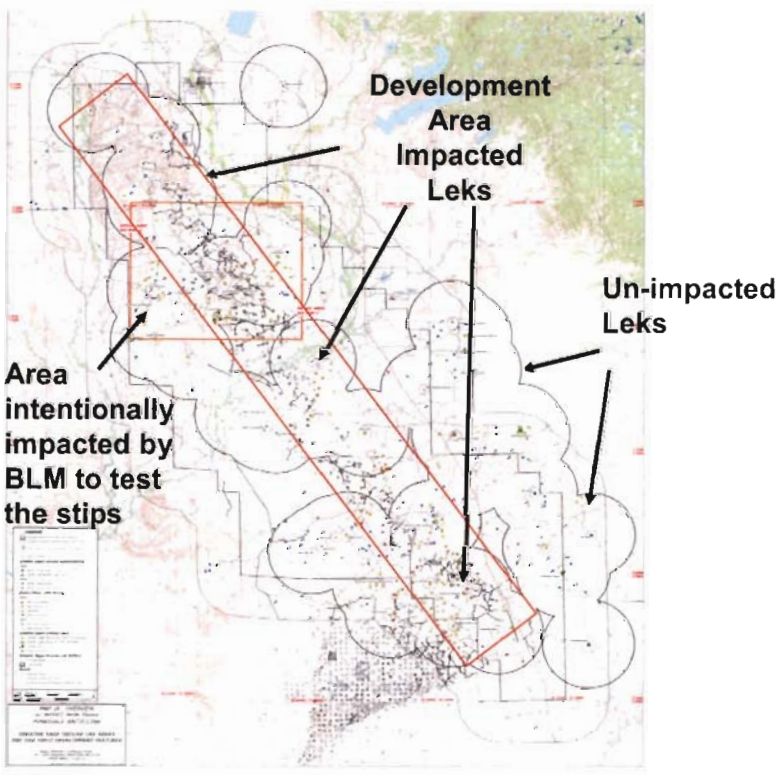
- Two leks (Lovatt Draw Reservoir and Mesa Springs in the Mesa complex) were provided no protection from year round development activity,
- Leks in the remainder of the field were protected through the stringent application of the standard protective stipulations, and
- Leks located outside the study area were not impacted by gas development activity and served as the control.

The intent of the study was to determine the effectiveness of the stipulations in an applied setting.

The base map used in Figure 31 is taken directly from the TRC Mariah (2006) wildlife report which is provided annually to the BLM by the PAPA operators. The red rectangle represents the 4 mile wide swath along crest of the Pinedale Mesa that we analyzed as the impacted development area. The leks intentionally impacted by BLM are located within the smaller red rectangle indicated on the map. In this smaller area the standard sage-grouse stipulations were waived, providing no spatial or temporal protection to these leks for a period of two years. Other leks within the developed area were protected by the stringent application of the stipulations. The leks impacted by vacating the stipulations were abandoned in a few years (Holloran 2005); the other leks, those protected by the application of the stipulations, continue to have males in attendance. This experiment provided evidence that the stipulations appear to be effective in reducing the impact of development on sage-grouse. On the PAPA maps well locations are identified by circles with crosses through them (A). The Upper Green management area contains 124 leks; 21 were included in our analysis as impacted and 32 as non-impacted leks.

Figure 31: Pinedale Anticline field development area

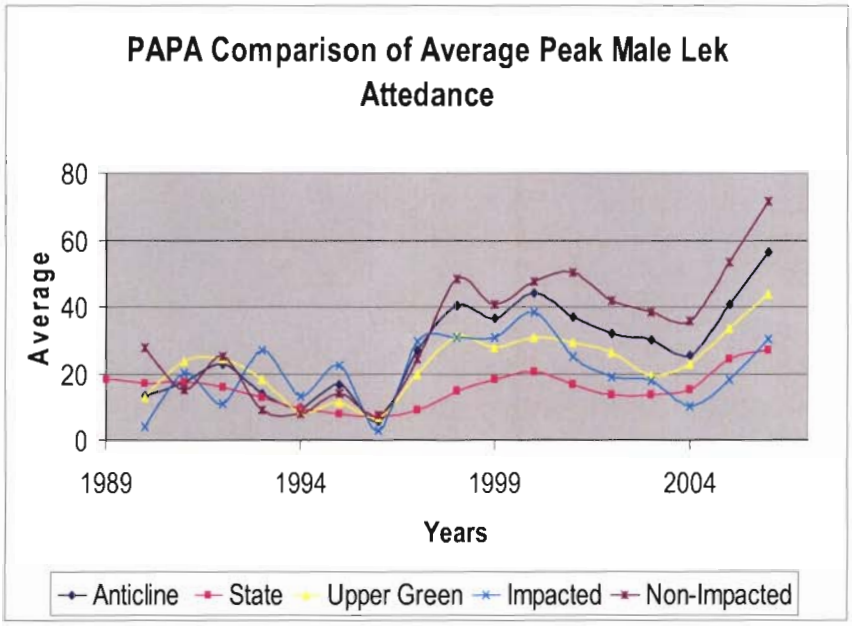
PAPA Field Development Area



The "impacted" leks in this analysis include those leks intentionally impacted by BLM. Holloran (2005) used these BLM-impacted leks, which ultimately became inactive during the course of his study, in deriving model-based estimates of population persistence. The exercise predicted localized extirpation of leks impacted by gas development at densities greater than 1 well per square mile. This work was completed in 2004 in the wake of a general state-wide decline. As

illustrated in Figure 32, predictions made at that time indicated extirpation of grouse was inevitable, not only for the development area but throughout the Upper Green. Since 2004 populations have increased. Given the long-term population fluctuations that sage-grouse exhibit range-wide, the results of any short-term modeling exercise must be interpreted with due circumspection.

Figure 32: Pinedale Anticline average male-lek attendance comparisons

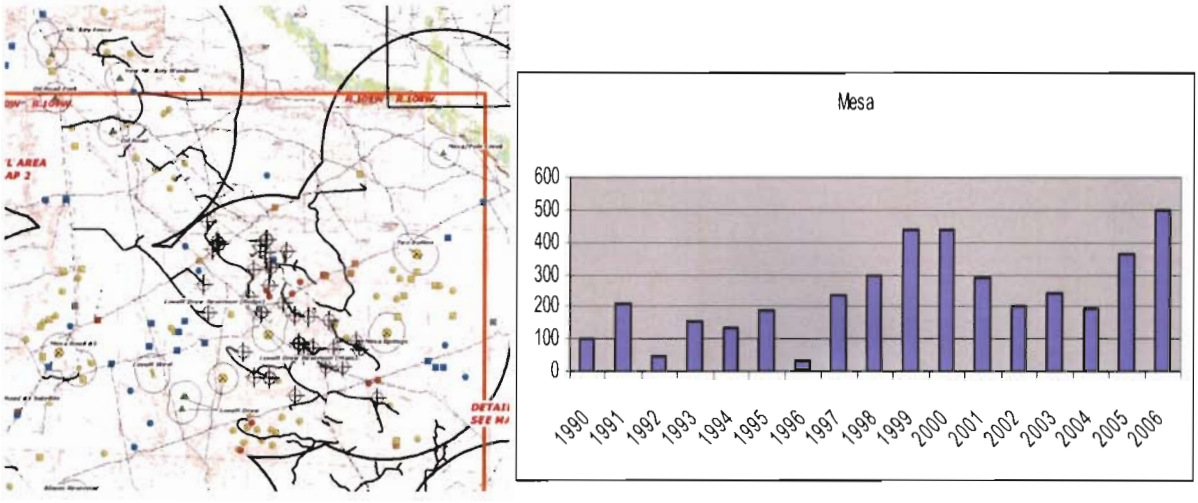


The WGFD data base contains limited data for the area before 1998, since that time lek counts have been consistently conducted with additional leks being identified annually.

The analysis of lek complexes in the area demonstrates that leks continue to be occupied even when impacted by the intensive natural gas development. The following analysis looks closely at three impacted and two non-impacted complexes.

MESA COMPLEX - The Mesa complex (Figure 33) includes the leks purposely impacted by the BLM to benefit the Holloran (2005) study of the effectiveness of the BLM standard sage-grouse stipulations. The BLM impacted leks (Lovatt Draw Reservoir and Mesa Spring) were further impacted by the activity taking place in Section 16, located immediately to the north. No stipulations or conditions of approval are placed on state mineral leases resulting in continued year round development activity. The Cat, Cora and Mesa/Pole Cat leks were removed from the analysis of this complex because they are un-impacted by gas development activity. This complex has been impacted by intensive year-round gas development operations since 1998 and remains active.

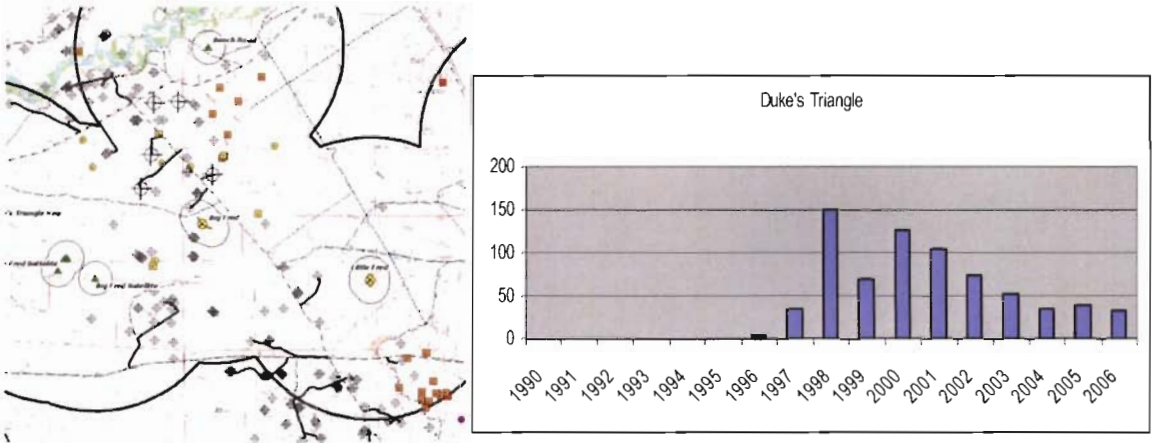
Figure 33: Mesa complex detail



DUKE'S TRIANGLE COMPLEX - The Duke's Triangle complex (Figure 34) consists of six leks, of which only two are regularly attended. Of the two significant leks in the complex, one (Big Fred) has declined steadily over the last five years. Development activity has occurred around these leks since 1998.

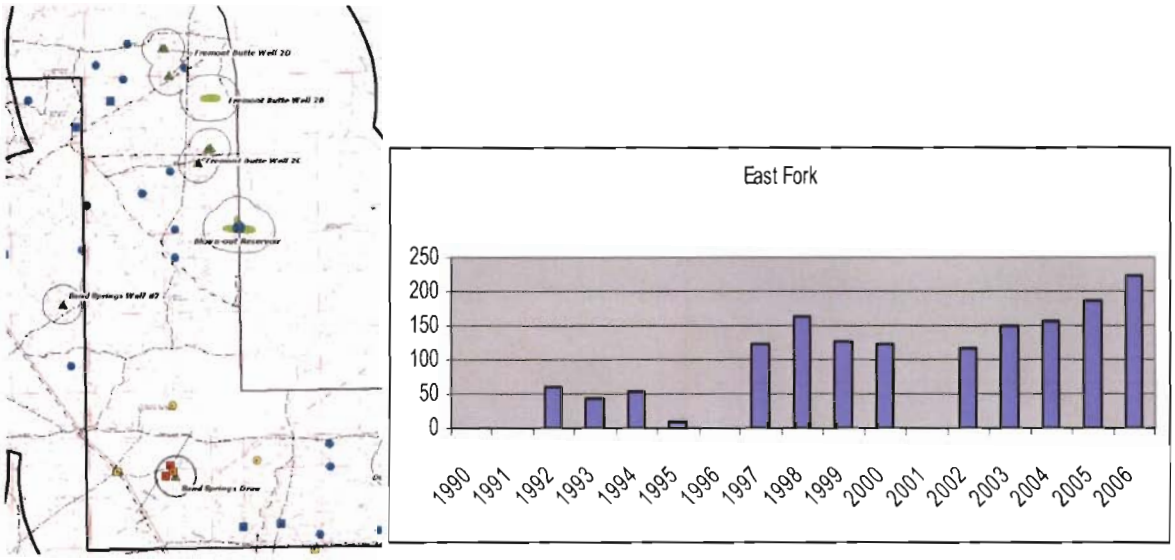
Big Fred is located approximately one mile northeast, directly down wind, of Section 36, a section of state owned minerals. State leases (Sections 16 and 36) are not encumbered by spatial and temporal stipulations and conditions of approval as are federal wells. Activity on federal leases on the Pinedale Mesa is generally shut down through the winter for the protection of crucial mule deer and antelope winter range, followed by the sage-grouse breeding and nesting/brood rearing period of March 1 to July 15. During this period of extremely limited activity on federal leases, drilling and completion activity continues on state leased areas. The Big Fred lek has been impacted by development activity throughout the breeding and brood rearing season since 2001 with increased activity levels from 2004 through 2006, a similar situation as was seen relative to the Mesa Springs and Lovatt Draw Reservoir leks.

Figure 34: Duke's Triangle complex detail



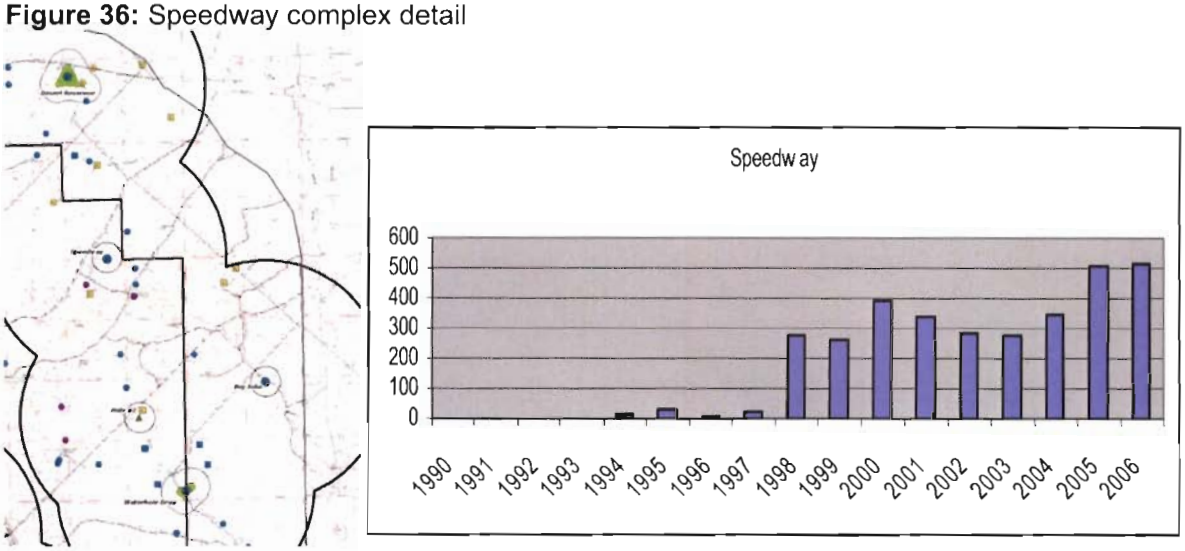
EAST FORK COMPLEX - The East Fork complex (Figure 35) is located east of the PAPA and is not impacted by gas development activity and shows generally the same trends as the impacted Mesa complex.

Figure 35: East Fork complex detail



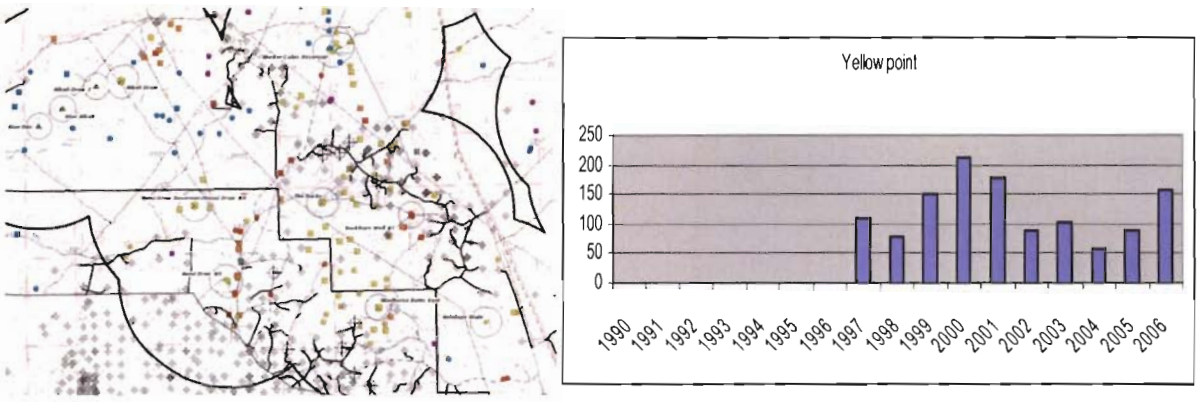
SPEEDWAY COMPLEX - The Speedway lek complex (Figure 36) is located to the south and east of the PAPA. As with the East Fork complex this group of leks is not impacted by gas development activity and trends are similar to the Mesa and East Fork complexes.

Figure 36: Speedway complex detail



YELLOWPOINT COMPLEX - The Yellowpoint complex (Figure 37) located at the south end of the PAPA geologic structure is impacted by that development activity as well as that which is occurring in the Jonah Field located southwest of the complex. Despite this level of development activity the Yellowpoint complex continues to be attended and trends are comparable to Mesa and the two non-impacted complexes.

Figure 37: Yellowpoint complex detail



SUMMARY OF PINEDALE ANTICLINE FINDINGS - A comparison of all five complexes (Figure 38) indicates that, with the exception of Duke's Triangle, the population trend for sage-grouse in the area of the Pinedale Anticline is similar regardless of the influence of natural gas development.

Figure 38: PAPA lek complex comparison

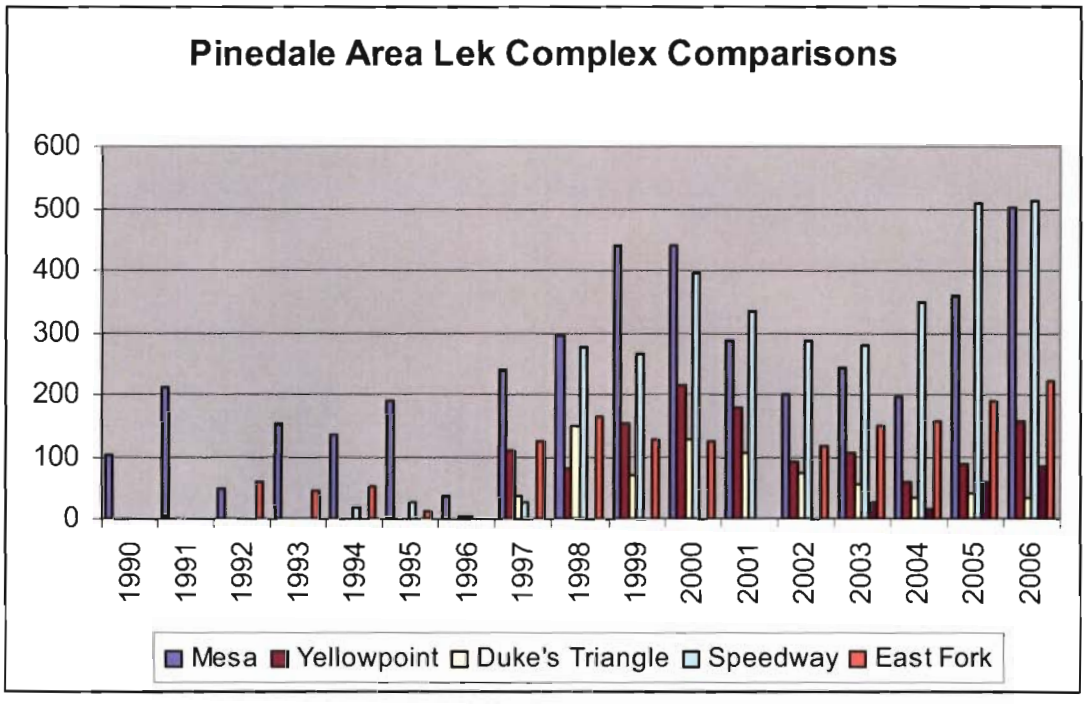
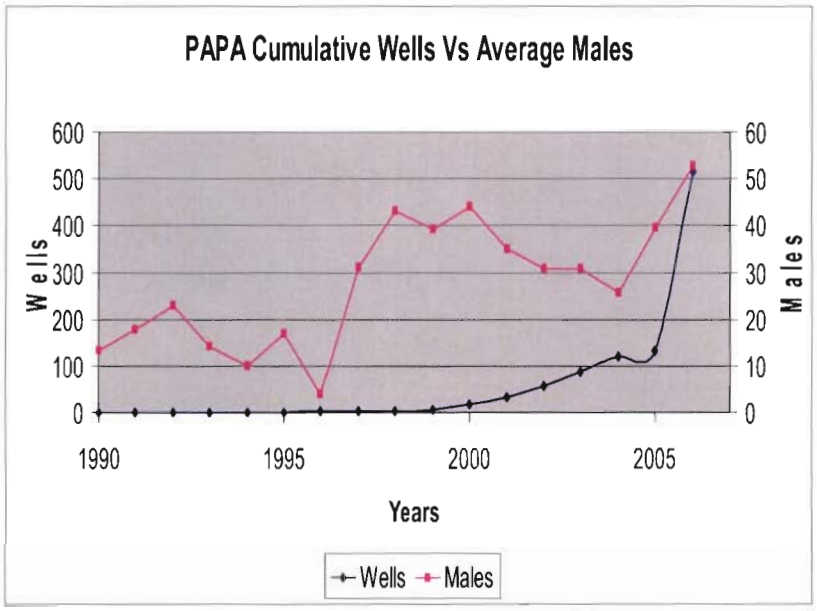


Figure 39 illustrates the cumulative number of wells drilled within the study area. The significant increase in the number of wells drilled from 2005 to 2006 represents the approval by BLM of multi-well pad drilling and year round activity. Pad drilling limits the surface disturbance and concentrates development activity thereby disturbing fewer leks. While this development scenario will limit surface disturbance and duration of development activity, it will enhance development intensity and possibly result in localized impacts to sage-grouse similar to those documented by Holloran (2005) at Lovatt Draw Reservoir and Mesa Springs leks, and to those we have demonstrated at the Big Fred lek.

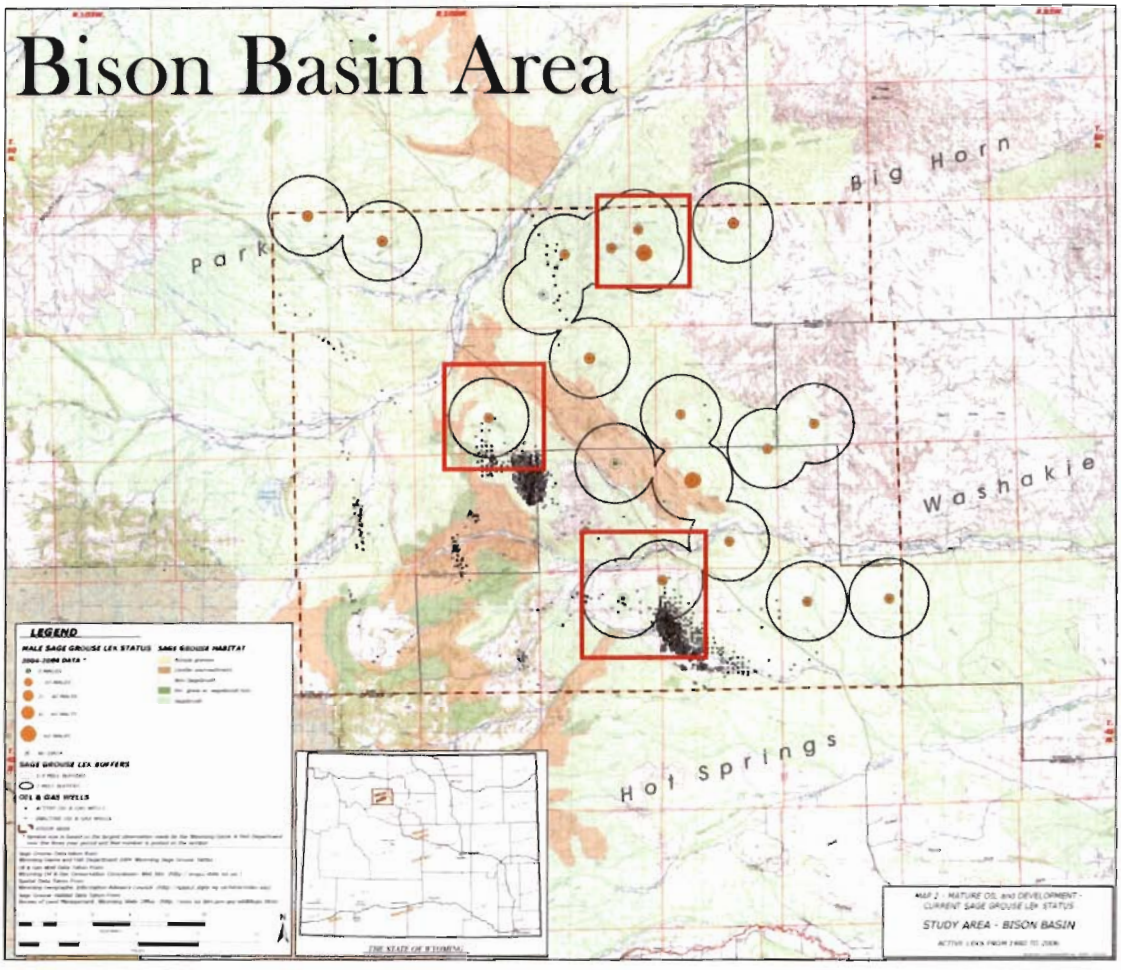
Figure 39: Pinedale Anticline comparison of male-lek attendance and wells drilled



BISON BASIN

The Bison Basin is an old oil field area located in the Big Horn Basin of northwest Wyoming (Figure 40). The small fields are densely developed, as they pre-dated WOGCC spacing regulations, with some being over 100-years old. Sage-grouse mitigation would not have been applied to the development of these fields. There is renewed interest in this resource area, additional geophysical exploration is in progress. We analyzed 5 impacted and 15 non-impacted leks out of the 96 leks identified in the WGFD management area.

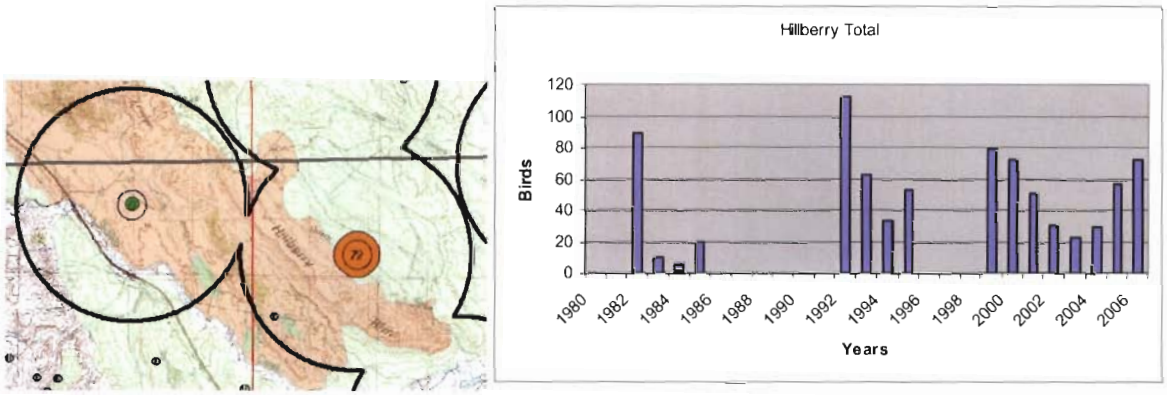
Figure 40: Bison Basin study area



A lack of consistent data for the area limits the comparisons that can be made between impacted and non-impacted leks and lek complexes but an attempt to evaluate three areas from north to south across the study area was made.

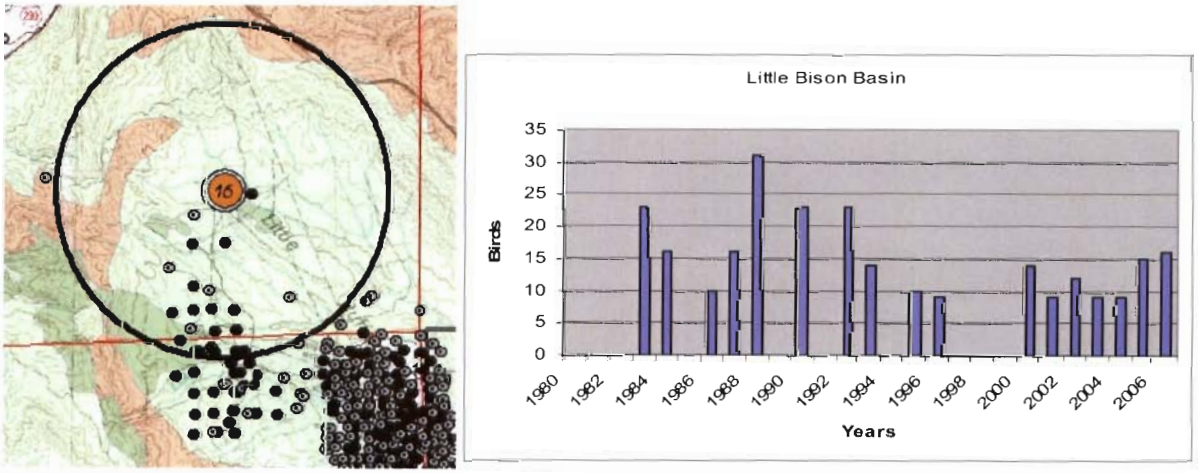
HILLBERRY COMPLEX - The Hillberry lek complex (Figure 41) is not impacted by oil and gas development and demonstrates the same oscillations seen in other complexes.

Figure 41: Hillberry complex detail



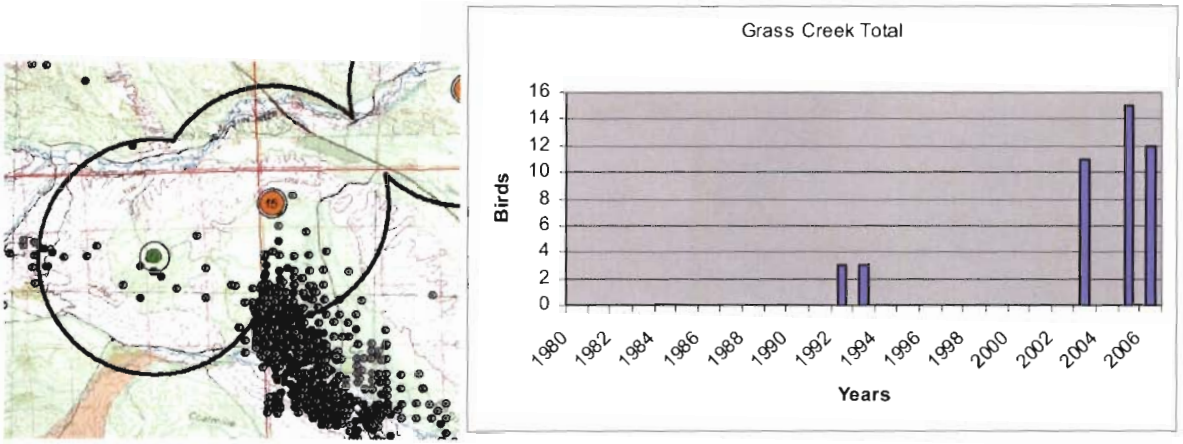
LITTLE BISON BASIN LEK - The Little Bison Basin lek (Figure 42) has had 23 wells drilled within the two mile radius of the lek and hundreds of wells drilled within a four mile radius. This field has been actively producing oil since 1915; sage-grouse continue to attend this impacted lek.

Figure 42: Little Bison Basin lek detail:



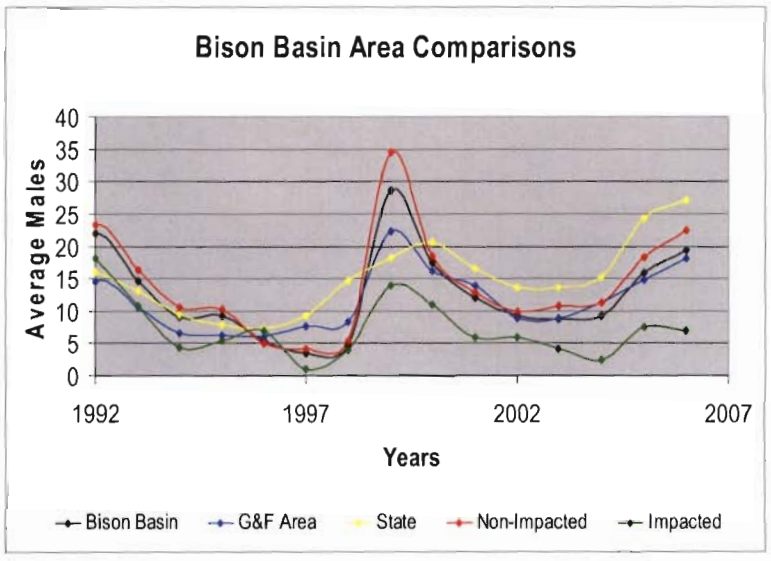
GRASS CREEK COMPLEX - Data are poor for the Grass Creek complex (Figure 43) but surveys conducted in the last four years indicate that the leks are occupied and stable. The complex is located in the Grass Greek oil field where almost 900 oil wells have been drilled since 1910. The Grass Creek oil field continues to be active today as does the sage-grouse complex of the same name.

Figure 43: Grass Creek complex detail



SUMMARY OF BISON BASIN FINDINGS - The comparison of the five lek categories for the Bison Basin study area (Figure 44) indicates that, even in this very old development area where no protective stipulations or spacing restrictions would have been applied, trends in this sage-grouse population are consistent with other populations and with state-wide trends. The only deviation seen is a slight decline in male attendance on impacted leks which is explained by the loss of three males attending the Grass Creek complex in 2006.

Figure 44: Bison Basin area comparisons



CONCLUSIONS

Five general conclusions emerge from this analysis.

1. Density of development is an important factor affecting male lek attendance
Sage-grouse continue to inhabit energy development areas characterized by a variety of well density scenarios. However, well density appears to affect lek activity. In both the PRB and Moxa, sage-grouse leks with more than 10 producing wells within the 2-mile lek radius continue to be attended by males during the breeding season, but leks with wells drilled within the ¼ mile lek-buffer or with more than 100 wells drilled within the 2-mile radius appear to become inactive. In the PAPA, the data show that year round drilling and completion activity within the ¼-mile and 2-mile radii (i.e. BLM granting exceptions to the sage-grouse protection stipulations or leks proximal to state leases) may lead to lek abandonment in a relatively short period of time.

Previous research has suggested that ≤1 well per 283 ha (approximately 1 well per section) within 3 km of a lek would reduce the negative consequences of gas field development (i.e. Holloran 2005, Walker et al. 20XX). There is no doubt that less than 1 well/square mile would reduce impact to sage-grouse but yet again we are left with the question about thresholds of development that no previous research has addressed. We have initiated research that will attempt to address this question.

It is likely that habitat quality plays a role in determining the level of development that impacts lek activity. Sage-grouse within relatively poor or marginal habitat (i.e. Moxa, PRB) appear to be less tolerant of increased well density than sage-grouse in areas of high quality habitat (i.e. PAPA, Wamsutter).

The conditions under which energy development impacts sage-grouse populations are more complex than has been previously suggested. Impacts appear to reflect an interaction of several factors including development density, the intensity of development activities, the life-history stage of the sage-grouse (i.e., brood rearing, lekking), and habitat quality. Some impacts are minimal while others pose a serious concern; the degree of impact seems to be related to the quality of the habitat affected by energy development, but this relationship is not always straightforward. Are the impacts of habitat fragmentation/conversion more severe when habitat is less-than-optimal, such as may be the case in PRB and Moxa? It cannot be stated that 80-acre spacing will facilitate population persistence in all instances; Moxa illustrates that this is not the case. But Moxa also illustrates the ¼ mile buffer caveat; leks that were abandoned in Moxa had development activity within this buffer. It is clear that 40-acre spacing will not support sage-grouse, but questions remain about the respective roles that increased human activity and habitat fragmentation/conversion play and whether some type of mitigation may be effective in areas impacted by 40-acre spacing. The implication for managing sage-grouse in energy development areas is that strategies will be most effective if they are developed on a population-specific basis. This will require site-specific research and activity planning.

2. BLM standard stipulations for reducing impacts to sage-grouse appear to be effective.
The stringent application of the current BLM lek and nesting habitat protection stipulations in the Pinedale Anticline reduced the impact of drilling and completion activities on lek attendance when compared to those leks where the stipulations were not applied. This comparison provides evidence that the BLM standard stipulations appear to be effective in reducing the impact of development activity on sage-grouse populations. Although we caution against extrapolating the results of a single short-term study to other populations or sage-grouse in

general, the evidence suggests that any statement that BLM stipulations are ineffective is unsupported.

While reviewing the existing body of research regarding the effectiveness of the standard BLM stipulations for mitigating the impacts of drilling operations on sage-grouse it became evident that the base assumption for the conclusion that these stipulations were ineffective was incorrect. Holloran (2005) states "My results suggest that current development stipulations are inadequate to maintain greater sage-grouse breeding populations in natural gas fields", Walker (20XX) agrees stating "Current lease stipulations that prohibit development within the 0.4 km of sage-grouse leks on federal lands are inadequate to ensure lek persistence and may result in impacts to breeding populations over larger areas". Also, in Braun et al. (2002), "We believe it is the responsibility of the oil and gas industry to demonstrate their activities have no negative impacts initially, short-term, or over the long term." We have demonstrated that, while energy development can negatively impact sage grouse, populations persist in oil and gas fields through decades and, indeed, centuries of oil and gas activity. It is unreasonable to expect an absence of any negative impact because any activity that modifies habitat directly or indirectly will have consequences for wildlife populations. The question is, at what threshold of development can we maintain viable sage-grouse populations and productive oil and gas fields? To date, previous research has aimed to determine whether energy development affects sage-grouse populations. This is what has been referred to as gratuitous testing, that is, research based on questions for which we almost certainly already know the answer. Research aimed at finding feasible solutions is needed.

The BLM standard sage-grouse stipulations were intended to reduce the impact of the activity, not to eliminate impact altogether; this clarification is found in the CEQ NEPA regulations at 40 CFR 1508.20, "mitigation may include one or more of the following:

> (b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation."

BLM stipulations intended to mitigate impacts to sage-grouse on the Pinedale Anticline (BLM 2006) are spatial and temporal, and include:

- no surface disturbance within ¼ mile of a lek to protect the integrity of the lek site, including a specific prohibition of high profile structures within the ¼ mile if BLM does not apply the stipulation and allows activity within the ¼ mile,
- no surface disturbing activity within 1 mile of a lek from March 1 to May 15 to avoid disturbing breeding birds, and
- no activity within 2 miles of a lek from April 1 to July 31 to protect nesting hens and early brood rearing.

All BLM offices in Wyoming that manage sage-grouse habitat have similar stipulations in place, the two mile no surface activity restriction is applied, with slight variation, from March 1 to July 15. When the effectiveness of the stipulation is evaluated in accordance with the CEQ regulations the results are significantly different. For example, on the PAPA, sage-grouse leks that were protected using the BLM standard stipulations continue to have males in attendance; leks at which these stipulations were waived (Lovatt Draw Reservoir and Mesa Springs) for research purposes were impacted and no longer have males in attendance.

Clarification of the intended purpose and potential effectiveness of the existing BLM stipulations is essential as research outlined above is routinely cited as the evidence to compel BLM to change their sage-grouse management strategies. For example the draft Big Horn Basin Conservation Area Sage-grouse Conservation Plan (2007) states "Researchers concluded existing stipulations were inadequate to maintain sage-grouse breeding populations." We have

cast doubt on this contention and provide evidence that existing stipulations may in fact reduce the impact of energy development on sage grouse populations.

Table 1 shows that well density and application of the BLM standard stipulations are important for maintaining lek attendance over the long term. Well densities at about 100 wells within the two mile radius were generally associated with persistence of sage-grouse populations. As well density exceeded 100 wells/2 mile radius, negative impacts on sage-grouse populations such as lek abandonment became apparent.

Table 1: Development Impact Summary

Development Scenario	Lek Status (1/4 mile lek buffer)	Development within 2 mile radius	Attendance Status
PRB 40 acre spacing	compromised	200 wells	abandoned
PRB 80 acre spacing	intact	100 wells	reduced and stable
Notches, un-spaced; an example of cluster development?	intact	40 wells in a one mi^2 area w/in the 2 mi radius	stable and increasing
Wamsutter, modified 80's	intact	50 to 60 wells	increasing
Wamsutter, modified 80's	intact, but close	+80 wells	increasing
Moxa 80 acre spacing	compromised	approaching 100 wells	abandoned
Moxa 80 acre spacing	compromised	between 50 and 100 wells	abandoned
Moxa 80 acre spacing	intact	between 50 and 100 wells	reduced and stable
Moxa 160 acre spacing	intact, but close	30 wells	increasing
PAPA	compromised	year round pad drilling	abandoned
PAPA	intact	year round pad drilling	increasing
PAPA 40 acre spacing	intact	between 100 and 200 wells	stable and increasing
Bison Basin, un-spaced	intact, but close	23 wells in 2 miles and hundreds w/in 4 miles	stable and increasing
Bison Basin, un-spaced	intact	hundreds of wells w/in 2 miles	stable and increasing
Bison Basin, un-spaced	compromised	28 wells in 2 miles and hundreds w/in 4 miles	abandoned

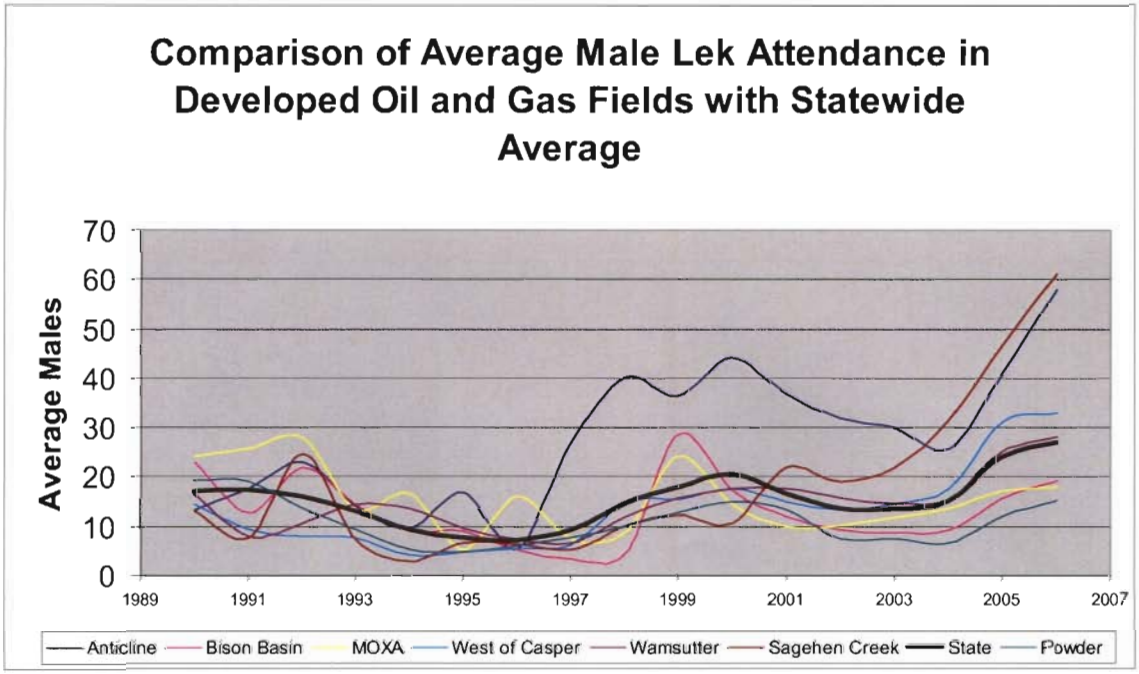
3. Extirpation has not occurred in any study area with either new or old development.
The data show that sage-grouse populations have persisted in energy development areas. Any contention that energy development will result in population extirpation must be qualified with statements on development density and intensity. However, there is concern about the effects of continued rapid expansion of energy development because we have yet to quantify the extent to which viable sage-grouse populations will tolerate habitat modification.

4. Impacted leks show varying rates of reduced male attendance compared to non-impacted leks.
Average male-lek attendance and population-growth rates are lower on impacted leks when compared to non-impacted leks.

PAPA development activity, which accelerated in 1998, appears to have decreased average male-lek attendance on impacted leks. We can see from the graph (Figure 32) that there was no divergence between the impacted and non-impacted lek averages prior to 1996. While there is now a significant difference in average male-lek attendance numbers on impacted vs. non-impacted leks, male attendance has increased in recent years on leks within the development areas and impacted leks continue to support males. However, in Wamsutter (Figures 24 and 25) the differential between impacted and non-impacted leks was in place before development activity began and may be due, in part, to the variation in habitat quality in the area. In the PRB (Figure 4) the differential between impacted and non-impacted leks was small before CBNG development (<0.6 males) and is only slightly higher today (<1.9 males).

5. All Greater Sage-Grouse populations studied showed synchronous fluctuations in male-lek attendance. The analysis presented in this report found that, regardless of the population in question, the male-lek attendance trend is the same throughout the State (Figure 45). Population increases and declines occur at approximately the same time and are generally of the same magnitude regardless of the specific population being evaluated. A similar observation was made by Braun et al. (2002) relative to the sage-grouse in the McCallum Oil Field in North Park, Colorado, "During the 1973 to 2001 interval, number of male sage-grouse counted and active leks in this area fluctuated in synchrony with the entire sage-grouse population in North Park." These same fluctuations are seen range wide; see Figure 4 taken from the WAFWA Greater Sage-grouse Conservation Assessment (Connelly et al. 2004). Greater sage-grouse populations, like many wildlife populations, show periodic fluctuation in abundance and distribution. These fluctuations are likely the result of a suite of factors including climatic trends and anthropogenic influences.

Figure 45: Comparison of average male-lek attendance in developed oil and gas fields with statewide average



Summary and implications

a) Strict application of the BLM protective stipulations reduces impact to sage-grouse populations in development areas. These stipulations should be implemented with further testing.
   i) It should be anticipated that multi year-round drilling and completion activity within 2 miles of a lek will negatively impact lek attendance and associated nesting and brood rearing activity.
b) Consider well density and removal of habitat, for example
   i) cluster 40 acre spaced wells (if geologically applicable, see the Lox Notches and Grass Creek complex discussions as examples) in marginal habitat, this is preferred over full scale 40 acre spacing that removes good quality habitat,
   ii) drilling multiple wells from a single location,
   iii) use the fewest number of surface well sites possible to extract the resource,
c) Leave undisturbed patches of habitat scattered throughout the field development area, for example map the habitat, the resource and create habitat set aside areas.
d) Application of management practices to reduce direct impacts to sagebrush habitats should assist in reducing the differential between impacted and non-impacted male-lek attendance and the likely displacement of grouse from development areas.
   i) Avoid impacting lek buffers.
   ii) Avoid impacting high quality nesting and early brood rearing habitats.
   iii) Reestablish or enhance sage-grouse habitat as quickly as possible using locally selected forb and sagebrush species.

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Oil and Gas Well Data: Wyoming Oil and Gas Conservation Commission
http://wogcc.state.wy.us/)

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Attachment

E

BMP Evaluation

Consideration of Additional Best Management Practices for Use in the Moxa Arch Project Area

- **Horizontal drilling** – One operator is currently testing horizontal drilling in the Moxa Arch area. Drilling the single horizontal well in the Moxa Arch is strictly a pilot program to determine if marginal tight gas sands on the periphery of the arch can be economically produced using this technology.

  The number of wells (two) projected by the Moxa operators in the margin of the arch in the flank areas reflects the formation characteristics of the potentially productive Frontier Formation. In the northern margin, the Frontier Formation consists of two adjacent tight gas sands of limited depth and long horizontal extent. One Moxa operator has decided to attempt to produce from the Frontier Formation in this area after evaluation of the depth to prospective pay zones, proximity of the prospective pay zones to each other, and linear extent of the pay zones. The operator decided to use horizontal drilling to attempt to maximize production from a formation that may have yield poor results from a vertical well because of its location on the flank. The operator plans to use completion technologies that are intended to ensure production from both sands. Drilling a vertical well in the northern margin of the Moxa Arch, as proposed by the Moxa operators, may not result in an economically justifiable well. The single horizontal well in the Moxa Arch has yet to be completed and cannot be evaluated until it is completed and produced.

  Horizontal drilling is economically prohibitive *at this time* where the Frontier Formation occurs deeper in the section, as it does in the southern margins of Moxa Arch. Therefore, the use of horizontal drilling in a particular portion of the Moxa Arch, such as crucial elk and antelope winter range, will necessarily depend upon the subsurface factors described above that dictate how natural gas could most efficiently be extracted.

  The use of horizontal drilling to successfully produce gas from beneath the Moxa Arch is an *unproven* technology and will remain so until such time when results from *more than a single test well* indicate successful production at cost that remains within the bounds of economic feasibility. Similar to directional wells, the additional costs associated with horizontal drilling must be minimized to a point where an operator can consider its use to be economically viable. Technical issues inherent in drilling horizontal wells must be resolved before its use can be considered more generally. Until such time as horizontal drilling and completion techniques prove to be economically viable and effective, its use in the Moxa Arch area will be location-specific and operator-specific.

  Drilling a horizontal well *is an attempt* to utilize *current* technology to produce sufficient gas resources to justify its use in the margins of Moxa Arch. A successful horizontal well would present an opportunity to utilize an alternate

technology, more fully produce the gas resource, and result in less surface disturbance than would occur with several vertical wells. The Moxa operators will continue to evaluate the use of horizontal drilling and other innovative drilling strategies to maximize production from Moxa area leases at locations where consideration of their use makes sense. Over the 10-year timeframe of the proposed project, the Moxa operators anticipate that some new innovative technologies will provide opportunities to minimize surface impacts and maximize extraction of the gas resource.

- **Cluster and phased drilling** – Cluster and phased drilling would be difficult to implement in the Moxa Arch, where approximately 30 operators develop individual leaseholds. Planning for development activities requires foresight and commitment of resources. If development activities were temporally or spatially restricted, undue economic hardship may result to operators that cannot absorb the financial losses associated with limitations that conflict with the company's development plan. Other considerations, such as rig availability, also contribute to the inherent instability of the use of cluster drilling as part of a sound business model. Operators plan their drilling activities according to availability of men and equipment.

  The support for cluster and phased drilling must be built on the premise that their use would actually provide benefit to wildlife and wildlife habitat. Cluster drilling in the checkerboard would result in one-square mile clusters on BLM lands offset from each other by single privately owned or state sections. Studies have not been conducted in the Moxa Arch area substantiating that cluster and phased drilling in (or outside) of the checkerboard area would:

  - Promote more efficient use of forage within a particular habitat; or
  - Result in a noticeably more sustainable population of wildlife; or
  - Ensure that the risk financial incurred by Moxa operators would be offset by an assured result.

  Without documentation, the ability of cluster drilling to provide the anticipated results is speculative. Big game habitats extend over large areas greater than a single section. Cluster and phased drilling in the checkerboard is not likely to diminish adverse effects to wildlife and grazing animals.

  Cluster drilling may result in fewer impacts *from drilling* in specific areas over a 10-year timeframe, but the overall effects of producing 1,861 wells over the lifetimes of the wells would remain. Forage amounts corresponding to surface disturbance would be lost. The Moxa operators proposed drilling approximately 1,861 wells. Estimated disturbance from road and well pad construction would result in a short-term loss of approximately 579 AUMs, using an average of 13 acres per AUM and a 70% effective utilization of the allotments (1995 Draft Moxa EIS). Approximately 1.5% of available AUMs would therefore be affected by the proposed infill project. Successful reclamation would reduce the loss of

available forage by approximately 50%, resulting in a disturbance of less than 1% of the Moxa Arch area. As proposed, the resulting disturbance is very small.

- **Centralized gathering systems** – *This explanation of consolidated production facilities was previously provided to the Kemmerer Field Office by the Moxa operators and is included below in its entirety.*

  Consolidated facilities (*centralized gathering systems*) in the Moxa Arch area would generally include separation, dehydration, metering, chemical treating, fluid storage and emission control equipment that would service two or more off site wells (satellites) from a single well pad (host). Depending on the need to segregate measured gas and fluid volumes from individual well bores, the host facility could include the same equipment as required for a single producing well or could require a redundancy of some equipment as necessary to provide for separate measurement of the individual well streams. The size of well pad required to accommodate this equipment could obviously vary significantly depending on the degree of well stream isolation needed, hydrocarbon and water volume capacity requirements, and the number of satellite wells being serviced by the consolidated facility.

  For host facilities whose satellites have minimal production equipment on location and can be operated relatively trouble free, there can be both economic and surface management advantages. The potential for reduced acreage disturbance as previously mentioned has positive ramifications from both an economic and surface management perspective. Where segregation of well streams is not necessary, reduction in equipment requirements is an obvious economic advantage. In addition, a significant reduction in well visits should be realized by centralizing facilities on one location. This scenario would result in the economic benefit of reducing man hours required per well and also reduce the impacts related to road travel and wildlife disturbance. However, comparable reduction in well visits can also be accomplished through the use of telemetry and remote well control devices on individual wells with complete production facilities. This method of well operation is being used more prevalently on both new and old wells in the Moxa area by most operators.

  Unfortunately, the majority of satellite wells in the Moxa area could not be expected to operate trouble free as was assumed in evaluating the potential advantages of host facilities. Moxa Frontier/Dakota and Frontier wells produce varying amounts of water and condensate. Declining gas volumes and reservoir pressures over time typically result in the need for some form of artificial lift in order to remove these well bore fluids and allow for maximum recovery of hydrocarbon reserves. It is general practice in the Moxa to utilize plunger lift to accomplish this goal. Plunger lift and control equipment is not well suited for wells lacking separation or dehydration on location. Without well site separation, liquids removed from the well bore during a plunger cycle would enter the flow line between the satellite well head and host facility. If insufficient gas volume is

available once the plunger reaches surface to push all of the liquids from the line, they will tend to accumulate in low areas of the pipeline. If subsequent plunger arrivals and gas flow fail to clear this liquid from the line, it may become necessary to install a pig launcher at the satellite well and a receiver at the host well. Operation of these pigging systems can require frequent visits to the satellite well site, can also pose potential safety hazards to lease operators and can result in disruption of gas sales should pigs become stuck in the line. It should be noted that the accumulation of liquids and need for pigging capabilities on satellite wells can also occur on wells prior to the installation of plunger systems. A major concern when considering satellite well operation is the potential for pipeline freezes between the satellite and host wells. Although these lines would necessarily be buried, the potential for cold weather or hydrate freezes is relatively high without some type of intervention such as a methanol injection pump or heater at the satellite well. These methods can help to minimize the potential for line freezes but also necessitate additional well visits for equipment maintenance and repair.

Consolidated facilities can offer economic and surface management advantages given the right conditions, but several factors need to be considered before the decision is made to pursue this course of action in a particular area. Mineral ownership, well quality and performance expectations, economics, topography, pipeline lengths and routes (cross country versus following access roads), surface management needs, safety considerations, and well operation issues all need to be taken into consideration to determine the practicality of consolidated facilities versus placement of production facilities on the individual locations.

- **Transportation system collaboration** – The Moxa operators conducted a Moxa-wide survey of existing wells and access roads in the summer of 2005. To comply with the 1997 Expanded Moxa Arch Record of Decision, the Moxa operators submitted the resulting GPS data to the BLM Kemmerer Field Office for its use in transportation planning throughout the Moxa Arch. As new wells are drilled and new access roads are constructed, the Moxa operators submit their data to the BLM on an annual basis. The BLM can use the data to determine the status of arterial roads and examine their use/usefulness in providing through access throughout the Moxa Arch.

  Individual operators use the data to assess existing roads and plan new roads to support future operations. Their intent and directive is to reduce duplication of existing routes, minimize the extent of new road construction, and reclaim unused, unnecessary, or duplicative roads.

- **Mitigation banking** – The Moxa operators are willing to discuss mitigation banking if such a system would:

  - Provide measurable benefits to affected resources that would be commensurate to measurable impacts.

- Be available to all operators as a reasonable and equitable course of action.
- Not depend upon favorable weather or other factors beyond human control.
- Not prevent an operator from exercising its lease rights.

- **Air Quality –** The Moxa operators cannot participate in the selection of a BLM-preferred alternative.

  The Moxa operators recognize that emissions resulting from oil and gas development operations incrementally add to existing emissions that may originate from or pass through the Moxa Arch area. Measures currently undertaken by some Moxa operators to minimize emissions from operations include:

  - Installation and use of low-emission compressors.
  - Installation of telemetry equipment to reduce vehicle trips on unpaved Moxa area roads.
  - Use of water or other means of dust suppression.
  - Development and use of a road management system to plan for new roads, eliminate redundancy in the transportation system, and generally minimize new road construction in the Moxa Arch area.
  - Use of bio-diesel as fuel.

  Tier 2 engines can be installed on new drilling rigs to reduce NOx and particulate emissions; however, installation of Tier 2 engines on an existing drilling rig is extremely costly. There is no market for the original engine that would be replaced. In addition, uncertainty exists about the effectiveness of add-on controls to meet Tier 2levels for existing rig engines.

  Imposition of a Tier 2 standard for existing and/new drilling rig engines lacks the necessary enforcement authority. Air quality in the State of Wyoming is administered by the state, which has primacy for the administration of the Clean Air Act. BLM enforcement of such a "requirement" may be impractical and is beyond the scope of its authority.

- **Weed control –** Measures intended to prevent the potential invasion and spread of noxious weeds in the Moxa Arch area is addressed in the surface use plan included in the Application for Permit to Drill (APDs) submitted for all federal wells. Although the State of Wyoming does not require submission of a surface use plan with its APDs, most, if not all, Moxa operators treat public and state lands substantially the same with respect to weed control. Controlling weeds on state and private lands, especially in the checkerboard areas of the Moxa Arch area, is an integral component of controlling weed infestation of federal lands.

- **Coordination with livestock operators** – The BLM issues grazing leases, tracks range quality, and manages rangeland health by determining the number of grazing animals and wildlife a particular allotment may be able to support. The BLM has also issued the mineral leases that allow the Moxa operators to drill and produce. The Moxa operators do not have the expertise to engage in meaningful discussions with grazing allottees. The nature and level to which the allotments are impacted is a matter of analysis by the rangeland managers of the BLM.

  The Moxa operators typically plan their operations a year or more prior to construction and are willing to share their development projections for the upcoming year with the BLM.

  The Moxa operators are willing to discuss what types of mitigation measures may be useful to the grazing allottees if such measures are recognized by the BLM and incorporated into the programmatic mitigation measures applied by the BLM to the proposed Moxa Arch infill project.

- **Closed Loop Drilling System** – The explanation that follows was developed by the Independent Petroleum Association of Mountain States (IPAMS).

Choosing Between a Earthen Reserve Pit and a Closed Loop System
Summary Report

by
The Independent Petroleum Association of Mountain States

Recent developments in drilling technology have made it possible and in some cases economically attractive to use a closed loop system. A closed loop system is a mechanical and chemical system which allows an operator to drill a well without the use of a reserve pit. In situations where there are environmental sensitivities or where economic consideration favor a closed loop system operators are beginning to employ this technology. Several factor should be analyzed to determine if a closed system is appropriate for any given location.

Environmentally Sensitive Areas: Operators desiring to drill in flood plains or in areas where a shallow aquifer exists may find a closed loop system an environmentally preferred system for drilling. Although, substantially extra cost are often to be expected, a closed system can help prevent overflows due to flooding. Additionally, in areas where shallow aquifers exist in conjunction with soils that tend to seep, less surface damage will occur with a closed system by avoiding the necessity of a much larger and shallower pit.

Variations In Basin Formations: While a closed system has proven to be a valuable technology for drilling in many environmentally sensitive areas, a closed system is operationally impractical, in cases involving under-balanced drilling. For example, when drilling in areas like the Piceance Basin of Colorado or the Green River Basin of Wyoming, operators encounter bursts of gas known as "kicks". To control the well during the drilling process more water than a closed system can provide is needed to keep mud down in the well boar. At this time, closed systems do not offer the flexibility needed to safely and effectively drill in most under-balanced situations.

Surface Impact: In cases where property owners are concerned about surface impact, an operator should be wary about selling the benefits of a closed system. Although it is true that in most cases a closed system will reduce location size by 5% to 20%, increased traffic may result from an increased need to haul of water and cuttings off site.

Cost Analysis: While a wide range of studies have been completed, the word is still out on the actual economics of using a closed system. Most often a site specific analysis is the best method for estimating expected costs. Factors that should be considered include:

1. The cost of pit construction and reclamation;
The cost associated with surface disturbance (i.e. is the land high value agricultural land?),
2. The cost associated with trucking water in for drilling,
3. The cost of disposing of produced water and cuttings (Depending on the proximity and availability of disposal sites, produced water can cost any where from $1.70 to more than $4.00 a barrel to dispose of. A closed system could become cost prohibitive if an operator is creating eight thousand barrels of produced water to complete a well.)

Summary: In conclusion, the choice to use a closed system or a earthen reserve pit requires careful analysis. In cases where environmental sensitivities require a closed system, an operator must determine if the prospect is worthy of the additional investment which will be needed to utilize a closed system. Beyond environmental considerations, variations between basin formations will play an important role in determining if closed system offers the flexibility needed during drilling operations. Finally, economic considerations should be analyzed on a site specific basis to determine the relative merits of a closed system versus an earthen reserve pit.

Attachment

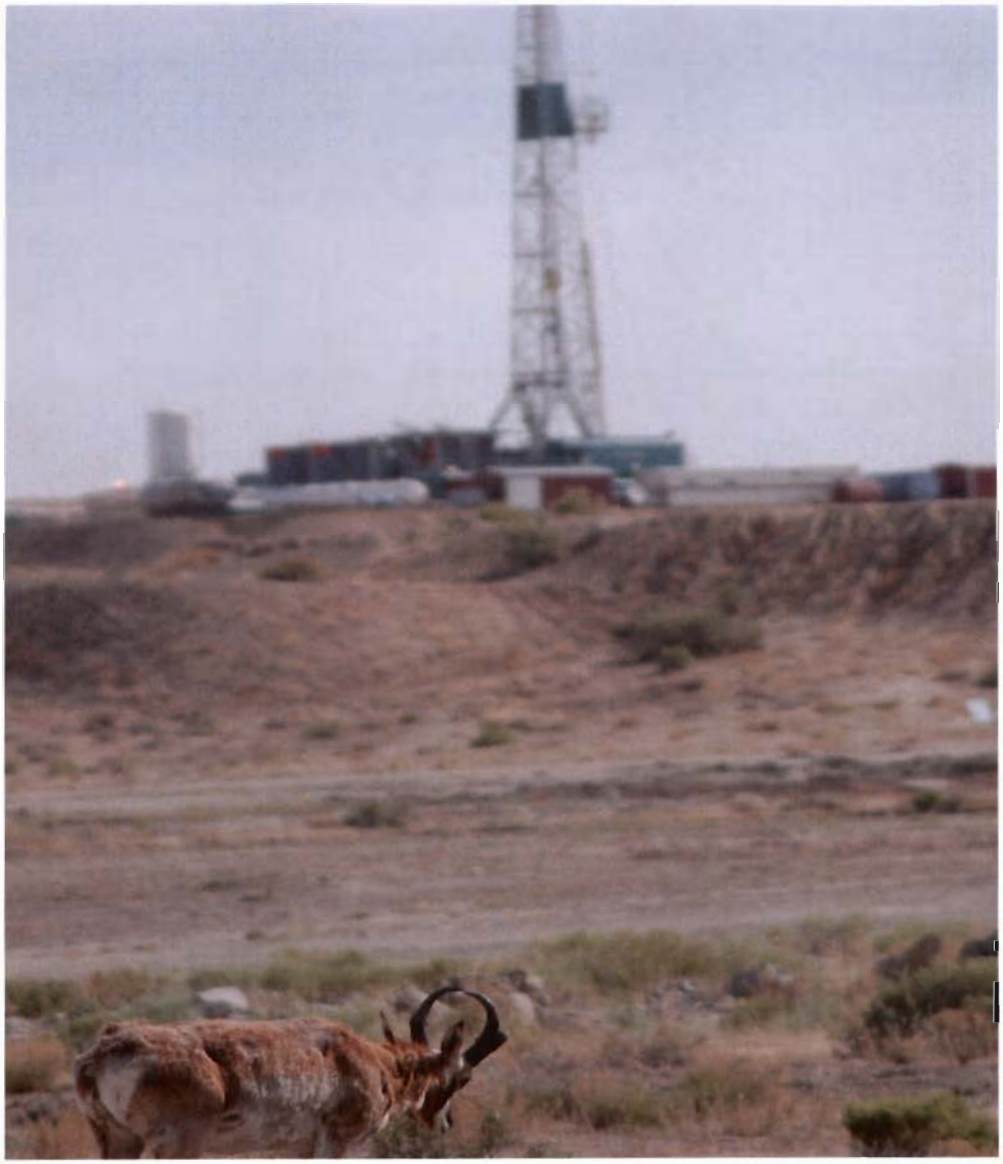
F

Draft Transportation Plan

DRAFT

TRANSPORTATION PLAN

Moxa Arch Area



January 2008

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Appendices

Introduction

In December 2004, certain oil and gas operators (identified herein as the "Operators") submitted a proposal to the Bureau of Land Management (BLM) to develop hydrocarbon resources underlying oil and gas leases owned, at least in part, by the Operators within the Moxa Arch area in Lincoln, Uinta, and Sweetwater counties, Wyoming. The project area consists of an existing gas producing area located on lands owned by the United States, the State of Wyoming, and private parties. Project development will result in the use of new roads and roads previously constructed and currently used in the project area. U.S. and State of Wyoming highways, county roads, and BLM roads will be used to access various parts of the project area.

The BLM is currently preparing an Environmental Impact Statement (EIS) to evaluate and disclose potential impacts from infill and development drilling in the project area. As part of the EIS process, the Operators developed this Transportation Plan to evaluate and make recommendations regarding the existing and proposed road system. This Transportation Plan incorporates guidance in the *Surface Operating Standards for Oil and Gas Exploration and Development, Fourth Edition* (Gold Book) (USDI and USDA, 2007), BLM Manual 9113 – *Roads*, and the Wyoming State Supplement to the BLM Manual 9113.

Purpose and Scope

The Moxa Transportation Plan was developed to guide transportation planning, road design, road construction, and road maintenance to meet the needs and requirements of the Operators, the BLM, and Lincoln, Uinta, and Sweetwater counties, as well as minimize environmental impacts for the life of the project. The Transportation Plan includes:

- Purpose and scope;
- General location information;
- Summary of existing and proposed development;
- Road classification and access;
- Planning procedures;
- General construction and management requirements;
- Plan maintenance;
- Appendices that include:
  - BLM Manual 9113 – Roads;
  - Wyoming Supplement to BLM Manual 9113 specifications;
  - Gold Book exerts, as it applies to BLM resource roads; and
  - Maps.

The Operators developed the Transportation Plan to document procedures for evaluating future routes, locating new roads, and providing roads data to the BLM's Kemmerer

Filed Office. Transportation planning will provide the Operators and the BLM the opportunity to revise the Moxa Arch roads system by adding new roads and removing and reclaiming those existing roads that may duplicate access.

The plan responds to concerns expressed by the BLM and the affected southwestern Wyoming counties during the planning stages of the Moxa Arch project and to transportation issues identified during public scoping.

The concerns are summarized below:

- Minimize construction to the extent possible. Design routing to incorporate as much of the existing transportation infrastructure as possible.
- Reclaim any roads determined to duplicate access and reclaim roads not needed for access.
- Maintain existing roads on BLM surface to current or improved conditions.
- Maintain existing and future roads as needed to prevent soil erosion and accommodate year-round access.
- Incorporate procedures to minimize potential hydrological impacts from construction in drainages.
- Confine traffic to access roads and well pads.
- Where wells are non-productive, reclaim drilling facilities and access roads to a pre-construction state as soon as possible.
- Minimize traffic volume to reduce potential conflicts with wildlife.
- Apply Gold Book standards to all road construction, culvert placement, and low-water crossing development.

Public comments from local counties identified the following issues:

- Effect of oil and gas traffic on county roads;
- Dust and erosion control in the late spring through fall;
- Coordination with the counties on road maintenance, road reconstruction, and traffic impacts;
- Weed control along service roads;
- Road maintenance to meet traffic level standards;
- Proper maintenance and construction of culverts and road base; and
- Traffic speed and trash control.

Road planning procedures are needed because well locations within the project area have yet to be precisely determined. Site-specific routes and possible alternative routes within the project area are not included in this plan. Identification of precise locations of well access routes, possible upgrades to existing routes, and the Operators and the BLM will determine reclamation of unnecessary routes after specific well pads are located.

The procedures in this plan consider future road use needs of the Operators and the public. The procedures will be implemented to maintain resource values, ensure safety, and avoid haphazard or unnecessary development of roads. They ensure that feasible alternatives for access that meet the objectives of the BLM, state, private surface owners, and users of public lands will be identified and analyzed prior to construction.

Because each new road will be unique, this plan incorporates general road design criteria. It does not provide detailed plans for construction or reconstruction. Each new road (or reconstructed road) will be designed to incorporate the general provisions of the plan.

Use of existing roads and construction of new roads will be conducted only after the applicable permits are approved, including those permits that may be required for the use of county roads or other roads not located on federal surface.

Location

The Moxa Arch project area is located in the mixed ("checkerboard") land ownership area of western Sweetwater, southeastern Lincoln, and northeastern Uinta counties, west of the Green River in Wyoming. It includes approximately 476,261 acres of federal, state, and private lands. The federal land management agencies include the BLM, the Bureau of Reclamation (BOR), and the U.S. Fish and Wildlife Service (USFWS). The project area is generally located within Townships 15 through 23 North, Ranges 111 through 113 West, 6th Principal Meridian. It lies in an area west of Green River, Wyoming, east of Lyman and Opal, Wyoming, and south of the Fontenelle Reservoir. Interstate 80 crosses the southern third of the Project Area (Map D-1).

Table 1: Project Area Surface Ownership

Surface Owner	Acreage Amount	% Project Area
BLM	231,380	48.6
BOR	26,903	5.6
USFWS	1,469	0.3
State of Wyoming	13,343	2.8
Private/Fee	202,943	42.7
Total	476,261	100

Project Area Setting

The Moxa Arch area consists of gently rolling to flat topography exhibiting occasional buttes and rims. Elevations range from 7,200 feet southeast of I-80 to 6,200 feet where the Blacks Fork exits the project area. The project area is vegetated primarily (66 percent) with desert shrub as characterized by Wyoming Big Sagebrush. Riparian species occur where surface water exists on approximately 2 percent of the project area. In addition to oil and gas facilities, the general setting includes ranching structures and associated infrastructure.

Perennial surface water consists of the upper Green River, which forms the northeastern project area boundary, Slate Creek, Muddy Creek, the Blacks Fork River, and the Hams Fork River.

Soils in the project area include residuum and colluvium of sedimentary uplands, alluvial deposits of stream floodplains and low terraces, alluvial deposits of alluvial fans and high stream terraces, and Aeolian deposits in the form of sand dunes occupying sedimentary uplands and high stream terraces. Sensitive soils are present in saline bottom lands and vegetated sand dunes. They comprise approximately 31 percent of the project area.

Summary of Existing and Proposed Future Development

As of March 2006, the project area contained approximately 1,208 productive wells. Data collected in August 2005 indicate that the project area contains approximately 1,047 miles of roads, including 73 highway miles. Map D-2 shows all existing roads within the Moxa Arch area, including BLM and county roads.

The Moxa Arch project consists of drilling, completing, producing, and eventually reclaiming approximately 1,861 wells. The Operators estimate approximately 1,226 additional wells will be drilled in the proven production, or "core," area and approximately 635 additional wells will be drilled in the flank area. The Operators anticipate drilling infill wells to the Frontier and Dakota formations at varying densities ranging from four to 12 wells in the core area and 320 acres per well in the flank area.

The productive life of each well is estimated to be approximately 40 years. Although actual operations are subject to change as conditions warrant, the Operators' plan of development is to drill wells at the rate of approximately 186 wells per year over a period of 10 years.

BLM Road Classification and Access

BLM Road Types

The BLM Gold Book and the Wyoming Supplement (BLM, 1991) to BLM Manual 9113 (BLM, 1985) define roads in terms of their functional use. Although the BLM is in the process of updating Manual 9113 and may incorporate aspects of the Wyoming Supplement, the updated document has yet to be finalized. The following classifications are drawn from the Wyoming Supplement and are described in terms of existing and proposed roads in the project area.

Resource roads. These normally are spur roads that usually provide point access. Roads servicing communication sites, BLM range improvements, and oil and gas exploration usually fall within this classification. The road has a design speed of 15 to 30 miles per hour (mph) and is constructed to a minimum subgrade of 16 feet (12 feet minimum full surfaced travelway) with intervisible turnouts.

A subcategory of "resource road" is titled "Special Purpose Road." Special purpose roads are designed for light travel and low speed (5 to 10 mph) and are used through and

within recreation areas and special use areas. The design criteria are intended to protect and enhance the existing esthetic, ecological, environmental, and cultural amenities within the area.

Local roads. These minimum volume roads usually provide the internal access network within an oil field, timber sale area, recreation area, etc. The design speed is 20 to 50 mph and the subgrade width is normally 24 feet (20 feet surfaced travelway). Low volume, local roads in mountainous terrain may be single lane roads with turnouts.

Collector roads. These roads normally provide primary access to large blocks of land and connect with or are an extension of a public road system. Collector roads usually require application of the highest standards used by the Bureau. The design speed is 30 to 50 mph and the subgrade width is a minimum of 24 feet (20 feet surfaced travelway).

Existing Access

Existing access to and in the project area is displayed in Map TBD. Access routes to the project area will include I-80 in the south, U.S. Highway 30 through the center, U.S. Highway 189 in the northwest, and State Highway 372 in the northeast. Access within the project area boundary will be via the existing road network, which consists of aerial (local) roads and individual well access roads (resource roads).

Transportation Planning Procedures

The Operators anticipate access road construction for the proposed project will consist of building additional BLM resource roads only. In planning and constructing new roads, the Operators will follow the following procedure:

1. The Operators and the BLM/appropriate surface management agency will evaluate the condition and projected use of existing roads.
2. The Operators will determine an initial access route in consideration of existing data.
3. The Operators and the BLM/appropriate surface management agency will verify the suitability of the initial access route in the field during the onsite inspection and finalize the route.
4. The Operators and the BLM/appropriate surface management agency will determine the road construction standards.

Evaluation of Existing Roads

Existing local roads will be used for primary access to future locations. In 2005, the Operators collected global positioning system (GPS) data locating the resource roads within the project area. These data were collected and updated within the past two years (2006, 2007) using hand-held GPS devices with a typical positional accuracy of approximately 20 feet. The data were not field-collected in a systematic mapping procedure and not tied to BLM GIS layers. These data can be overlain on a DeLorme map of the project area and translated into a Geographic Information System (GIS) layer.

The existing roads currently in use will be evaluated by the Operators, the BLM, and the counties, as applicable, to meet agency/county standards and transportation and development needs and to ensure safe travel conditions. Roads that are not needed for current or future operations will be reclaimed.

Existing roads that require upgrades to accommodate project operations will be upgraded if necessary to meet the anticipated use levels. Existing roads that require upgrading will meet standards appropriate to the anticipated traffic volume and all weather road requirements. Upgrading may include ditching, drainage, graveling, crowning, and capping the roadbed as necessary to provide a well-constructed, safe roadway. Upgrading will not occur during muddy conditions.

Planning Future Access

Well spacing regulations of the Wyoming Oil and Gas Conservation Commission may result in well pads that are not immediately adjacent to existing roads. Most new road construction will likely consist of short segments that will tie a well site to an existing BLM local or resource road.

The Operators will site future well locations in consideration of probable geologic and reservoir data. The Operators will use all available data, including the GIS data and/or aerial photographs, if available, to determine well pad locations more effectively and efficiently, prior to verification of locations on the ground. The Operators will consider topography, floodplains, existing roads, and geologic parameters.

The Operators will evaluate alternate routes, if necessary, to ensure that the selected route meets the management needs of the applicable agency or landowner. The appropriate parties will subsequently perform a field review at the onsite inspection to verify the selection.

Field Verification

Final routes for future wells and their access roads will be determined at the onsite inspection. If private land must be crossed, permission will be secured from the landowner prior to field verification. The Operators and the appropriate authorities/landowner will consider the following when finalizing the access routes:

- Terrain and slope;
- Surface drainage;
- Soils data;
- Types of load;
- Improvements, such as culvert installation and placement;
- Existing installed features, such as fences used for grazing management;
- Road surface material;
- Upgrades to existing access routes; and
- Pipeline placement.

The Operators will incorporate best management practices when planning new roads in consideration of soil characteristics, and potential for erosion, among other factors. The onsite inspection will result in the determination of site-specific environmental protection measures, which will be applied to the Application for Permit to Drill (APD).

Road Construction Standards and Management

The Operators will construct all-weather BLM resource roads to provide access to individual well sites from the Moxa local roads. New road construction or reconstruction will be suitable for the intended use and will comply with BLM road and safety standards. New roads will comply with the requirements of BLM Manual 9113 – Roads (Appendix A), the Wyoming State Supplement, and other sections of the BLM Manual where appropriate, such as Section 9112 – Bridges and Major Culverts. Drawings will be prepared according to BLM Manual 9102 – Facility Design and the Wyoming State Supplement (Appendix B). Figure B-1 displays a road schematic illustrating road features.

The Operators will determine the appropriate road type and associated road design standards based on the expected traffic volume and other factors, such as seasonal or year-round use, vehicle use, soil types, rainfall, topography, construction costs, compatibility with other resource values, and safety. In general, resource roads will be crowned, ditched, and graveled and maintained in accordance with BLM specifications for resource roads, or to current or better conditions. A typical road cross section is shown in Figure B-2. A typical cut-and-fill drawing for road construction is shown in Figure B-3. A road design with specifications will be prepared and provided by a licensed professional engineer for each new road to be constructed that exceeds 300 feet in length.

Source of Construction Materials

All construction materials for project access roads would consist of native borrow and soil accumulated during road construction. If additional construction materials are required for surfacing of the drill pad and access road, they will be obtained from a contractor having a permitted source of materials within the general area.

Technical Requirements for Roads

Each new road will be designed and constructed according to its location, use, and management requirements. The Operators will apply appropriate technical construction procedures drawn from the Gold Book (relevant exerts in Appendix C), BLM Manual 9113 (Appendix A), State of Wyoming Supplement (Appendix B), with clarification from the Rock Springs BLM Field Office Engineer if needed, according to site-specific requirements. Table B-1 contains a matrix of technical requirements typically used on BLM roads.

Site-specific design requirements that will be applied to new roads will be performed after a particular route is determined. Site-specific design elements that will be considered prior to construction will include:

- Horizontal and vertical alignment;
- Rating for degree of curve and curve super elevation;
- Sight distances for horizontal and vertical curves;
- Cross-section elements;
- Earthwork design;
- Drainage elements, such as culverts;
- Cattleguards; and
- Signs and markers.

Vehicle Use

Resource roads will be designed to accommodate light vehicles and trucks or heavy vehicles. Light vehicles include automobiles, vans, pickup trucks, or other small vehicles used for personnel transport. Trucks or heavy vehicles include all trucks used to transport equipment or freight or trucks mounted with special equipment. Trucks do not include light vehicles and display axle weights less than 32,000 pounds and gross weights less than 80,000 pounds. Trucks with overweight or overwidth permits may require alternate routes.

The roadway structure, which includes the subgrade, the subbase course (in some cases), and the base course or base course used as a surface course in the case of graded earth roads, will be strong enough to support H-20 loadings (AASHTO specification), as required by BLM specifications.

Vehicle speeds will be limited by the intended road classification and use, as specified in BLM Manual 9113 – Roads. Resource roads will be designed for minimal speeds of 15 to 30 mph. The project area contains no high speed roads.

Construction

All access road construction for roads greater than 300 feet will be in accordance with a road design submitted to the BLM for approval as part of the APD approval process. If a well is productive, gathering lines will generally be installed adjacent to the new roads unless otherwise specified in the APD. A schematic of a typical roadway schematic is shown in Figure B-1. Maps of existing and proposed access routes and roads to be upgraded will be included in the APD.

Road construction will consist of:

- Staking the road;
- Modifying construction procedures if construction operations were to occur during the winter months to minimize environmental damage;

- Clearing the right-of-way;
- Stripping the topsoil;
- Grading and drainage feature construction; and
- Performing interim reclamation.

After APD approval, a road will be staked according to the design plan. Construction staking consists of determining finished site elevations, cut and fill slopes and their respective catch points, drainage, balanced earthwork and other features such as stabilization fabric locations. During the staking process, Public Land Survey System monuments will be located and protected from damage. Staking will be approved by the BLM at the onsite inspection prior to construction activities. Approximately 40 feet of route width will be cleared to allow construction of a 20-foot travelway, adjacent borrow ditches, and other structures that may be part of the road.

The road route will be cleared, grubbed, trimmed, and vegetation will be removed. Vegetation will be retained and preserved to the extent practicable to ensure safe travel by personnel and equipment. All debris, trees, stumps, roots, and other protruding vegetative material within the clearing limits would be cleared according to BLM specifications.

Six inches of topsoil will be stripped from the disturbed area and deposited in a windrow apart from other excavated materials. After excavation, the resulting slopes and borrow ditches will be shaped and smoothed. The piled topsoil will then be spread over the exposed subsoil outside of the travelway and revegetated as part of interim reclamation.

Road subgrades for resource roads in the project area are typically 40 feet in width. The running surface of access roads is approximately 16 feet. Access road lengths will vary according to the location of a specific well and its relation to the existing road network.

Drainage features would include either appropriately hardened low water crossings or culverts, constructed per Gold Book standards. Culverts would be constructed of corrugated metal pipe with an appropriately sized diameter.

During the onsite, soil conditions will be evaluated to determine their ability to support construction and operations loads. Soils properties will be evaluated in consideration of the soil samples taken and analyses performed in support of this project. Gravel will be applied to the road surface where needed. In general, gravel surfacing will vary in thickness according to a road's design specifications. Table B-2 shows the grading requirements for soil-aggregate materials.

Maintenance

The Operators will be responsible for preventative and corrective road maintenance for its resource roads throughout the duration of the project. Normal road maintenance activities include monitoring, blading, surface replacement, dust abatement, spot repairs, slide removal, ditch cleaning, culvert cleaning, litter cleanup, noxious weed control, and snow removal. The Operators will blade only where necessary. Blading will be avoided across established grass and forb vegetation in ditches and areas adjacent to roads.

Crowns and outslopes will be maintained to keep water off the road. The use of telemetry will reduce traffic volume associated with well maintenance operations.

Reclamation

The Operators will plan for interim and final reclamation prior to construction to achieve successful future reclamation by submitting a reclamation plan as part of its Surface Use Plan of Operations in the APD.

Interim reclamation

The Operators will perform interim reclamation on all disturbed areas, where appropriate. Interim reclamation is required of any disturbed surface that is not necessary for long-term production operations. Interim reclamation minimizes the environmental impacts of development on other resources and uses by reestablishing vegetation to restore habitat, forage, scenic resources, and reduce soil erosion and maintenance costs. Interim reclamation actions will be monitored for effectiveness, and the Operators will act to ensure the viability of interim reclamation actions.

Interim reclamation will follow the procedures developed by the reclamation professional as described in the Operator's reclamation commitment. It will consist of minimizing the footprint of disturbance by reclaiming all portions of the well site and road not needed for production operations. The portions of the cleared well site and access road not needed for operational and safety purposes will be recontoured to a final or intermediate contour that blends with the surrounding topography as much as possible. Damage from erosion will be repaired after grading is completed and prior to seeding. Gullies will be filled, and irregularities will be smoothed. Crusted surfaces will be scarified at right angles to the plane of the slope. Cut slopes, fill slopes, and borrow ditches will be covered with topsoil and seeded.

Final reclamation

The long-term objective of final reclamation is to facilitate eventual ecosystem restoration, including the restoration of the natural vegetation community, hydrology, and wildlife habitats. At well abandonment or if a road no longer is required for operations, the Operators will reclaim the road according to the APD reclamation plan or to the reclamation procedures developed as a result of the Operators' reclamation commitment unless the surface management agency or surface owner requests that it be left unreclaimed.

Unless otherwise directed, final reclamation generally will include recontouring the road back to the original contour, seeding, controlling noxious weeds, and may also include other techniques to improve reclamation success, such as ripping, scarifying, replacing topsoil, placing waterbars, pitting, mulching, redistributing woody debris, and barricading. Site preparation will include respreading topsoil to an adequate depth, and may also include ripping, tilling, disking on contour, and dozer track-imprinting. Culverts and other drainage control devices will be removed.

Disturbed areas will be revegetated after the site has been satisfactorily prepared. Seeds of native, perennial species, or other plant materials specified by the surface management agency or surface owner, will be used. Seeding will typically be accomplished by drilling on the contour where practical or by other approved methods. If waterbars were used, they will be removed and seeded following successful revegetation. Culverts, if used, will also be removed.

The Operators will construct barriers to discourage vehicle travel on the abandoned roadbed. Revegetation will continue until an acceptable level of success is determined by the BLM.

Plan Maintenance

The Operators will update the Moxa Transportation Plan annually by the end of January by providing the BLM with current information as conditions change with project implementation.

Updated data will include:

- GPS data of the locations of all newly constructed access roads and well pads.
- GPS data of the locations of reclaimed roads.

Summary

The Moxa Transportation Plan is intended to document procedures for the identification of possible access routes that meet the objectives of the BLM, private surface owner, and the needs of the public. The transportation planning process is intended to consider future road use needs, including public access and resource development or use and affected resource values and safety. The goal of the Operators is to avoid haphazard or unnecessary development of roads in the Moxa project area. This plan develops and documents road location and design criteria.

References

Bureau of Land Management (BLM). 1991. BLM Manual Supplement 9113 Roads, Release 9-16. Wyoming State Office. Cheyenne, Wyoming.

Bureau of Land Management (BLM). 1985. BLM Manual 9113 Roads, Release 9-247. U.S. Department of the Interior. Washington D.C.

U.S. Department of the Interior and U.S. Department of Agriculture (USDI and USDA). 2007. Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, the Gold Book. BLM/WO/ST-06/021+3071 Bureau of Land Management. Denver, Colorado. 84

Appendix A

BLM Manual 9113 – Roads

Insert Manual 9113 here

Appendix B

Wyoming State Supplement to BLM Manual 9113

Wyoming State Supplement to BLM Manual 9113

In March 1991, the Wyoming BLM issued the Wyoming State Supplement to the Bureau 9113 Manual. The supplement amends the national guidance regarding road construction within Wyoming on BLM lands. The Operators will conduct its operations in accordance with the policy changes detailed in the Wyoming Supplement. These changes are included in their entirety below.

.06 Policy.

A. Roads constructed on BLM land will be constructed to the approved standard required for its intended use. Roads constructed on Bureau land will meet the minimum standards listed in Bureau Manual 9113. This applies to roads constructed by the BLM, other Federal agencies, State government, and energy companies and other private organizations.

Any exception to the Bureau road standards must be authorized by the District Manager with concurrence by the State Office Chief, Branch of Engineering and Support Services. The exception must be based on an engineering evaluation approved by a qualified road designer. The evaluation will be certified by a Chief, Branch of Engineering and Support Services, that the road will not create a foreseeable safety hazard for the user.

F. Bureau Manual 9113 requires that all roads constructed or reconstructed by nongovernmental entities across public lands must be designed by or under the direction of a licensed professional engineer. In Wyoming the licensed professional engineer is also responsible to assure that the construction of the road meets design criteria and is constructed to Bureau standards.

The BLM District Engineer will approve and sign all plans for new construction or major reconstruction submitted by nongovernmental entities. In addition, where a road is developed by other parties but will eventually be under the control and maintenance responsibility of the Bureau, the BLM District Engineer will review the route proposals and approve the road standards and route location.

M. The BLM in Wyoming requires, as a minimum standard, all cattleguards, bridges, other structures, etc., will have a minimum curb-to-curb width or rail-to-rail width (whichever is less) of 14 feet for single lane roads and 24 feet for double lane roads, but in all cases not less than the nominal width of the adjacent travelway as measured at right angles to the travelway centerline. All structures will be designed for a minimum of a H-20 loading. These standards apply to all roads constructed or upgraded on public lands.

Bridges and major culverts constructed on public lands will conform to Bureau standards as outlined in Bureau Manual 9112, including being designed by or under the direction of a qualified registered professional engineer.

Bureau Manual 9113 does not recognize temporary or nonstandard roads. In the past the oil and gas industry has been allowed to construct temporary roads with the minimum width necessary for exploration to minimize surface disturbance by limiting the amount of cut and fill. The minimum geometric standard (temporary road) for oil and gas exploration roads is a "resource road" classification. A standard below the resource road classification may only be constructed for short duration use (30 to 60 days) and should not service traffic during the winter and spring months.

In most cases, flat-bladed roads develop into canals and are a hazard to the user as well as creating environmental problems. Flat-bladed roads will not be authorized in Wyoming. The exception to this rule will be for the lowest class resource road where upgrading of short segments of an existing route is planned, i.e., excavating a hump for better site distance, widening a curve, etc.

In Wyoming, Bureau roads are designed, constructed, and/or upgraded for long-term use and are to be located, designed, and constructed to provide safety to the user and require the minimum amount of maintenance. Adequate design and construction of drainage structures, cut and fill slopes, and the travelway will minimize future maintenance needs. The Bureau will not accept roads constructed by others which require excessive maintenance expenditures by the Bureau.

.16 **Functional Classification.** The BLM in Wyoming defines the three classes of Bureau roads as:

A. **Collector Roads.** These roads normally provide primary access to large blocks of land and connect with or are an extension of a public road system. Collector roads usually require application of the highest standards used by the Bureau. The design speed is 30 to 50 miles per hour and the subgrade width is a minimum of 24 feet (20 feet surfaced travelway).

B. **Local Roads.** These minimum volume roads usually provide the internal access network within an oil field, timber sale area, recreation area, etc. The design speed is 20 to 50 mph and the subgrade width is normally 24 feet (20 feet surfaced travelway). Low volume, local roads in mountainous terrain may be single lane roads with turnouts.

C. **Resource Roads.** These normally are spur roads that usually provide point access. Roads servicing communication sites, BLM range improvements, and oil and gas exploration usually fall within this classification. The road has a design speed of 15 to 30 mph and is constructed to a minimum subgrade of 16 feet (12 feet minimum full surfaced travelway) with intervisible turnouts.

A subcategory of Paragraph C is titled "Special Purpose Road." Special purpose roads are designed for light travel and low speed (5 to 10 mph) and are used through and within recreation areas and special use areas. The design criteria are

intended to protect and enhance the existing esthetic, ecological, environmental, and cultural amenities within the area.

.2 **Road Standards.** The following standards are the minimum standards for all roads constructed on Bureau land in Wyoming. These standards are values established to ensure adequate uniformity and quality of all roads constructed on lands administered by the Bureau. Number of vehicles (peak ADT), vehicle types, and design speed determine the geometric standards of the road.

Road Element	Single Lane[1]	Double Lane
Width (full surface travelway)	12 feet[2]	20 feet[2]
Average design speed	15-25 mph	25-35 mph
Maximum grade	10%[3]	10%[3]
Minimum radius (feet)	65 feet	100 feet
Normal cut slope (back slope)	2:1	2:1
Normal fill slope	2:1	2:1
Normal ditch (1-foot deep)	4:1	4:1

1 Requires turnouts.
[2] The taper of the surfacing material is a minimum of 4:1. Subbase width for single lane roads is never less than 16 feet. Travelway width increases along curves, with increased fill height, etc.
[3] Any grade above 8% requires a complete engineering analysis.

.31 **Route Analysis.** In Wyoming the District Engineer is required to sign off on the route analysis for all roads proposed for construction and reconstruction. The sign off will state that the proposed route will not create a safety hazard and the road can be constructed to Bureau standards on the selected route.

.4 **Design.** The District engineer will review and approve all road designs including proposed construction or reconstruction related to oil and gas, mining, realty, timber production, and other resource uses. The approval will be in the form of an approval certificate stamped on the cover sheet of the plans or a letter to the file.

The survey and design requirements will vary with the slope of the project. Projects that are small in scope will not require the same level of survey and design as the more complex projects. The District engineer will assist the applicant in determining the survey and design requirement so as to minimize cost while assuring that the road is safe for the user and meets Bureau standards.

.41 **Design Technology.**

C. **Computer Design**. Computer design will be required for all BLM constructed roads. The RDS, DCA, and Lumber Jack are suitable design programs. Use of other computer road design packages will be approved by the State Office Chief, Branch of Engineering and Support Services, prior to its application.

.44 Surveys and Investigations

Aerial Surveys. The BLM in Wyoming will normally contract for low level photography for use in road design on major BLM road construction and reconstruction projects exceeding one mile in length.

.45 Design Guidelines

Aggregate Surfacing. Unless otherwise specified, aggregate for untreated subbase and base material will meet the grading requirements for Grading W as outlined in the Wyoming Highway Department specifications for road and bridge construction (See Table B-2).

.51 Staking. The requirements for construction staking will be determined by the District engineer and vary with the class of the road and complexity of the terrain. All roads will have, at a minimum, the centerline staked at a maximum of 100-foot stations. The location for all structures including culverts, catteguards, bridges, etc., will be staked. Slope stakes will normally be required for any construction requiring side casting or end haul.

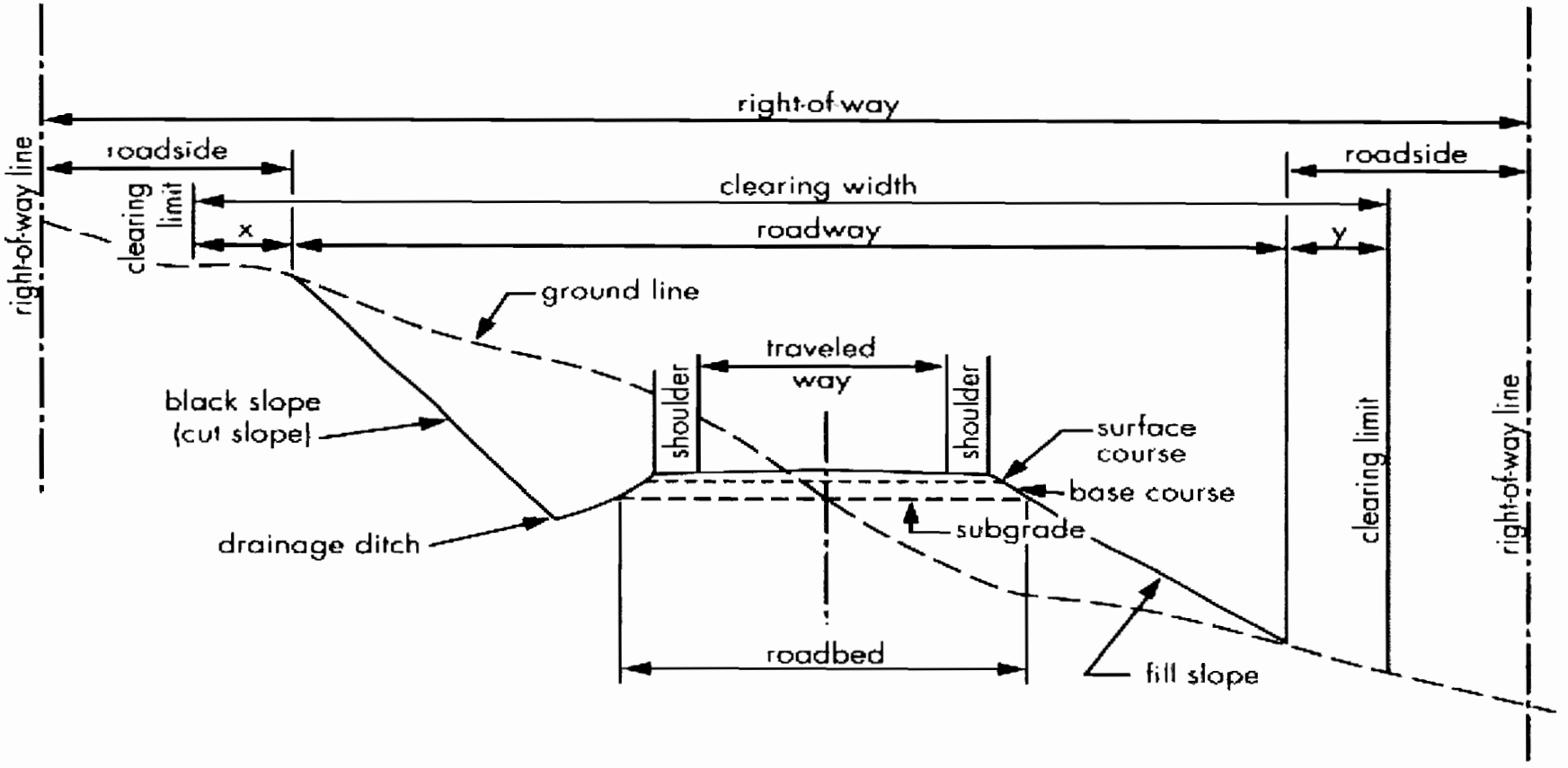
Technical Requirements for Roads

Technical specifications described in Table B-1 or other requirements specified by the Rock Springs Field Office will be used as a basis for all new road construction on BLM lands.

Table B-1: Technical Requirements for Roads

Functional Classification	Estimated 20-yr ADT	Terrain	Design Speed		Travelway Width (a)		Maximum Grade		Subgrade Width (a+2b)	Taper Width (b)	Cut Section Side Ditch	Vertical & Horizontal Alignment
			Pref	Min	Pref	Min	Pref	Min				
Resource	Less than 20	level & rolling	30	*	14	*	8	10	(normally) Travelway width + Twice the taper width of surfacing materials	(normally) Taper slope = 4:1 Taper width = surface depth x 4	Slope from edge of subgrade to bottom of ditrch = 4:1. Distance from edge of subgrade to bottom of ditch = 4 feet. From bottom of ditch, side of ditch slopes upward the same as side cut slope.	For vertical & horizontal alignment parameters, see BLM Manual #9113 – Roads.
		mountainous	15	*	14	*	8	10				
Local	Less than 100	level & rolling	40	30	20	20	6	10				
		mountainous	20	15	14	12	8	15				
	More than 75	level & rolling	50	40	24	20	6	10				
		mountainous	30	15	24	20	8	14				
Collector	50-100	level & rolling	50	30	24	20	6	8				
		mountainous	30	20	20	20	8	12				
	More than 100	level & rolling	50	40	24	20	6	8				
		mountainous	30	20	24	20	8	12				
Recommended earth side slopes for BLM roads:		Height of cut or fill in feet: 0 – 4 4 – 10 Over 10			Level or rolling terrain 4:1 3:1 2:1				Mountainous terrain 3:1 2:1 1.5:1		See BLM Manual #9113 for additional information.	

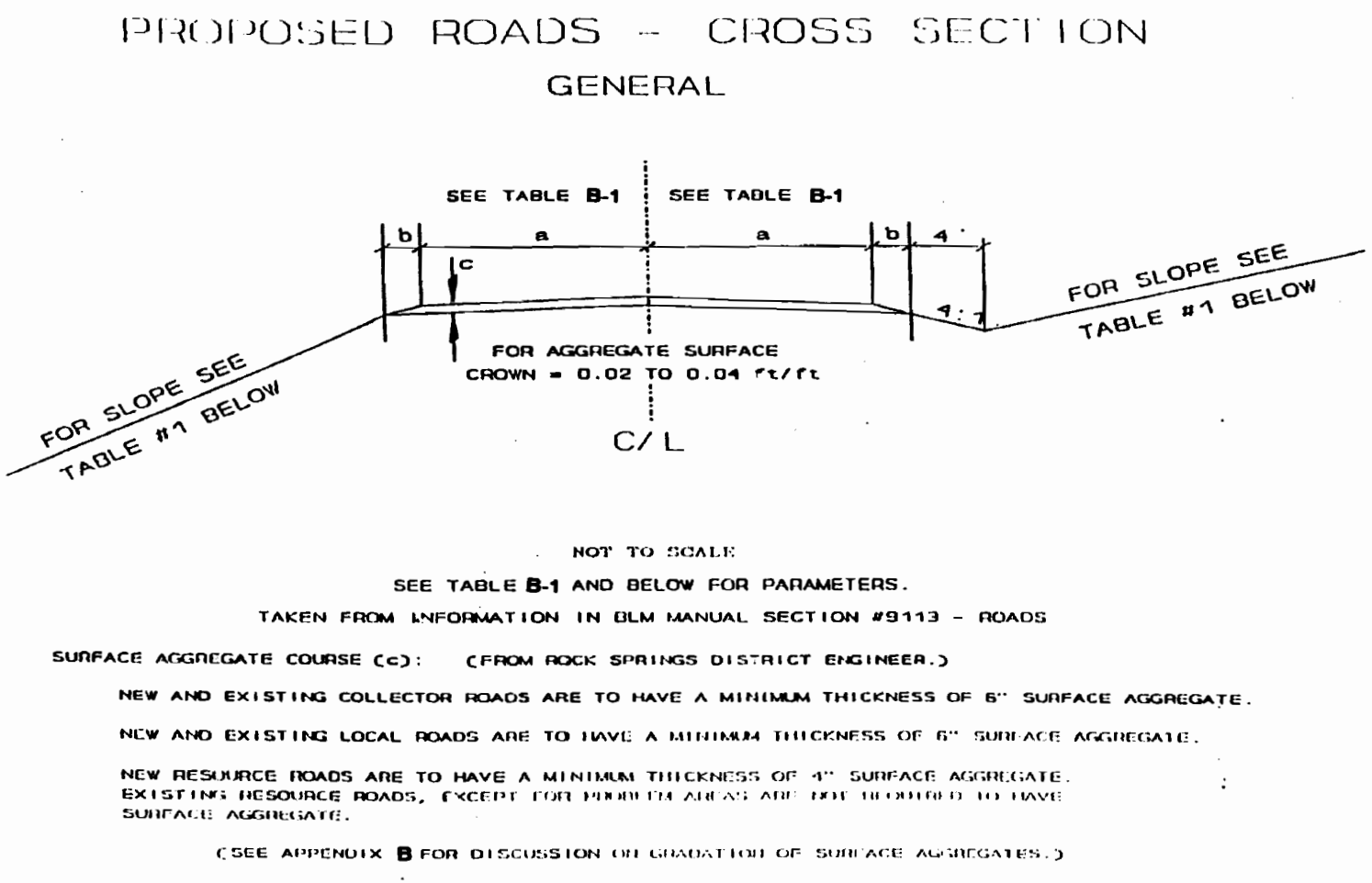
Source: BLM, 1992



Note: Shapes and dimensions will vary to fit local conditions
See drawings for typical sections
x and y denote clearing outside of roadway

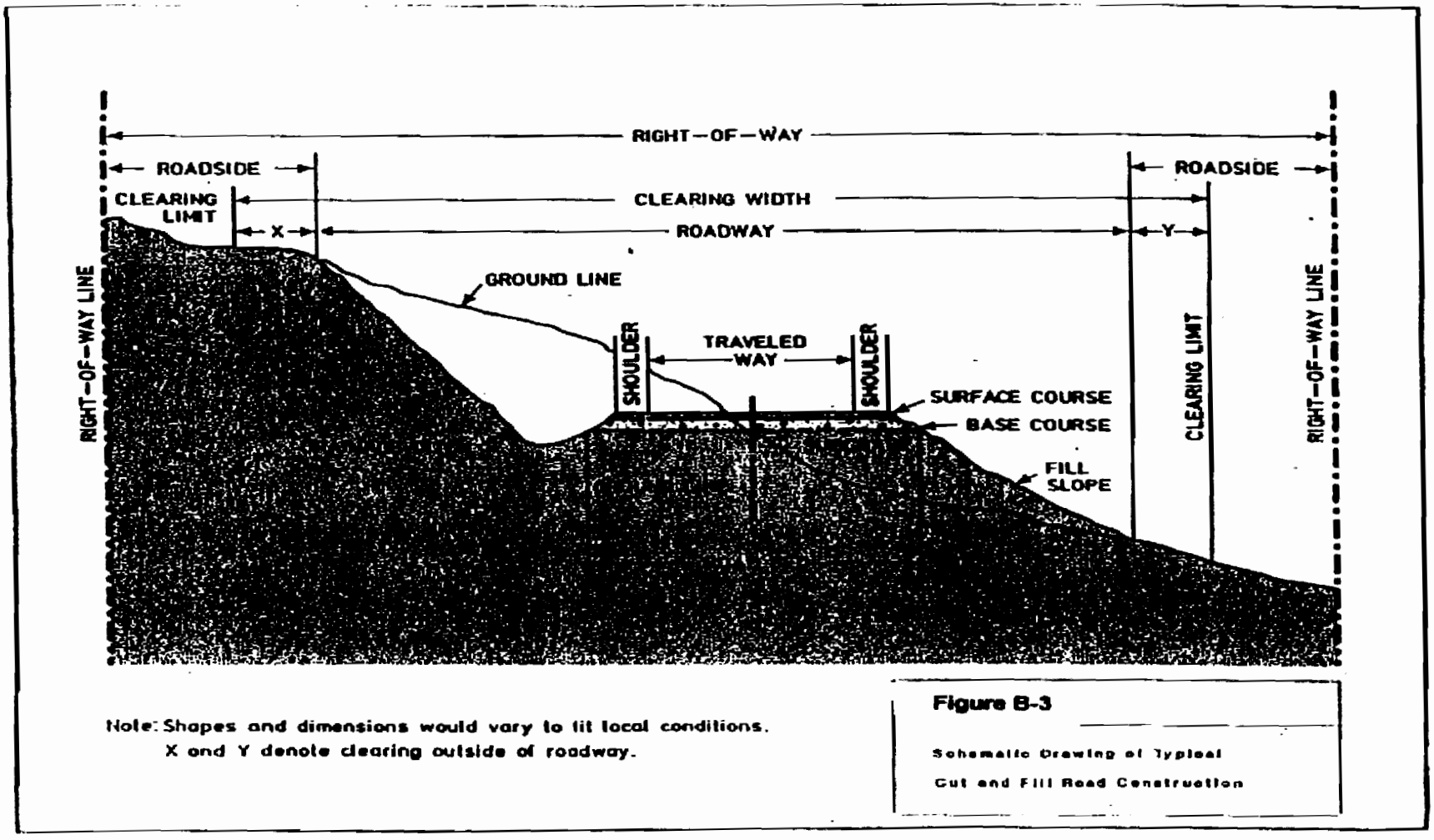
Source: BLM, 1992

Figure B-1: Roadway Schematic



Source: BLM, 1985

Figure B-2: Typical Resource Road Cross Section



Source: BLM, 1992

Figure B-3: Typical Cut and Fill Road Construction

Appendix C

Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, the Gold Book (Exerts)

Gold Book (Exerts)

Note: The text that follows are exerts from the Gold Book. For complete description of construction specifications and accompanying drawings, please refer to the actual text.

Basic Design Requirements for BLM Resource Roads

The surface management agency will provide requirements specific to proposed oil and gas roads during project planning and/or at the onsite review with consideration of safety, impacts on land and resources, and cost of transportation. Requirements for specific proposals may vary somewhat from the generalized requirements that follow.

- Design speed specific to oil and gas roads is 15 to 30 miles per hour.
- Preferred travelway width is 14 feet with turnouts. For the FS, this can vary from two parallel vehicle tracks, bladed 12-foot sections with turnouts, or a broader defined overland corridor approved by the surface management agency.
- Recommended minimum horizontal curve radii is determined by the design vehicle and design speed. Where terrain will not allow the proper curve radii, curve widening is necessary. Specifications are available from the surface management agency.
- Road gradient has a major effect on the environmental and visual impact of a road, particularly in terms of erosion. The gradient should fit as closely as possible to the natural terrain, considering vehicle operational limitations, soil types, environmental constraints, and traffic service levels. The gradient should not exceed 8 percent except for pitch grades (300 feet or less in length) in order to minimize environmental effects. In mountainous or dissected terrain, grades greater than 8 percent up to 16 percent may be permissible with prior approval of the surface management agency.
- The primary purpose of turnouts is for user convenience and safety and to maintain user speed. Turnouts are generally naturally occurring, such as additional widths on ridges or other available areas on flat terrain. On roads open to the public, turnouts must be located at 1,000-foot intervals or be intervisible, whichever is less.
- Drainage control must be ensured over the entire road through the use of drainage dips, insloping, natural rolling topography, ditch turnouts, or culverts. Ditches and culverts may be required in some situations, depending on grades, soils, and local hydrology. If culverts or drainage crossings are needed, they should be designed for a 25-year or greater storm frequency, without development of a static head at the pipe inlet.
- Gravel or other surfacing is not always required, but may be necessary for "soft" road sections, steep grades, highly erosive soils, clay soils, or where all-weather access is needed.
- At times, a limited number of oil field vehicles (critical vehicles) larger than the design vehicle may make occasional use of the road. The operator should consider these needs in road design.

Field Survey Requirements

Field survey requirements vary with topography, geologic hazard, potential for public and recreational use, or other concerns. Each surface management agency has survey requirements based on design requirements and concerns specific to the area. The surface management agency should be contacted as early as possible to determine the survey requirements. The following general requirements are imposed to control work and produce the desired road.

- A flagline is established along the construction route. Flags should be placed approximately every 100 feet, or be intervisible, whichever is less.
- Construction control staking may be required depending on conditions of the site.
- Culvert installations are located and staked.

Design Drawings and Templates

- On side slopes of 0 to 20 percent, where horizontal and vertical alignment can be worked out on the ground, a plan and profile drawing may not be required. Standard templates, drainage dip spacing, culvert locations, and turnout spacing guides would be acceptable.
- A plan and profile view would be the minimum drawing required on steeper slopes and in areas of environmental concern. The drawing should identify grade, alignment, stationing, turnouts, and culvert locations.
- Standard templates of road cross-sections and drainage dips are required for all resource, local, and higher-class roads.
- Additional information may be required in areas of environmental or engineering concern.

Construction

The operator must take all necessary precautions for protection of the work and safety of the public during construction of the road. Warning signs must be posted during blasting operations.

Clearing and Grubbing

Clearing and grubbing will normally be required on all sections of the road. Exceptions would be allowed in areas of sparse, non-woody vegetation.

All clearing and grubbing should be confined to a specified clearing width , which is usually somewhat wider than the limits of actual construction (roadway). Branches of all trees extending over the roadbed should be trimmed to provide a clear height of 14 feet above the roadbed surface. All vegetative debris must be disposed of as specified by the surface management agency.

Excavation

All soil material and fragmented rock removed in excavation is to be used as directed in the approved plan. Excess cut material shall not be wasted unless specified in the approved plan.

Roadbed Construction

Roadbed material should not be placed when the materials or the surface are frozen or too wet for satisfactory compaction. Equipment should be routed over the layers of roadbed material already in place to help avoid uneven compaction anywhere along the travel route. Borrow material shall not be used until material from roadway excavation has been placed in the embankments, unless otherwise permitted. Borrow areas used by the operator must be approved prior to the start of excavation.

Roadside ditches should conform to the slope, grade, and shape of the required cross-section with no projections of roots, stumps, rocks, or similar debris. Side ditches must be excavated to a depth of 1-foot minimum below the finished road surface. Drainage turnout spacing on these ditches should not exceed 500 feet; slopes greater than 5 percent may require closer spacing of turnout furrows (wing ditches or relief ditches).

Road Maintenance

Maintenance activities normally required include monitoring, blading, surface replacement, dust abatement, spot repairs, slide removal, ditch cleaning, culvert cleaning, litter cleanup, noxious weed control, and snow removal. When applicable, specific areas shall be identified in the road maintenance plan for disposal of slide material, borrow or quarry sites, stockpiles, or other uses that are needed for the project.

Key maintenance considerations include regular inspections; reduction of ruts and holes; maintenance of crowns and outslopes to keep water off the road; replacement of surfacing materials; clearing of sediment blocking ditches and culverts; maintenance of interim reclamation; and noxious weed control.

Conduct additional inspections following snowmelt or heavy or prolonged rainfall to look for drainage, erosion, or siltation problems. Blade only when necessary and avoid blading established grass and forb vegetation in ditches and adjacent to the road. Ensure that maintenance operators have proper training and understand the surface management agency's road maintenance objectives.

Road Drainage

The most economical control measure should be designed to meet resource and road management objectives and constraints. The economic considerations should include both construction and maintenance costs. The need for drainage structures can be minimized by proper road location. However, adequate drainage is essential for a stable road. A proper drainage system should include the best combination of various design

elements, such as ditches, culverts, drainage dips, crown, in-slope or out-slope, low-water crossings, subsurface drains, and bridges.

Surface Drainage

Surface drainage provides for the interception, collection, and removal of water from the surface of roads and slope areas. The design may need to allow for debris passage, mud flows, and water heavily laden with silt, sand, and gravel. Culverts should be designed in accordance with applicable practices adopted by State and Federal water quality regulators under authority of the Federal Clean Water Act (CWA). Culverts should accommodate a 10-year flood without development of a static head and avoid serious velocity damage from a 25-year flood.

Subsurface Road Drainage

Subsurface drainage is provided to intercept, collect, and remove groundwater that may flow into the base course and subgrade; to lower high water tables; or to drain locally saturated deposits or soils.

Drainage Structures

Proper location and design can provide economical and efficient drainage in many cases. However, structural measures are often required to ensure proper and adequate drainage. Some of the most common structures are drainage dips, ditches, road crowning, culverts, and bridges.

Drainage Dips

The primary purpose of a drainage dip is to intercept and remove surface water from the travelway and shoulders before the combination of water volume and velocity begins to erode the surface materials. Drainage dips should not be confused with water bars, which are normally used for drainage and erosion protection of closed or blocked roads. Spacing of drainage dips depends upon local conditions such as soil material, grade, and topography. The surface management agency should be consulted for spacing instructions.

Ditches

The geometric design of ditches must consider the resource objectives for soil, water, and visual quality; maintenance capabilities and associated costs; and construction costs. Ditch grades should be no less than 0.5 percent to provide positive drainage and to avoid siltation. The types of ditches normally used are drainage, trap, interception, and outlet.

Road Crowning

Roads that use crowning and ditching are common and can be used with all road classes, except non-constructed roads. This design provides good drainage of water from the surface of the road.

Culverts

Culverts are used in two applications: in streams and gullies to allow normal drainage to flow under the travelway and to drain inside road ditches. The latter may not be required if drainage dips are used. The location of culverts should be shown on the plan and profile or similar drawings or maps submitted with the APD.

All culverts should be laid on natural ground or at the original elevation of any drainage crossed, except as noted for ditch relief culverts.

Culverts should have a minimum diameter of 18 inches. The diameter should be determined by the anticipated amount of water that would flow through the culvert. Factors to be considered include the geographic area being drained, soils and slopes in the drainage area, annual precipitation, and likely storm events.

The outlet of all culverts should extend at least 1 foot beyond the toe of any slope. It may be necessary to install rip-rap or other energy dissipation devices at the outlet end of the culvert to prevent soil erosion or trap sediment.

Ditch Relief Culverts

Ditch relief culverts are installed to periodically relieve the ditch line flow by piping water to the opposite side of the road where the flow can be dispersed away from the roadway. The spacing of ditch relief culverts is dependent on the road gradient, soil types, and runoff characteristics.

A culvert with an 18-inch diameter is the minimum for ditch relief to prevent failure from debris blockage.

The depth of culvert burial must be sufficient to ensure protection of the culvert barrel for the design life of the culvert. This requires anticipating the amount of material that may be lost due to road use and erosion.

Ditch relief culverts can provide better flow when skewed with an entrance angle of 45 to 60 degrees with the side of the ditch. The culvert gradient should be greater than the approach ditch gradient. This improves the flow hydraulics and reduces siltation and debris plugging the culvert inlet. Culverts placed in natural drainages can also be used for ditch relief.

Wetland Crossings

Wetlands are especially sensitive areas and should be avoided, if possible. Generally, these areas require crossings that prevent unnatural fluctuations in water level. Marshy and swampy terrain may contain bodies of water with no discernible current. The design of culverts for roads crossing these locations requires unique considerations. Construction of some wetland crossings may require a Section 404 Corps of Engineers permit in addition to the approval of the surface management agency.

The culvert should be designed with a flat grade so water can flow either way and maintain its natural water level on both sides. The culvert may become partially blocked by aquatic growth and should be installed with the flowline below the standing water level at its lowest elevation. Special attention must be given to the selection of culvert materials that will resist corrosion.

Road Reclamation

Interim reclamation consists of reclaiming portions of the road not needed for vehicle travel. Wherever possible, cut slopes, fill slopes, and borrow ditches should be covered with topsoil and revegetated to restore habitat, forage, scenic resources, and to reduce soil erosion and maintenance costs.

At abandonment, roads must be reclaimed by the operator unless the surface management agency or surface owner requests that they be left unreclaimed.

Final reclamation includes recontouring the road back to the original contour, seeding, controlling noxious weeds, and may also include other techniques to improve reclamation success, such as ripping, scarifying, replacing topsoil, placing waterbars, pitting, mulching, redistributing woody debris, and barricading.

Seeds of native, perennial species or other plant materials specified by the surface management agency or surface owner must be used. If waterbars were used, they should be removed and seeded following successful revegetation.

Appendix D

Maps

Map D-1: Moxa Project Area

Map D-2: Existing Moxa Area Roads