
KEMMERER
PROPOSED RESOURCE MANAGEMENT PLAN AND
FINAL ENVIRONMENTAL IMPACT STATEMENT

Appendix S

Addendum to the Reasonable Foreseeable Development
Scenario for Oil and Gas

Introduction

The following report was prepared by the BLM Wyoming State Office Reservoir Management Group at the request of the Kemmerer Field Office as the basis for considering changes to Alternative B in response to public comments on the Draft RMP and EIS. At least twelve individuals and organizations requested in their comments letters that BLM consider limiting leasing and development to protect wildlife habitat in the areas containing large contiguous blocks of sagebrush, mountain shrub, and aspen habitat on BLM-administered surface. The expansion of constraints was requested to reduce the potential effects of habitat fragmentation on sage-dependent species, such as pygmy rabbit, sagebrush obligate migratory birds, and sage-grouse.

Other public comments requested that BLM consider protecting the sagebrush, mountain shrub, and aspen habitat within the contiguous blocks of BLM-administered surface by allowing lease sales with no surface occupancy (NSO) stipulations, which would limit surface disturbance while allowing development and extraction of fluid minerals.

To adequately address the public comments and requests for additional analyses in the Proposed RMP and Final EIS, the BLM Reservoir Management Group was asked to project the reductions in potential well numbers that would result from the designating the contiguous BLM-administered contiguous habitat either unavailable for leasing or available for leasing with an NSO stipulation. The following addendum to the 2006 Reasonable Foreseeable Development Scenario (BLM 2006) was developed to use as a basis for analysis of the additional constraints under Alternative B and a new proposed NSO alternative, called Alternative B1 that is evaluated further in Appendix Q.

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**KEMMERER UNLEASED FEDERAL LANDS
GEOLOGIC OIL AND GAS ANALYSIS
KEMMERER FIELD OFFICE, WYOMING**

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BUREAU OF LAND MANAGEMENT
WYOMING STATE OFFICE
RESERVOIR MANAGEMENT GROUP**

FINAL REPORT

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Summary

A brief geological analysis of the potential for future activity in three blocks of Bureau managed lands was prepared. The potential technical and economic feasibility of directionally and horizontally drilling potential was discussed in a qualitative manner for each block. The projections of the Final Reasonable Foreseeable Development Scenario for Oil and Gas were reviewed. We analyzed their projections for this region and determined that up to 105 wells may not be drilled in the three blocks if presently leased lands remain unleased for the planning period. If these lands are allowed to be leased with a no surface occupancy stipulation, then up to 65 wells may not be drilled. Our projections of potential future undrilled wells for no leasing and no surface occupancy scenarios for each individual block are shown in the attached table and described below.

Introduction

A map was prepared to go with this analysis. It shows all active and abandoned wells, oil and gas fields, Raymond Mountain WSA, selected USGS potential oil and gas targets, selected blocks of land analyzed for this report, the Fortuna U.S. LP Bear Canyon project, Federal oil and gas mineral lands, Federal oil and gas leases within selected blocks of land, and the Bridger – Teton Forest boundary. Areas with significant amounts of presently unleased potential oil and gas lands were divided into three blocks for analysis purposes. For each block we prepared a brief geologic analysis that discusses past drilling activity, potential plays, projections of play potential (further exploration and development activities that could occur), and technical opportunities for directional drilling.

Blocks A and B

The USGS (2004 and 2006b) recently assessed the undiscovered resource of the Wyoming Thrust Belt Province. They predicted that part of the undiscovered resource covering areas that include Blocks A and B could amount to about 39 million barrels of oil, 57 million barrels of natural gas liquids, and 557 billion cubic feet of gas. The USGS found that 20 oil and gas accumulations had been discovered to date and projected that up to 16 additional oil accumulations with more than 0.5 million barrels of oil and up to 28 gas accumulations with more than 3 billion cubic feet of gas could be discovered in the future. Most accumulations are expected to be in a depth range of 11,000 to 12,000 feet (USGS, 2004 and 2006b).

Block A – Townships 25-28 North, Ranges 118 and 119 West

Seven drilled and abandoned wells lie in Block A (see map). Six were drilled in the Absaroka Thrust Play identified by the USGS in its 1995 assessment (Beeman et al, 1996), and one well was drilled in the Crawford-Meade Thrusts Play (lands immediately west of the Absaroka Thrust Play). The one well in the Crawford-Meade Thrusts Play drilled to 8,935 feet in 1962 and was abandoned with no hydrocarbon shows.

Of the six wells drilled in the Absaroka Thrust Play, only one well reported hydrocarbon shows. Those shows were in the Triassic Thaynes Formation and Permian Phosphoria Formation. The earliest well spud (1959) drilled to only 1,010 feet. The other wells were spud between 1965 and 1981 and tested depths of 6,200 to 18,769 feet. The Federal #1-23 in section 23 of Township 25

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North, Range 118 West appears to have drilled through the entire package of Overthrust sediments and encountered the subthrust Cretaceous Bear River Formation at 18,340 feet.

The eastern part of Block A lies within the northernmost part of the Absaroka Thrust Play identified by the USGS in its 1995 assessment (see map). Nearest production lies more than 20 miles south. This portion of the Absaroka Thrust Play in Block B appears to have low potential for the discovery of new economic hydrocarbon reserves.

The western part of Block A (west of the Absaroka Thrust Play) lies within the hypothetical Crawford-Meade Thrusts Play identified by the USGS in its 1995 assessment (see map). The USGS identified the southern part of this play (that area lying in Utah) as having the most potential. The portion of the Crawford-Meade Thrusts Play lying within Block A has very little potential for the discovery of new economic hydrocarbon reserves.

Of the three blocks analyzed, Block A has the lowest potential for the discovery of new hydrocarbon traps, and we would not anticipate interest, other than sporadic exploratory proposals, in this area within the planning period. The projections of the Final Reasonable Foreseeable Development Scenario for Oil and Gas were reviewed. We analyzed their projections for this region and determined that up to 10 wells may not be drilled in Block A if presently leased lands remain unleased for the planning period. If these lands are allowed to be leased with a no surface occupancy stipulation, then up to five wells may not be drilled in Block A.

Since most reservoirs in this area are expected to be greater than 11,000 feet in depth, directional drilling is technically feasible at $\frac{3}{4}$ to one mile from the surface location. We expect that a directional well (most likely s-shaped) could be economic with up to a $\frac{3}{4}$ mile deviation. More information than is available would be needed to determine potential economics for any deviated wellbore extending more than $\frac{3}{4}$ of a mile from the surface location.

We expect that a horizontal wellbore would be technically and economically feasible up to one mile from the surface location. More information than is available would be needed to determine potential economics for any horizontal wellbore extending more than one mile from the surface location.

Block B – Townships 21-24 North, Ranges 118 and 119 West

Industry has drilled and abandoned 17 wells in Block B (see map). Sixteen were drilled in the Absaroka Thrust Play identified by the USGS in its 1995 assessment (Beeman et al, 1996), and one well was drilled in the Crawford-Meade Thrusts Play. In addition, three wells have been productive of oil and gas, and Fortuna US LP is currently drilling a well in their Bear Canyon Project area. The Ordovician Bighorn Dolomite has produced oil and gas from the productive wells at depths between 13,000 and 14,000 feet.

The earliest well spud was a 1928 well drilled to 1,525 feet. All other wells were spud between 1976 and 1991. These wells were drilled to depths ranging from 8,730 to 17,316 feet. Almost 90 percent of these wells drilled deeper than 12,300 feet. Eight wells appear to have drilled through the entire package of Overthrust sediments and encountered subthrust Cretaceous sediments. Depths to the subthrust ranged from 12,805 to 15,890 feet.

In addition to the three productive wells, shows of hydrocarbons occurred in;

- the Bear Canyon #1-24 in section 24 of Township 23 North, R. 118 West – gas in the Devonian Darby Formation and oil in the Ordovician Bighorn Dolomite,
- the Dempsey Ridge #20-11 in section 20 of Township 22 North, 118 West - H₂S gas-cut water in the Ordovician Bighorn Dolomite,
- the Federal Beckwith #26-1 in section 26 of Township 23 North, 119 West - gas cut water Triassic Thaynes Formation, and
- the Road Hollow #2 in section 29 of Township 21 North, 118 West - oil and gas in the Ordovician Bighorn Dolomite.

Most of Block B lies within the Absaroka Thrust Play (see map). Production from this play occurs in the three wells, in the Collett Creek Field area on the south end of Block B. In addition, the four wells described above tested shows of hydrocarbons. This portion of the Absaroka Thrust Play has a higher potential for the discovery of new economic hydrocarbon reserves than Block A, and some of the undiscovered accumulations projected by the USGS (2004 and 2006b) are likely to occur in this block. Any reservoirs discovered in this part of Block B may be most economic if drilled with horizontal legs. In addition, significantly fewer wellbores would be needed to fully develop reservoirs if horizontal legs are economic to drill and produce. Fortuna U.S. LP is presently attempting to test this idea at their Bear Canyon Project in Block B (see map).

The westernmost part of Block B (west of the Absaroka Thrust Play) lies within the hypothetical Crawford-Meade Thrusts Play identified by the USGS in its 1995 assessment (see map). The one well testing this play in Block B had no hydrocarbon shows. This portion of Block B has little potential, as described for Block A.

The projections of the Final Reasonable Foreseeable Development Scenario for Oil and Gas were reviewed. We analyzed their projections for this region and determined that up to 45 wells may not be drilled in Block B if presently leased lands remain unleased for the planning period. If these lands are allowed to be leased with a no surface occupancy stipulation, then up to 25 wells may not be drilled in Block B.

Since most reservoirs in block B are expected to be greater than 11,000 feet in depth, directional drilling is technically feasible at $\frac{3}{4}$ to one mile from the surface location. We expect that a directional well (most likely s-shaped) could be economic with up to a $\frac{3}{4}$ mile deviation. More information than is available would be needed to determine potential economics for any deviated wellbore extending more than $\frac{3}{4}$ of a mile from the surface location.

We expect that a horizontal wellbore would be technically and economically feasible up to one mile from the surface location. More information than is available would be needed to determine potential economics for any horizontal wellbore extending more than one mile from the surface location.

Block C - Townships 22-24 North, Ranges 113 and 114 West

Block C lies within the Southwestern Wyoming Province on the western edge of the Greater Green River Basin (see map). The westernmost edge of Block C lies in the Wyoming Thrust Belt Province. That area was not reviewed further since that part of Block C is not of interest to the Kemmerer Field Office. The USGS (2005 and 2006a) recently assessed the undiscovered resource of the Southwest Wyoming Province. They predicted a large undiscovered resource in the Province. Parts of five assessment units cover at least part of Block C (three conventional types, one with continuous reservoir types, and one coalbed gas type). A number of oil and gas accumulations could occur and be economically productive within this part of Block C. Most accumulations are expected to be in at depths greater than 11,000 (USGS, 2005 and 2006a). Any potential coalbed gas accumulations in the Fort Union Coalbed Gas Assessment Unit (see map) would be at shallower depths (3,500 to 6,000 feet).

Fields to the west of Block C would not be analogous to potential reservoirs so are not reviewed. Fields on the east side of Block C produce from the Cretaceous Frontier and Dakota formations on the Moxa Arch, an anticlinal structure. Depositional facies of the Frontier change from those that are productive on the east side of Block C to facies in the rest of Block C that have lower potential for accumulation of good reservoir rocks. The Dakota remains as a high potential reservoir throughout Block C. One or more potential new Dakota reservoirs similar to the new Dakota reservoir at Ballerina Field immediately south of Block C (see map) are good potential targets in Block C. Dakota Formation reservoirs would generally be found at depths greater than 12,000 feet.

Although Block C is off the west flank of the Moxa Arch a number of small local structures are known to be present and additional structures may be located in the future. These structures have the potential to contain additional trapped reservoirs in formations both above and below the Dakota Formation. These types of reservoirs are less likely to be present than Dakota Formation reservoirs. In addition, the USGS (2005 and 2006a) has identified a Fort Union coalbed gas play that covers most of Block C (see map). Any potential coalbed gas reservoir would be in the 3,000 to 6,000 foot range, and well spacing at these depths would be expected to be at 160 acres. Coalbed gas potential has not yet been tested in the area and would not be likely in the short term.

The projections of the Final Reasonable Foreseeable Development Scenario for Oil and Gas were reviewed. We analyzed their projections for this region and determined that up to 50 wells may not be drilled in Block C if presently leased lands remain unleased for the planning period. If these lands are allowed to be leased with a no surface occupancy stipulation, then up to 35 wells may not be drilled in Block C.

Since the most likely reservoir (Dakota Formation) and deeper potential reservoirs in block C are expected to be greater than 12,000 feet in depth, directional drilling is technically feasible at $\frac{3}{4}$ to one mile from the surface location. We expect that a directional well (most likely s-shaped) could be economic with up to a $\frac{3}{4}$ mile deviation. More information than is available would be needed to determine potential economics for any deviated wellbore extending more than $\frac{3}{4}$ of a mile from the surface location.

Other shallower reservoirs (including coalbed gas) would not be as amenable to directional drilling with such large deviations due to economic considerations. These potential reservoirs would be expected to have lower potential reserves than the Dakota Formation and so would be less likely to be able to economically bear the costs of significant deviation.

At present, characteristics of potential reservoirs (especially lack of identified fracture porosity) in Block B do not make them a likely target for horizontal wellbores.

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RFD Well Estimate by Geologic Play (Number of Projected Wells)	Block A		Block B		Block C	
	No Leasing	No Surface Occupancy	No Leasing	No Surface Occupancy	No Leasing	No Surface Occupancy
Crawford-Meade Thrust (20)	3	1	8	6		
Absaroka Thrust (160)	7	4	37	19		
Fort Union Coalbed Gas (40)					20	20
Green River Basin (1,740)					30	15
Total Well Reduction	10	5	45	25	50	35

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