

UPPER MISSOURI RIVER BREAKS NATIONAL MONUMENT

**REASONABLE FORESEEABLE DEVELOPMENT
SCENARIO**

**Bureau of Land Management
Great Falls Oil and Gas Field Station
Lewistown Field Office**

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Executive Summary

The Reasonable Foreseeable Development (RFD) Scenario is a long-term projection (scenario) of oil and gas exploration, development, production, and reclamation activity in the Upper Missouri River Breaks National Monument. The Monument Study Area (area in review) lies in the East Block of the Monument and encloses the 43 Federal leases that exist on Monument lands. The RFD projects a baseline scenario of activity assuming all potentially productive areas can be open under standard lease terms and conditions, except those areas designated as closed to leasing by law, regulation or executive order. It provides basic information that is analyzed in the National Environmental Policy Act (NEPA) document under various alternatives. In this case, the NEPA document is the Upper Missouri River Breaks National Monument Resource Management Plan - Environment Impact Statement.

The RFD Study Area (study area) lies in northcentral Montana, approximately 60 miles north of Lewistown, Montana, and 38 miles south of Chinook, Montana. The area contains three producing gas fields with 41 active gas wells that are completed in the Judith River or Eagle Formations. Of the 41 active wells, 21 are producing and 20 are shut in. Ten of the active wells are in the Monument. In addition, the BLM currently has three approved Applications for Permit to Drill (APDs) (undrilled), two within the Monument and one within 1/2 mile of the Monument. The greater portion of the study area is characterized by steep river breaks country with plateaus and narrow ridges caused by erosion.

The Bureau of Land Management (BLM) has received APDs from three federal lease holders in the study area in Blaine County, Montana. One APD has been received from Klabzuba Oil and Gas, Inc., one from Macum Energy, Inc., and one from Devon Energy. All three are pending approval based on the outcome of the Monument RMP/EIS. The three wells would be drilled from the following locations:

Klabzuba Federal 31-25-20B	SE $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 31, T. 25 N., R. 20 E.
Macum Federal 23-10	NE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 10, T. 25 N., R. 20 E.
Devon Federal 9-7	SW $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 9, T. 26 N., R. 20 E.

The wells would develop known gas resources in three producing gas fields in the study area. The wells would not require the construction of any new roads. If the wells are productive, they would require the installation of 3.7 miles of new pipeline in the study area to connect into existing pipelines.

The infrastructure related to natural gas surface operations, other than the access roads and pipelines, includes the following:

- Meter shed (8 feet long x 8 feet tall x 5 feet wide)
- Well head (can be enclosed within the meter shed depending on the operation)
- Gas meter run (enclosed within the meter shed)
- Glycol barrel (can be enclosed within the meter shed)
- Small water separator (normally enclosed within the meter shed depending on the well and the operation)
- Water pit sized depending on the operation, but can range from 20 feet x 20 feet x 8 feet to 40 feet x 40 feet x 10 feet)
- Gas compressor (Compressors typically do not accompany each well. Depending on the operation and the size of the compressor, one gas compressor could service 8-12 wells). Currently, no gas compressors are located within the study area; however, a skid-mounted 42 HP compressor has been approved by the State of Montana on the David Kincaid No. 1 private well (the compressor has not been installed as of the date of this document).

The study area is being addressed because of the potential for future exploration and development on lands with existing federal leases. All federal lands in the study area are considered to have moderate and high potential for oil and gas occurrence. Occurrence is based on structural geology and historic activity of the area. It is further confirmed using well information to identify the extents of reservoirs. The areas considered to have high potential are those lands in the 18 exploration/development areas (also referred to as exploration/production areas) where commercial volumes and moderate shows of natural gas were evident at the time of well completion. All other federal lands in the study area are considered to have moderate potential for oil and gas occurrence.

In conjunction with these proposed actions, a review was conducted to evaluate the geologic potential of the study area and determine the Reasonable Foreseeable Development (RFD) that could be expected. A total of 11 exploration/production areas were identified with RFD well projections, as shown in the table below.

RFD Well Projections

Exploration/Production Area	Wells within 1/2 Mile of the Monument	Monument Wells	Total Wells
North Leroy	4	1	5
Central Leroy	0	6	6
Central Leroy East	0	3	3
Leroy Bullwacker East	0	6	6
Sherard Northwest Leroy	7	8	15
West Leroy	1	0	1
South Sawtooth	13	4	17
Sherard Unit Area East	2	8	10
Southeast Leroy	1	1	2
Chase Hill	0	2	2
Sherard Unit	1	5	6
Total Wells in the 11 Areas	29	44	73

Specific well locations are not identified because many wells are considered proprietary information.

In addition to the 15.9 miles of existing roads supporting natural gas operations, the RFD locations would require 34.1 miles of new roads both in the Monument and within 1/2 mile of the Monument.

In addition to the 52.2 miles of existing pipeline, assuming a 35% success rate and because pipelines will be mostly buried in the access road corridor, the length of road to each new well was used. The new miles of pipelines are estimated at 11.9 miles. Liquid hydrocarbon storage at each well site is typically not required for the wells in the study area because the gas in this region normally does not yield liquid hydrocarbon. As a result, the number of well site visits can be limited to only those necessary for routine maintenance as determined via remote well monitoring with radio telemetry.

REASONABLE FORESEEABLE DEVELOPMENT SCENARIO

1.0 Introduction

The Reasonable Foreseeable Development (RFD) Scenario is a projection of oil and gas exploration, development, production, and reclamation activity on 43 federal oil and gas leases within the Upper Missouri River Breaks National Monument (Monument). The RFD projects a baseline scenario of activity assuming all potentially productive areas will remain open under standard lease terms and conditions, except those areas designated as closed to leasing by law, regulation, lease stipulations or executive order.

Based on the Monument Proclamation, the 43 federal oil and gas leases in the Monument are considered to have valid and existing lease rights to allow for exploration, development and production of oil and gas. The RFD is necessary because the project area is similar to a development-type project having existing leases, ongoing production from three existing gas fields, and the potential for future exploration and development of federal leases in a national monument.

The Monument Proclamation withdrew from future leasing federal lands in the Monument that were unleased when the Proclamation was signed. Therefore, this RFD does not address future leasing in the Monument. However, leasing may occur on the unleased federal lands adjacent to (outside) the Monument. This RFD forecasts a number of wells to be drilled both in the Monument and within a ½-mile zone of the Monument to determine cumulative effects on the Monument and surrounding lands. This RFD provides basic information that is analyzed under various alternatives in the Upper Missouri River Breaks National Monument Resource Management Plan/Environment Impact Statement (RMP/EIS).

The content of this RFD is based on Bureau of Land Management (BLM) Handbook H-1624-1, Planning for Fluid Mineral Resources. The handbook was recently updated and clarified by Instruction Memorandum No. 2004-089, dated January 16, 2004. The complete RFD is available for review at the BLM Great Falls Oil & Gas Field Station, Lewistown Field Office, Montana State Office, and on the BLM website at http://www.blm.gov/mt/st/en/fo/lewistown_field_office/um_rmp_process.html.

An RFD has several parts. It predicts the potential for mineral occurrence based on geologic information. It also predicts the potential for mineral development based on historic drilling trends, economic trends, and other factors that affect the rate of development. The assessment of development potential includes a drilling activity forecast, which is an estimate of the type and amount of drilling and development activity that reasonably could take place. The drilling activity forecast is unconstrained in the sense that limiting factors are not in effect such as lease stipulations, conditions of approval, and the possibility that some areas may not be suitable for drilling because of potential impacts to other resources in the Monument. This RFD also includes a surface use forecast and a prediction of possible well locations. Note that specific well locations are not identified within this document because many of the well locations are considered proprietary information; however, general information such as the number of wells, lengths of roads and lengths of pipelines for each exploration/production area are identified in the document. The forecast of activity helps analyze the effects of the RMP/EIS alternatives when various lease stipulations/conditions of approval are applied that could preclude or alter the activity taking place in some areas. The RFD also provides information for the analysis of effects of the drilling and development decision on many resources such as wildlife, cultural, recreation, air quality or visual resource management. It is a representation to the public and the decisionmaker of the potential “on-the-ground” effects of development decisions.

1.1 RFD Study Area

The study area (study area) for this RFD is defined as the lands within the 43 federal oil and gas leases in the Monument and the lands which lie ½ mile outside of the Monument. This area is further described as being located approximately 60 miles north of Lewistown, Montana. The study area lies among three producing fields known as the Leroy, Sherard and Sawtooth Mountain Gas Fields. Geologically speaking, the study area lies at the southeastern extent of the Bearpaw Uplift in northcentral Montana. The study area can be geographically described as an area starting from a point four miles northeast/east of the PN Bridge and extending 31 miles to the northeast by 15 miles wide through the Bullwhacker area and continuing on up to the Chimney Butte/Al's Creek Drainage area (see Figure 1.1-1).

The study area includes 43 federal oil and gas leases issued between 1967 and 1999 and covers about 42,000 acres. Of the 43 leases, 12 were issued based on the 1988 West HiLine RMP (see Table 1.1-1). The remaining 31 leases are considered “non-West HiLine leases” and are shown in Table 1.1-2.

In March 2000, the Montana Wilderness Association (MWA) filed suit challenging BLM's issuance of three leases that are now included in the Monument, alleging the BLM did not fully comply with the National Environmental Policy Act (NEPA), Endangered Species Act (ESA) and National Historic Preservation Act (NHPA). In March 2004 the United States District Court for the District of Montana, Great Falls Division, ruled in favor of the Plaintiffs and ordered the BLM to:

- Prepare an EIS for the oil and gas leasing program that covers the three leases.
- Prepare a valid biological assessment of the oil and gas leasing program in conjunction with the EIS.
- Consult with all required entities.

Under the order, all surface-disturbing activity on the three leases is prohibited pending completion of the appropriate environmental reviews. In January 2006 the District Court enjoined activity on the three leases until BLM could demonstrate compliance with the directives set forth in the March 2004 order. The leases involved in the suit, as well as nine others in the Monument, were based on the BLM's 1988 West HiLine RMP. In light of the court's ruling, the BLM believes all 12 Monument leases based on the West HiLine RMP should be analyzed in the Monument RMP/EIS, which will consider the current stipulations that apply to the 12 leases issued under the West HiLine RMP, and the conditions of approval or mitigating measures that should be applied to surface occupancy and surface-disturbing activities associated with all 43 oil and gas leases in the Monument. To fully comply with the January 2006 court order the Monument RMP/EIS also addresses a no lease alternative for the 12 West HiLine leases. The no lease alternative is addressed as a subalternative, Alternative E_{NL} which would not allow surface disturbance or the processing of applications for permits to drill (APDs). The BLM will not process any further APDs on leases in the Monument until the Monument RMP/EIS is completed.

Well Status and Production Terms

The following terms are used throughout the RFD:

ABD-GW	Abandoned gas well (depleted producer)
BBL	Barrels
BCF	Billion cubic feet
D&A	Drilled and abandoned
Dual Comp Gas	Dually completed gas well (completed in two separate zones from the same well)
GAS	Producing gas well
GSI	Shut in gas well
MCF	Thousand cubic feet
MCFPD	Thousand cubic feet per day
MCFPM	Thousand cubic feet per month
MMB	Million barrels
MMCF	Million cubic feet

Figure 1.1-1

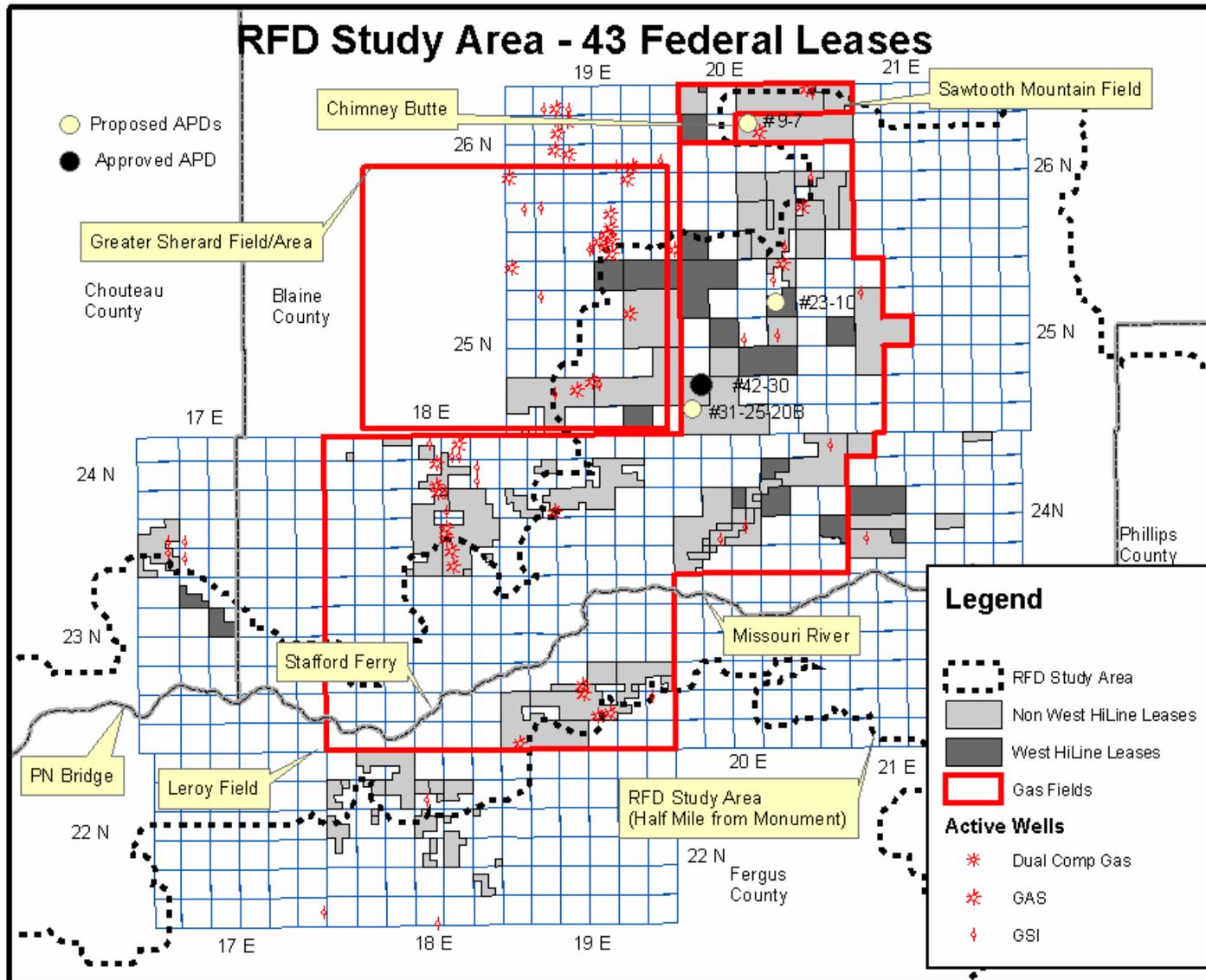


Table 1.1-1 Federal Oil and Gas Leases in RFD Study Area West HiLine Leases							
Lease No.	Lease Effective Date	Lease Location by Section ¹	Township and Range	County	Lease Acreage in the Monument	Lease Acreage outside the Monument	Total Lease Acreage
MTM84559*	11/1/1995	5 6 7	25N/20E	Blaine	1,880	0	1,880
MTM84560*	11/1/1995	6 7 31	26N/20E	Blaine	134	1,119	1,253
MTM87212*	9/1/1997	3	25N/19E	Blaine	122	528	650
MTM87658*	2/1/1998	25	24N/20E	Blaine	485	0	485
MTM89082*	5/1/1999	1 2	25N/19E	Blaine	1,131	167	1,298
MTM89452**	11/1/1999	5 9	23N/17E	Chouteau	800	0	800
MTM89469*	11/1/1999	35	25N/19E	Blaine	640	0	640
MTM89473***	11/1/1999	15 21 22	24N/20E	Blaine	1,240	0	1,240
MTM89474***	11/1/1999	10	25N/20E	Blaine	80	480	560
MTM89475*	12/1/1999	13 17	25N/20E	Blaine	1,280	0	1,280
MTM89476*	12/1/1999	21 22	25N/20E	Blaine	1,120	160	1,280
MTM89482***	11/1/1999	19 20 29	24N/21E	Blaine	1,416	0	1,416
Total					10,328	2,454	12,782

¹ Many leases do not take up the full section.

* Leases are under lease suspension caused by the Monument RMP/EIS – Lease suspension granted on October 14, 2004.

** Lease was segregated on October 14, 2004 for those minerals not within the Monument.

*** Leases are under lease suspension caused by the lawsuit – Lease suspension granted on September 1, 2000. Lease suspensions add time to the life of a lease due to administrative actions.

Table 1.1-2 Federal Oil and Gas Leases in RFD Study Area Non-West HiLine Leases							
Lease No.	Lease Effective Date	Lease Location by Section ¹	Township and Range	County	Lease Acreage in the Monument	Lease Acreage outside the Monument	Total Lease Acreage
MTM1565	5/1/1967	24 25 26 27	25N/19E	Blaine	2,560	0	2,560
MTM1568	5/1/1967	11 12 13 14	25N/19E	Blaine	2,320	240	2,560
MTM1578	5/1/1967	28 29 30 31 32	25N/19E	Blaine	575	1,988	2,563
MTM1885	6/1/1967	1 2	26N/20E	Blaine	40	611	651
MTM1886	6/1/1967	9 10 11 12	26N/20E	Blaine	1,920	640	2,560
MTM1888	6/1/1967	2 3 4 6	26N/20E	Blaine	480	1,982	2,462
MTM1903	6/1/1967	23 24 25 35	26N/20E	Blaine	1,360	200	1,560
MTM1903B	6/1/1967	26	26N/20E	Blaine	320	240	560
MTM1914	6/1/1967	15	25N/20E	Blaine	200	440	640

**Table 1.1-2
Federal Oil and Gas Leases in RFD Study Area
Non-West HiLine Leases**

Lease No.	Lease Effective Date	Lease Location by Section¹	Township and Range	County	Lease Acreage in the Monument	Lease Acreage outside the Monument	Total Lease Acreage
MTM2060	7/1/1967	15 21 22 28 29 32	24N/20E	Blaine	640	0	640
MTM2061	7/1//1967	21 28 29 31 32	24N/20E	Blaine	640	0	640
MTM13816	11/1/1969	7 11 12 13 14 15	24N/21E 24N/20E	Blaine	2,533	0	2,533
MTM13818	11/1/1969	20 21 28 29 30 31	24N/20E	Blaine	2,532	0	2,532
MTM13821A	11/1/1969	29 30 31 32	24N/21E	Blaine	1,099	0	1,099
MTM13827	11/1/1969	11 27 29 30	24N/21E	Blaine	1,156	0	1,156
MTM16098	9/1/1970	14 15 17 19 20 21 22	24N/19E	Blaine	1,240	1,280	2,520
MTM16102	9/1/1970	3 20 30	25N/20E	Blaine	1,506	163	1,669
MTM16103	9/1/1970	22 27 28 33 34	26N/20E	Blaine	13	2,507	2,520
MTM16327	10/1/1970	9 10 11 14 15 22 23 27 34	24N/18E	Chouteau	80	2,358	2,438
MTM16458	10/1/1970	21 23 24 25 27 33	26N/20E	Blaine	688	1,272	1,960
MTM16461	10/1/1970	29 31 32 33	25N/20E	Blaine	2,547	0	2,547
MTM16617	11/1/1970	7 8 10 17 18 19 22 25	22N/18E	Fergus	490	929	1,419
MTM16618	11/1/1970	23 24 25 26 35 36	24N/18E	Chouteau	320	2240	2,560
MTM16939	12/1/1970	7 17 18 19	25N/21E	Blaine	2,530	0	2,530
MTM17376	2/1/1971	7 33 35	24N/18E	Chouteau	40	80	120
MTM18274	7/1/1971	4 5 9 10 13 14 15 17 22 23 24	22N/18E	Fergus	1,367	1,160	2,527
MTM18282	5/1/1973	29 30 31 32 33	23N/19E	Blaine	851	1,680	2,531
MTM18283	5/1/1973	22 23 24 26 27 28 29	23N/19E	Blaine	1,240	1,320	2,560
MTM19446	9/1/1971	30 31	24N/17E	Chouteau	110	1,113	1,223
MTM53751	6/1/1982	20 21 22 23 24	23N/19E	Blaine	680	160	840
MTM89460	11/1/1999	7 11	22N/18E	Fergus	400	40	440
Total					32,477	22,463	55,120

¹ Many leases do not take up the full section.

2.0 Description of the Monument Geology

2.1 Surface Geology

The Monument is contained within a triangular wedge of land lying between three island mountain ranges. At the north apex of the triangle is the Bears Paw Mountain Range. On the east side are the Little Rocky Mountains and to the southwest side are the Highwood Mountains. These ranges are places where magma rose up from the earth's mantle penetrating a two-mile thick layer of sedimentary rocks at various times during the Tertiary Period. Figure 2.1-1 shows the general area.

The Little Rocky Mountains are made up of plutonic igneous rock types while both the Bears Paw and Highwood ranges resulted from volcanic eruptions forming fine grained rocks on or near the surface. The Bears Paw Mountains were covered by extensive heavy basalt layers. Over time, the layers slid away from the uplift deforming the younger sedimentary rocks as they went. The Bears Paw Mountain Arch is surrounded by a mass of tilted sections of rocks that may be covered with slightly younger volcanics in the near vicinity of the Bears Paw Mountain Arch. Between the Highwood and Bears Paw Mountains sedimentary rocks are tilted and shot through by radiating dikes that, when eroded, form spires and walls of dark igneous rock in contrast with the lighter sedimentary layers they intrude. The gravity sliding produced the thrust faulting that formed many of the structural traps for natural gas to accumulate.

Following the mountain building events, the volcanic cones and much of the sedimentary rock surrounding the Bears Paw Mountains were stripped away by erosion. Pediment and terrace deposits formed in the foothills from the eroded material. During the last glacial age (50 thousand to 10 thousand years ago) continental ice sheets descending from the north were deflected east and west by the Bears Paw Mountains. The ice dammed the northward flow of the Missouri River and resulted in the formation of a new channel draining to the east into the Musselshell valley and thence south to the Gulf of Mexico. It is this younger portion of the Missouri River channel that forms the area known as the Missouri breaks.

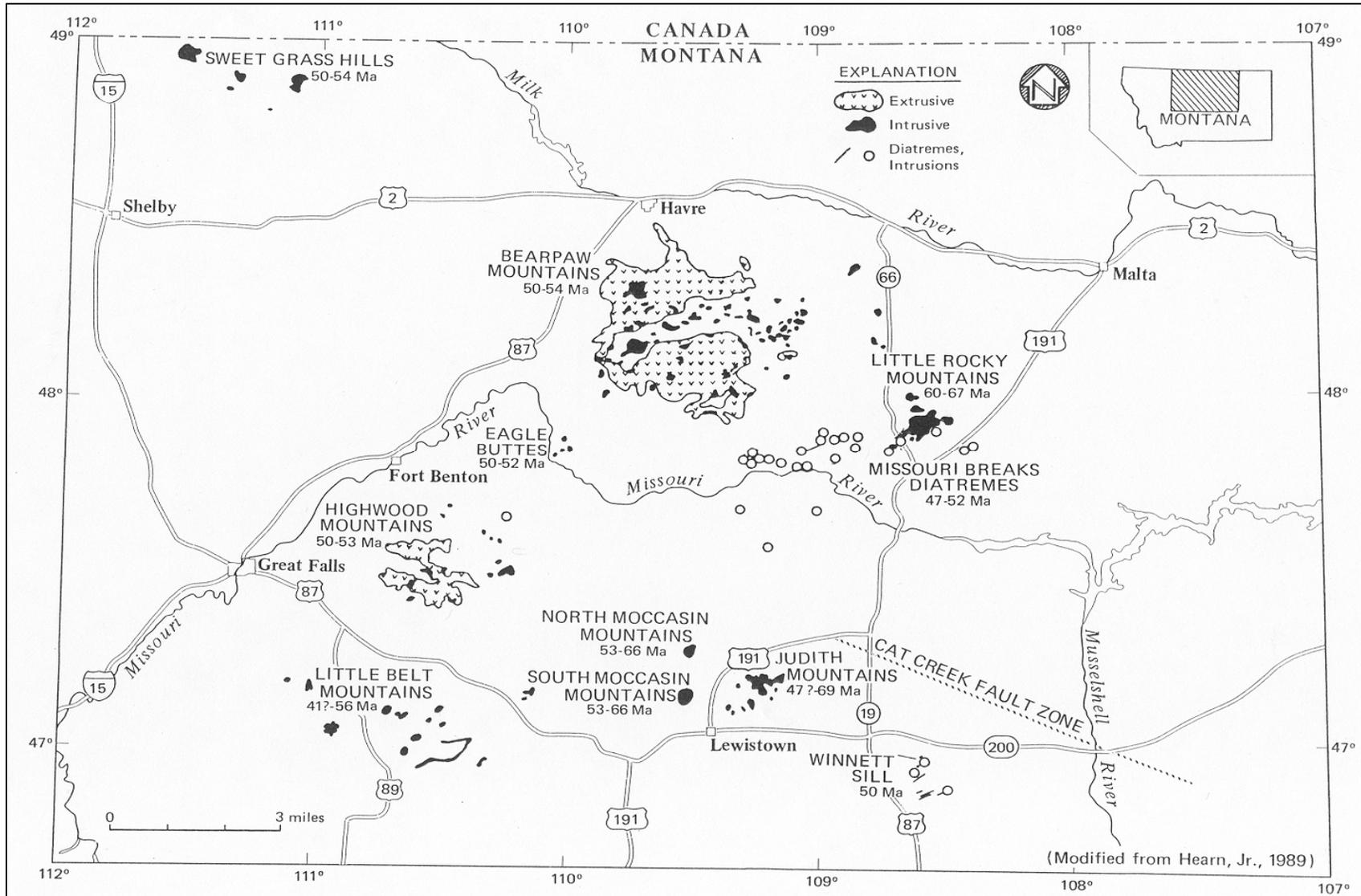
Predominately exposed formations in the study area include Quaternary alluvium deposits, the Cretaceous Bearpaw Shale and Judith River Formations. In a few rare instances, the Cretaceous Claggett Shale and the Eagle Formations are exposed adjacent areas with significant faulting or deep cutting coulees.

2.2 Subsurface Stratigraphy and Structure

The Bearpaw Uplift in northcentral Montana is characterized by a complex of normal, high angle reverse and thrust faults. The faults are thought to be a result of Eocene intrusion and volcanic activity (nearly 65 million years ago).

Other tectonic features included gravity detachment blocks which slid away from the center of the Uplift. Scattered through a circular zone 20 to 30 miles wide on the plains surrounding the Bears Paw Mountains are long, sharp, narrow, anticlinal folds (perhaps 100 or more), usually cut near their crests by steeply dipping reverse faults. Strike of the folds and faults is peripheral to the circular mountain area. In cross-section, the folds and faults appear to have been caused by nearly horizontal thrusts outward from the mountains. The length of the folds differs greatly, but they average about ten miles. Between folds, upper Cretaceous strata lie nearly horizontal and apparently undisturbed. The faults and folds and other structural features mapped at the surface are essentially "rootless" as they disappear within the sediments of the upper Colorado Shale. Nonetheless, the intensive faulting which affects the shallow subsurface strata (0-2,000 feet) provides effective traps for natural gas to accumulate. Figure 2.2-1 shows the sedimentary formations exposed along the Missouri River Channel, which is a central geographic feature of the Monument. Figure 2.2-2 shows the geologic structural cross section in an east-southeast direction, and Figure 2.2-3 shows the cross section area.

Figure 2.1-1
Geology of Northcentral Montana



Within the early Tertiary (nearly 50 million years ago) further change came to the Bear Paw Uplift. Whether it was one titanic explosive event or a series of related events, the forces that caused the doming of the Bearpaw Uplift were removed and the central portion of the Bearpaw Uplift collapsed. This collapse caused a further variety of structural features, most of them fault-related. Eagle Formation gas reservoirs are commonly found in blocks defined on four sides by faults, as well as in anticlinal traps.

A good analogy of the area would be similar to taking a thrust-folded plate of glass, and then lightly dropping it onto a hard surface. The result of the many pieces would be the equivalent of the mosaic of randomly oriented individual fault blocks in and near the Monument. Each fault block can have its own unique orientation and as a result can create its own separate gas trap/reservoir.

Figure 2.2-1

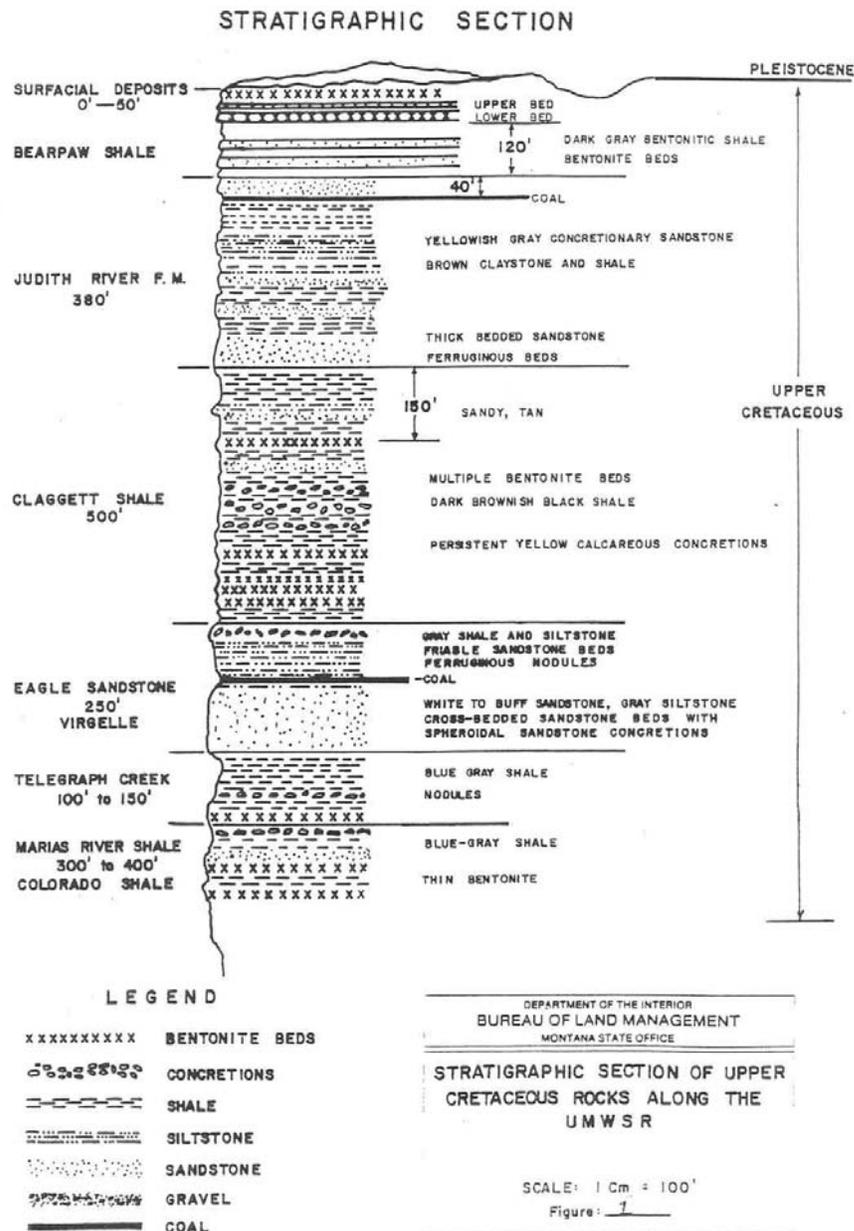
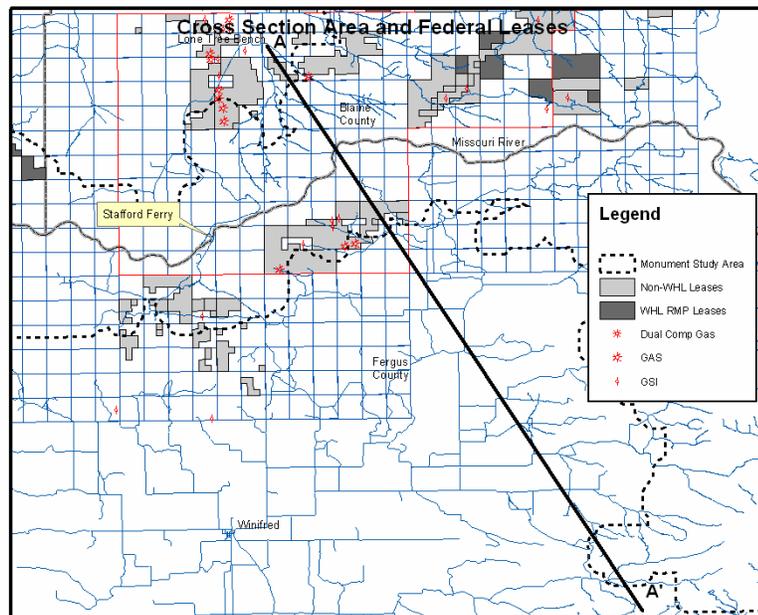




Figure 2.2-2
Geologic Structural Cross Section

A is in the Lone Tree Bench Area; A' is 16 miles east-southeast of the town of Winifred, Montana).

Figure 2.2-3
Cross Section Area and Federal Leases



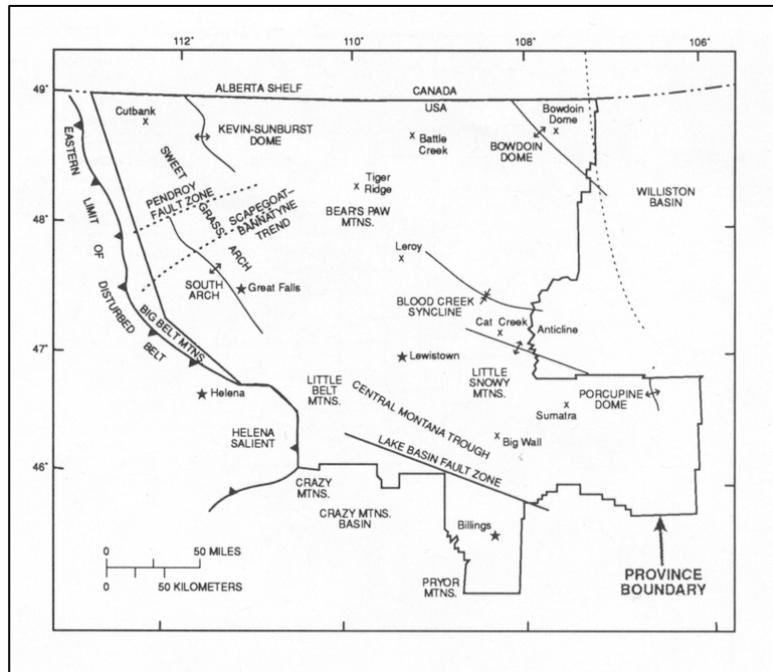
2.3 Reservoirs, Traps, Source Rocks, Seals, Hydrocarbon Generation and Migration

In 1995 the U.S. Geological Survey conducted an “Assessment of Undiscovered Resources in Petroleum Plays: U.S. Portion of Williston Basin and North Central Montana.”¹ The Assessment Report identified twelve plays within the northcentral Montana Province (NCMP).

The primary hydrocarbon target in the study area has been the Shallow Cretaceous Biogenic Gas Play including the Judith River and Eagle Formations (see Table 2.3-1). While the Assessment Report identified eleven other hydrocarbon plays within the NCMP, six of the eleven plays have some chance of discovering further oil and gas reserves outside of the Cretaceous Biogenic Gas Play. Of those six plays, there are no known discoveries within the study area or within a 24-mile radius of the study area.

Based on historic oil and gas activity within the NCMP, both oil and gas are produced within the northern part of the Province (See Figure 2.3-1). Of 52 known oil and gas fields within the northern NCMP, only two fields are known to have produced oil (Rabbit Hills and Bowes). The closest known oil field to the Monument is the Bowes field, approximately 24 miles to the north, which produces from a deeper horizon in the early Jurassic Sawtooth Formation (Play 2808) as defined by the USGS Assessment Report. Of the 224 wells drilled in the study area, only five wells have penetrated the Sawtooth Formation without shows of oil. This indicates there is minimal interest to explore for the deeper hydrocarbon resource and the deeper horizons are currently less likely to be the primary target for future exploration. However, this does not preclude exploration from the deeper horizons and it is not fully conclusive that the resource will not occur within the study area or that no future exploratory wells will be drilled to the deeper horizons in or out of the study area. None of the RFD wells are forecasted to be drilled to the deeper plays.

Figure 2.3-1
Northcentral Montana Province (NCMP)



¹ U.S. Department of Interior, USGS, Assessment of Undiscovered Resources in Petroleum Plays: U.S. Portion of Williston Basin and North Central Montana. U.S. Geological Survey's National Petroleum Assessment, Seventh International Williston Basin Symposium. T.S. Dyman, J.A. Peterson, J.W. Schmoker, C.W. Spencer, D.D. Rice, K.W. Porter, D. A. Lopez, T.J. Heck, W.R. Beeman.

**Table 2.3-1
USGS Play Summary for North-Central Montana**

North-Central Montana Province (Play Number)	Monument Play?	Oil or Gas Play?	Representative Fields	Hypothetical (H) or Confirmed I	Total Mean Oil (MMB)	Total Mean Gas (BCF)	Future Potential
Conventional Plays							
Proterozoic (No. 2801)	No	Oil & Gas	No known accumulations.	H – See Map A, Figure 6	0	0	Unknown high risk
Cambrian-Ordovician Sandstones (No. 2802)	Yes	Oil	No accums but shows; Williston Basin analog.	H–The stratigraphic section within this play thins as it continues east. See Map B, Figure 6.	1.4	0	Good for small fields.
Red River Carbonates (No. 2803)	Yes	Oil	No accums but shows; Williston Basin analog.	H – See Map C, Figure 6.	3.7	0	Good for small fields.
Devonian-Mississippian Carbonates (No. 2805)	Yes	Oil	Kevin-Sunburst, Reagan, Landslide Butte and Pondera	C – See Map D, Figure 6.	57.8	0	Good for small fields in sparsely drilled areas.
Tyler Sands to the Northeast (No. 2806)	No	Oil	Big Wall, Devil’s Basin and Sumatra	C– See Map E, Figure 6.	43.7	0	Good for small to medium- sized fields.
Fractured-Faulted Carbonates in Anticlines (No. 2807)	Yes	Oil	No production in province.	H- See Map F, Figure 6.	2.0	0	Small fields.
Jurassic-Cretaceous Sandstones (No. 2808)	Yes	Oil & Gas	Cutbank and Cat Creek	C – See Map G, Figure 7.	40.0	90.9	Mature play good for small fields.
Shallow Cretaceous Biogenic Gas Play (No. 2809)	*Yes	Gas	Leroy, Sherard, Tiger Ridge, Battle Creek	C – See Map H, Figure 7.	0	400.2	Probably good; need to understand relation between discrete and

North-Central Montana Province (Play Number)	Monument Play?	Oil or Gas Play?	Representative Fields	Hypothetical (H) or Confirmed I	Total Mean Oil (MMB)	Total Mean Gas (BCF)	Future Potential
							continuous-type accumulations.
Unconventional Plays							
Bakken Shale Fracture System (No. 2804)	No	Oil	No production. Williston Basin analog	H – See Map I, Figure 8.	16.2	0	Fair potential in West and South; Low Ro Problem.
Northern Great Plains Biogenic Gas Play (NGPBG) High Potential (No. 2810)	No	Gas	Suffield Block Canada	C – See Map J, Figure 9.	0	5,400	Play is well developed in Canada; good for small fields; generally low per-well recovery
NGPBG Moderate Potential (No. 2811)	No	Gas		C – See Map K, Figure 9.	0	20,500	
NGPBG Low Potential (No. 2812)	Yes	Gas		C – See Map L, Figure 9.	0	15,400	

* Active production, Eagle and Judith River Formations. The only active play within the Monument.

The three existing gas fields in the study area (Leroy, Sawtooth Mountain and Sherard Area) produce from the Eagle and Judith River Formations. These Formations typically do not occur in a contiguous “blanket type” productive unit within the fields. Rather, they are made up of numerous structural features including fault blocks and conventional anticlinal structures that provide a series of reservoirs where gas has become trapped. The fields are made up of numerous separate producing reservoir units. For example, the Leroy Gas Field contains numerous traps that may contain gas. Each reservoir/trap is unique with respect to depth, reservoir pressure, pay thickness, porosity, water saturation, orientation, and gas/water content or extent.

The Eagle Formation occurs across northcentral Montana and within the Monument (see Figure 2.4-1b(H) for its coverage across northcentral Montana). The white cliff formations along the Missouri River offer a good example of exposed sections of the Eagle Formation. It has many quality features as gas reservoir rock and in many cases it can be viewed as a textbook example of reservoir rock. The Eagle Formation is the primary target for natural gas in the Monument because of its relatively shallow depths (generally less than 1,700 feet true vertical depth) and the potential of discovering additional gas reservoirs.

The Eagle formation is composed of three rock units (see Figure No. 2.2-1). Depending on the structural orientation of the fault blocks, the **upper unit** of the Eagle Formation is likely to be the most prolific formation to contain gas. It is typically made up of yellowish tan-weathering, light-gray, fine-grained, salt-and-pepper sandstone, commonly cross-stratified, massive, cliff-forming, with a thin to 2-foot-thick interval of black pebbles (from granule to 2 inches in diameter) at the top of the sandstone interval or in dark shale slightly above the top of the unit in the lowest Claggett beds. The **middle unit** is typically poorly exposed with thin sandstones and grayish green shale with thin, discontinuous lignite seams and some bentonitic intervals. It typically does not contain enough commercial quantities to deem it as a reservoir unit. If conditions exist, the Virgelle Member (the **lower unit** of sandstone rock within the Eagle Formation) can contain commercial volumes of natural gas. It can be described as generally white-weathering, locally concretionary, fine and medium-grained, friable to moderately hard, salt-and-pepper sandstone, generally massive and burrowed to locally cross-stratified; it forms the prominent white cliff section above the underlying Telegraph Creek Formation. Typically overall, the Eagle productive intervals can range from 4 to 60 feet thick and formation porosities average 28%. Structural position and depth of burial are of key importance as to how much of the Eagle Sand section is capable of gas production. Initial reservoir pressures range from 110 psi in some of the more shallow sections (500-600 feet deep) up to nearly 600 psi in some of the deeper sections.

In addition to the Eagle, the Judith River Formation (a younger upper Cretaceous interval, see Figure No. 2.2-1) can also be considered a target for development; however, unless significant gas in the Judith River Formation is discovered, the formation will likely remain a secondary target for development. Per historic operations, success has been limited at developing this formation within the Leroy, Sawtooth and Sherard gas fields and, therefore, future development of the Judith River Formation would likely result from the search for gas in the deeper Eagle Formation. The Judith River Formation also contains three rock units. The **upper unit** is composed of basal yellowish gray to yellowish brown weathering fine grained, quartzose sandstone overlain by a sequence of interbedded sandstones, mudstones and carbonaceous shale with common small ferruginous concretions. The sandstones are light colored, cross-stratified, commonly discontinuous laterally and have dark-brown ferruginous caps. The top of the upper unit locally contains thin, dark, fissile, oyster-bearing shale overlain by Bearpaw Shale. The **middle unit** is composed of greenish gray-weathering, fine-grained sandstones, siltstones, mudstones and brown carbonaceous shale typically with conspicuous banded appearance; numerous conspicuous rusty-brown to purplish black-weathering ironstone concretions with many of the bed being betonitic. The **lower sandstone unit** is composed of light yellowish gray-weathering, locally orange-stained, quartzose, massive to poorly bedded, burrowed to bioturbated. The uppermost beds are light-brown, ferruginous and form resistant ledges. Each of the mentioned units can be considered reservoir rock; however, structural position and depth of burial are also of key importance as to how much of the Judith River Formation is capable of gas production. Referring back to Figure 2.2-1, it is apparent the Judith River is a more shallow Formation. Because of its shallow depth, pressures tend to be less than the Eagle Formation. Initial reservoir pressures within the Judith River Formation typically range from 100-350 psi.

Other zones that may have potential for future natural gas exploration in the Monument are the sands within the Colorado Group of the Upper and Lower Cretaceous. They are the Niobrara, Carlile, Greenhorn, Bell Fourche and

Muddy Formations. Of the 224 wells drilled in the study area, 43 wells have penetrated the Colorado Group section and only one has been completed as a commercial gas well, just outside of the Monument yet within the study area. See the discussion under Section 4.2.2, the North Leroy exploration/production area.

The gas produced in the study area from the Eagle and Judith River Formations (Cretaceous and younger rocks) in the study area is of biogenic origin and its source originates from the decomposition of organic matter by microorganisms in the underlying formations (i.e. inner-bedded marine shales mostly of the Montana and Colorado Groups of the Cretaceous). The biogenic gas was generated in the immature sediments and has migrated along fracture planes developed within the older Cretaceous shales and sandstones and over geologic time accumulated in the Judith River and Eagle reservoirs. The trapping mechanisms for the two formations are provided primarily by the overlying Bearpaw Shale and Claggett Shale Formation seals respectively and secondary traps created by fault blocks. The Bearpaw Shale Formation has an average thickness of 1,300 feet and the Claggett Shale Formation has a thickness of at least 500 feet.

Based on historic gas production within the area, it is without question the source rocks have been buried deep enough to generate enough natural gas hydrocarbons to be considered an economically viable gas play. The question for future exploration is whether there is sufficient evidence from previous exploration and development to justify continued exploration for commercial reserves where the resource has not been depleted over the previous 35 years, or whether the natural gas has leaked off through fractures in the earth's surface.

2.4 Summary of USGS or Other Play Descriptions

The 1995 USGS Assessment Report included the following information:

- As of the date of the study (1995), the estimated volume of undiscovered natural gas resources under all lands within the NCMP ranged from 58.2 to 719.9 billion cubic feet (BCF), with a mean estimate of **491.1 BCF** (bold emphasis added).
- The estimated volume of undiscovered oil resources under all lands within the NCMP ranges from 14.3 to 180.9 million barrels (MMB), with a mean estimate of **114.3 MMB**. (Bold emphasis added.)
- The counties included in the Assessment Report include a portion of Glacier (east half), Toole, Liberty, Hill, Blaine, Phillips, Petroleum, Fergus, Chouteau, Pondera, a portion of Teton (east half), a portion of Lewis and Clark (northeast corner), a portion of Cascade (all but a southwest piece), Judith Basin, a portion of Rosebud (northern two-thirds), Musselshell, Yellowstone, a portion of Big Horn (most western portion), Golden Valley, Wheatland, and a portion of Meagher (northeast one-third). See Figures 2.4-1a through 2.4-1d.
- The Eagle and Judith River Formations are the predominant target formations within the Monument. The estimated volume of natural gas under all lands in the NCMP contained within the Shallow Cretaceous biogenic gas formations (including the Eagle and Judith River Formations) ranges from 44.9 to 594.5 BCF with a mean estimate of **400.2 BCF** (bold emphasis added). As of the Assessment Report date, 692 BCF of natural gas had been produced from the Eagle Formation in the NCMP, of which 11.4 BCF was produced from the study area and 5.7 BCF was produced from 17 wells in the Monument.
- Of the twelve plays studied in the NCMP, eight plays are included as areas of potential within the study area.
- Only four of the eight plays have confirmed production throughout the NCMP: Play Nos. 2805, 2808, 2809 and 2812.
- Only Play No. 2809 (Shallow Cretaceous Biogenic Gas Play) has been economically successful within the Monument study area.

Figure 2.4-1a (Maps A-F) illustrates the approximate boundaries of conventional petroleum plays in northcentral Montana: (A) Proterozoic Play – 2801, (B) Cambrian-Ordovician Sandstones Play – 2802, (C) Red River

Carbonates Play – 2803, (D) Devonian-Mississippian Carbonates Play – 2805, (E) Tyler Sandstone Play – 2806, and (F) Fractured-Faulted Carbonates in Anticlines Play – 2807. The area of each play is shaded.

Figure 2.4-1a
Play Coverage Maps (A-F)

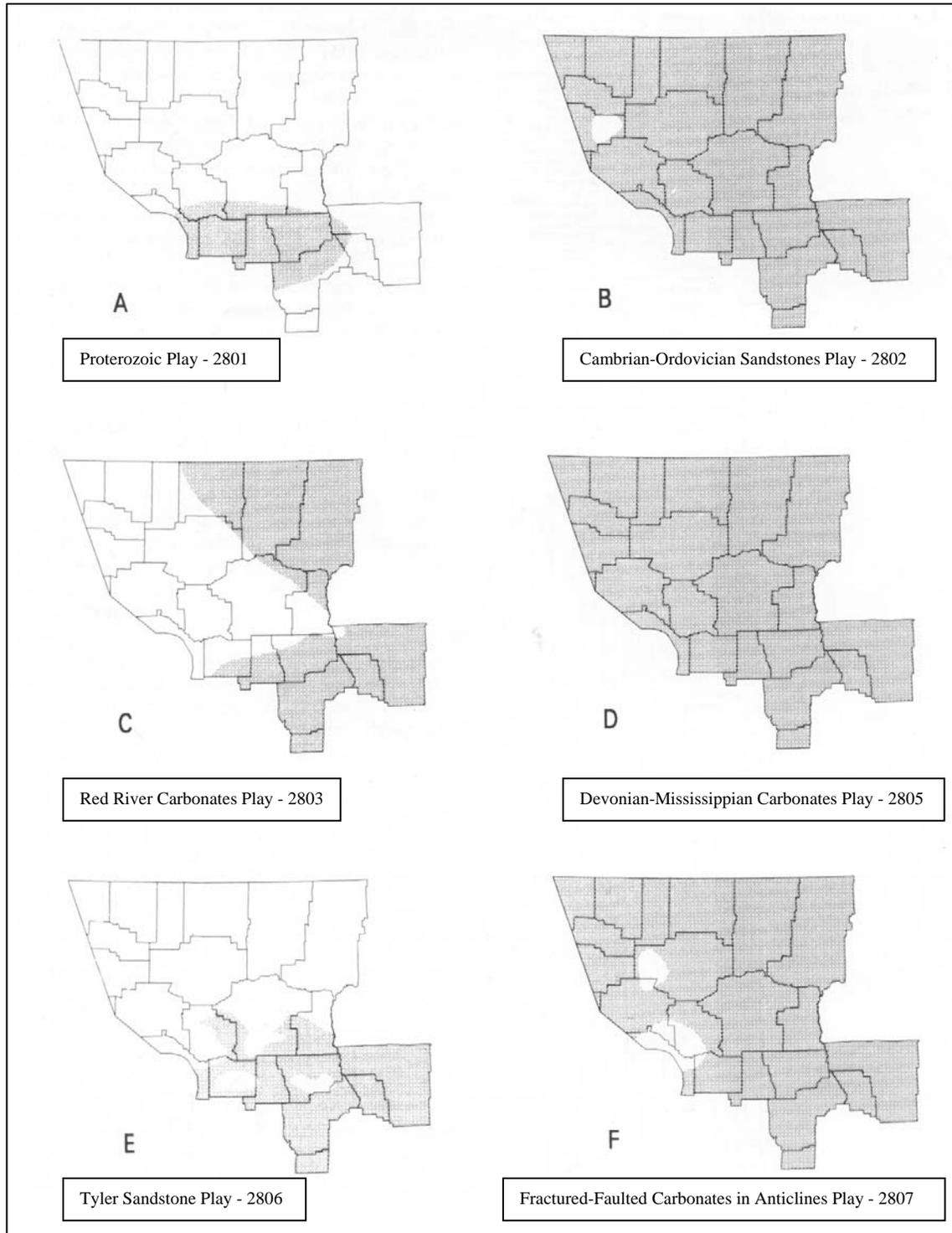


Figure 2.4-1b (Maps G-H) illustrates approximate boundaries of conventional petroleum plays in northcentral Montana: (G) Jurassic-Lower Cretaceous Sandstones Play – 2808, and (H) **Shallow Cretaceous Biogenic Gas Play – 2809 (prominent play for the Monument)**. The area of each play is shaded.

Figure 2.4-1b
Play Coverage Maps (G-H)

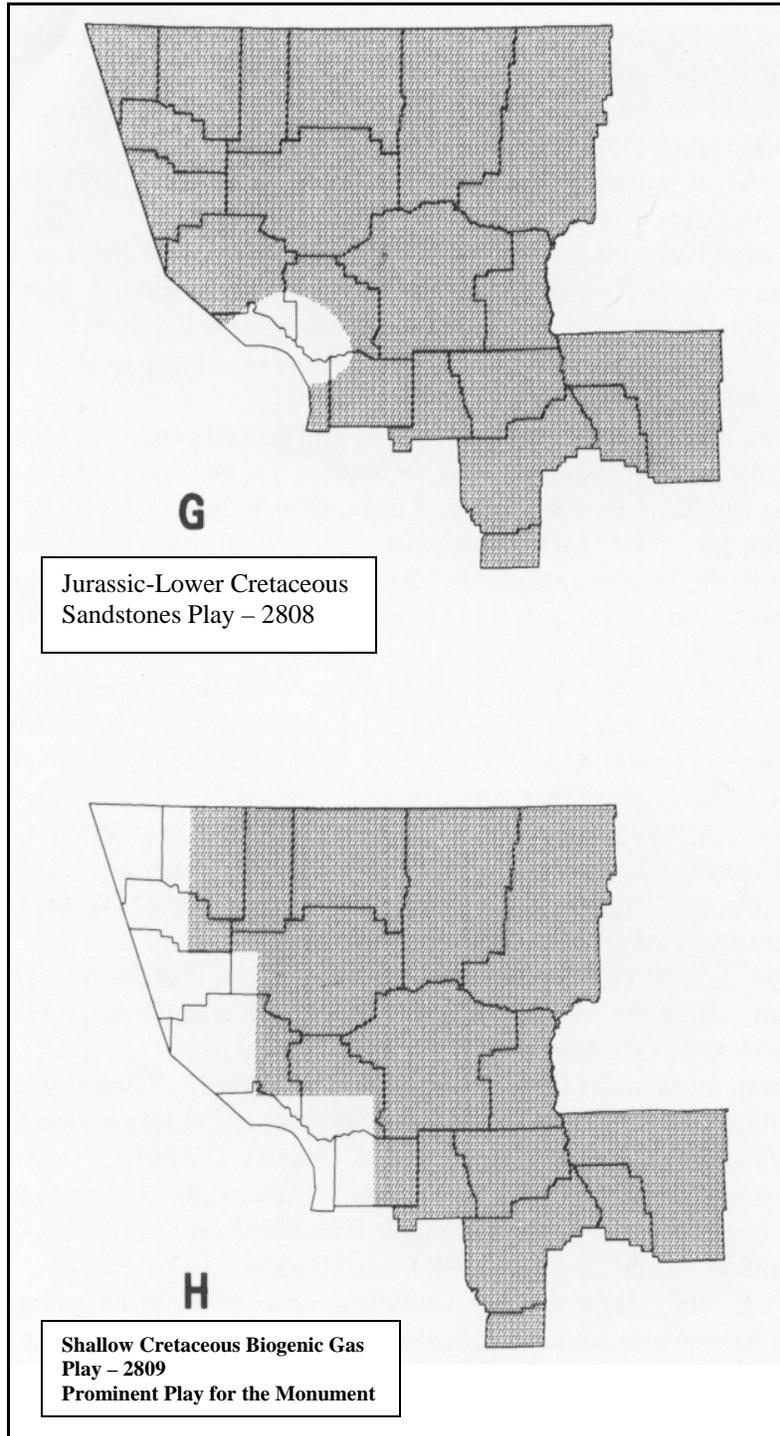


Figure 2.4-1c (Map I) illustrates the approximate boundaries of unconventional (I) Bakken Shale Fracture Systems Play – 2804. The area of play is shaded.

Figure 2.4-1c
Play Coverage Map (I)

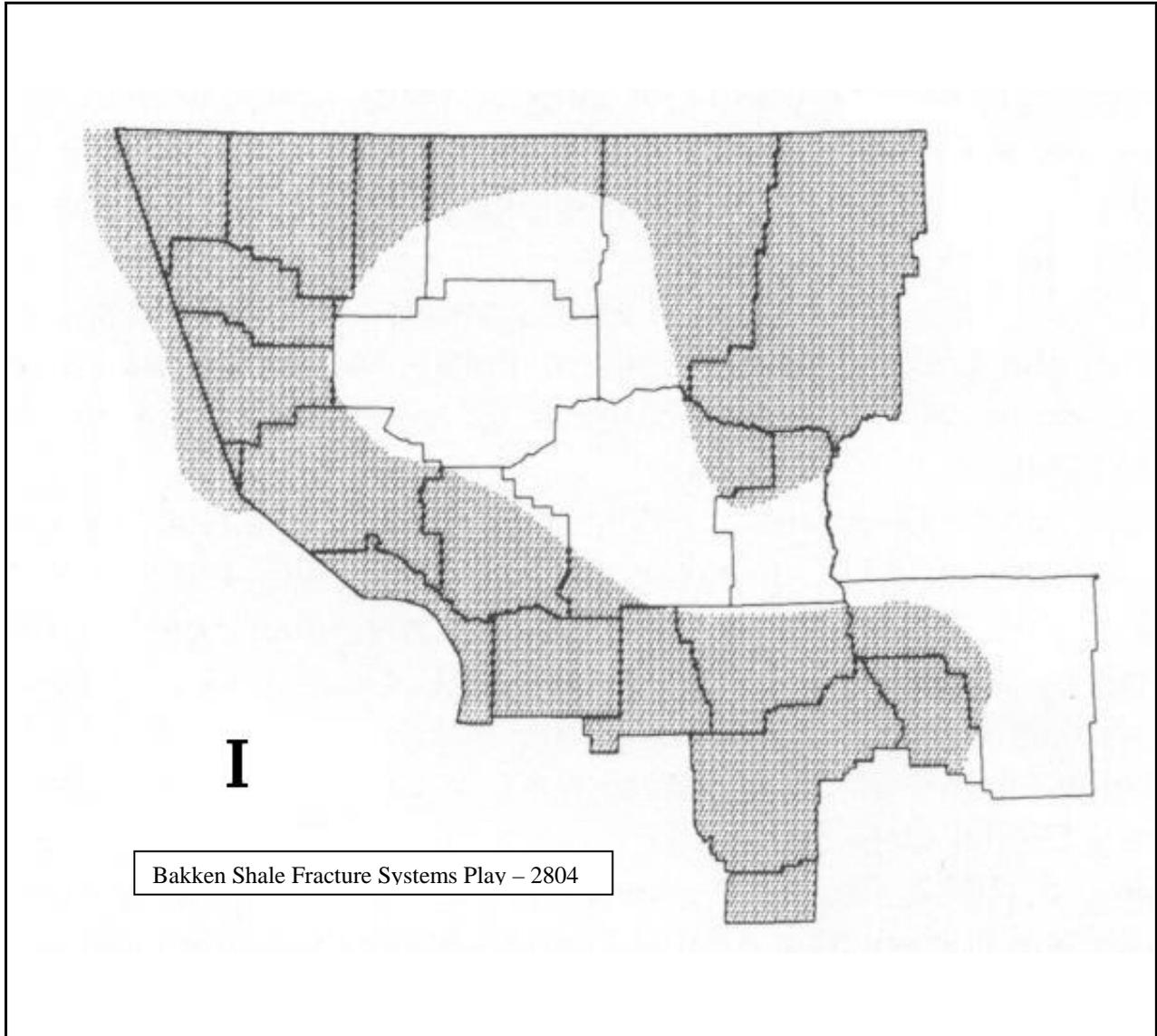
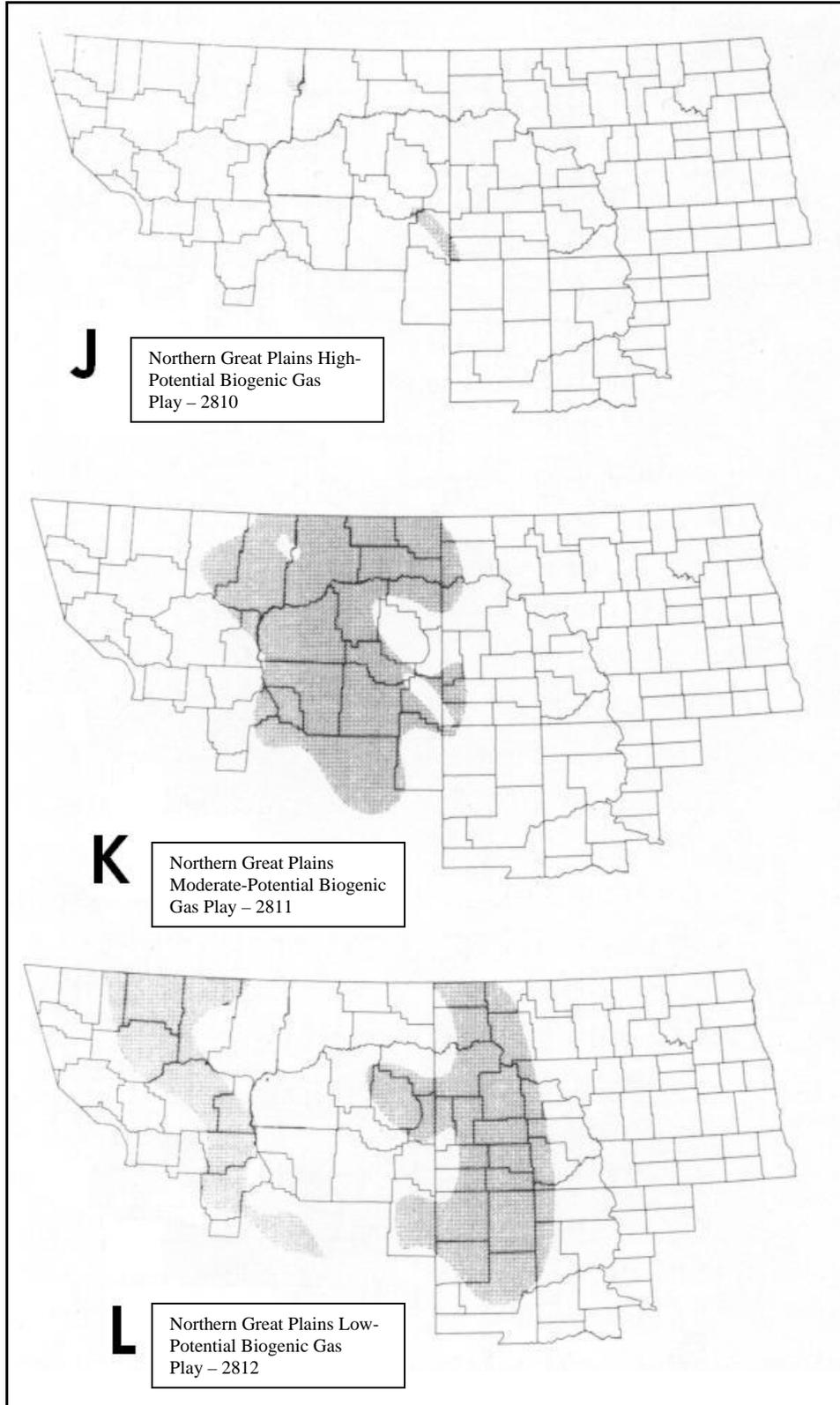


Figure 2.4-1d (Maps J-L) illustrates the approximate boundaries of unconventional continuous-type plays in the Williston Basin and northcentral Montana: (J) Northern Great Plains High-Potential Biogenic Gas Play – 2810, (K) Northern Great Plains Moderate-Potential Biogenic Gas Play – 2811, and (L) Northern Great Plains Low-Potential Biogenic Gas Play – 2812. The area of each play is shaded.

Figure 2.4-1d
Play Coverage Maps (J-L)



Following is a description of the four plays with confirmed production in the NCMP.

2.4.1 Conventional Plays

Devonian-Mississippian Carbonates Play – 2805. (Figure 2.4-1a(D))

The play is characterized primarily by oil accumulations in carbonate reservoirs of Devonian-Mississippian age in both structural and stratigraphic traps. The play includes (1) Devonian carbonate strata of the Souris River, Duperow, Nisku, Potlatch, and Three Forks Formations throughout the 250 x 150 mile area of the province; and (2) predominantly carbonate rocks of the Mississippian Madison Group. The play extends throughout the area of the province, although these rocks vary in reservoir quality and thickness. Devonian and Mississippian strata vary in total thickness from 1,000–2,500 feet.

Reservoirs: Known reservoir rocks include (1) dolomite facies within carbonate-evaporite cycles of the Devonian Nisku Formation; and (2) oolitic and bioclastic carbonate banks and mounds and karst zones in the Mississippian Madison Group. Dolomitization, which may be associated with nearshore salinity variations within Devonian reservoirs, is greatest along a line trending northwestward from the Little Belt Mountains. Widespread paleokarst reservoirs in the middle and upper part of the Madison Group are the result of post-Mississippian erosion. In addition, dolomitized subtidal carbonate banks within the Madison Group are excellent reservoirs where they are interbedded with supratidal anhydrite. Productive zones vary from 10 to 100 feet in thickness.

Source rocks: Source rocks include black organic-rich shale of the Bakken Shale, shale in the Three Forks Formation (Sappington Member), Lodgepole Limestone, and Heath Formation. The Heath is the uppermost unit in the Big Snowy Group, which overlies the Madison Group and occurs in the Central Montana Trough. Vitrinite reflectance values vary from 0.49–0.55% in Heath shale in southern Fergus County, Montana, indicating that they are thermally immature and are at or immediately below the oil generation window. Aram (1993) identified R_o^2 values in the Heath of 0.69–0.84% and total organic carbon (TOC) values of up to 9 weight percent in Petroleum County and in Garfield County immediately east of the province. In the Williston Basin, organic matter in the Bakken Shale is primarily sapropelic kerogen and averages 11 weight percent total TOC. These source rocks are generally thermally mature to marginally mature in the central part of the play, but are often overmature in the disturbed belt to the west. In the western part of the play, Devonian and Mississippian hydrocarbons migrated eastward from source areas within the disturbed belt. Dolson and others (1993) identified a Bakken Shale source for Sun River (Madison) reservoirs along the Sweetgrass Arch. The Bakken Shale is thermally mature ($R_o = 1.5\%$) in the thrust belt to the west and northwest, and oils may have migrated updip into traps along the arch.

Traps: Stratigraphic traps are the result of selective dolomitization of limestone, facies barriers in carbonate-evaporite sequences, and paleosol and karst systems. Most traps have been enhanced by Laramide folding and faulting. Oil found in several Jurassic Sawtooth reservoirs may have been generated in Mississippian source rocks in places where Jurassic reservoirs unconformably overlie Sun River (Madison) dolomite reservoirs. Many Madison Group traps (such as the Pondera field) are strongly influenced by Laramide faulting and folding. Drilling depths to the top of the Devonian vary from 2,700–7,500 feet, but the average depth is 3,000–4,000 feet. Evaporite and shale reservoir seals are present in the Devonian-Mississippian section.

Exploration status: Hydrocarbons have been produced in the play since 1922 when oil was discovered in the Madison at the Kevin-Sunburst field. Six reservoirs greater than 1 million barrels of oil (MMBO) are identified for this play. Typical of these is Pondera field, discovered in 1927. It produces from a 15-foot-thick pay zone in a paleokarst dolomite reservoir in the Sun River at an average depth of 1,950 feet. Reservoir porosity in the field averages 16% and oil gravity is 34° API. A total of 360 wells had been completed in a field area of 7,600 acres, and greater than 35 MMBO had been produced to the end of 1990. The Mississippian section is moderately well

² R_o indicates the term vitrinite reflectance. It is a scientific method for identifying the temperature history of sediments in sedimentary basins. The reflectance of vitrinite was first studied by coal explorationists attempting to diagnose the thermal maturity, or rank, of coal beds. More recently, its utility as a tool for the study of sedimentary organic matter metamorphism from kerogens to hydrocarbons has been increasingly exploited. Generally, the onset of oil generation is correlated with a reflectance of 0.5-0.6% and the termination of oil generation with reflectance of 0.85-1.1%, Wikipedia.org, the free encyclopedia.

explored in the northwestern part of the play, but Devonian production has been limited to two small Nisku wells in the Kevin-Sunburst field that each produces less than 20 barrels of oil per day. Oil shows have been reported in the Nisku from several wildcat wells in the southern part of the Sweetgrass Arch area in the 1980s.

Resource potential: Future potential is moderate for oil and low for gas, mainly in smaller fields. Larger structures have been drilled without success, but opportunity exists for small fields.

Jurassic-Cretaceous Sandstones Play – 2808. (Figure 2.4-1b(G))

The play is defined by oil and gas accumulations mainly in stratigraphic traps locally affected by structure, and in fluvial and deltaic sandstone reservoirs of Jurassic and Cretaceous age. The play covers most of the area of the province except for the Little Belt Mountains. It includes predominantly clastic rocks of the Jurassic Sawtooth, Swift, and Morrison Formations, Lower Cretaceous Kootenai Formation, Lower and Upper Cretaceous Colorado Group, and Upper Cretaceous Montana Group. These strata vary in thickness from 1,500 to 3,000 feet in the play, but they are thin on the Sweetgrass Arch. Cretaceous strata are absent in the play from the southern part of the Sweetgrass Arch to the Little Belt Mountains, and their zero edge forms the southwestern boundary of the play. The base of the Jurassic section varies in depth from 1,000–5,000 feet. Jurassic and Cretaceous strata are combined in the play because of similarities in depositional environment and facies, trapping mechanisms, and source rocks.

Reservoirs: The best reservoir rocks include fluvial to nearshore marine sandstone of the Swift, Sawtooth, Morrison, Kootenai, Blackleaf, and Marias River Formations and their stratigraphic equivalents. Valley-fill fluvial channels form major reservoirs at Cutbank field along the updip end of the Sweetgrass Arch. Jurassic reservoirs of the Sawtooth and Swift Formations occur in generally lenticular, laterally discontinuous marine sandstone. Permeability barriers associated with environments of deposition, diagenetic alteration of sandstones, and Laramide folding and faulting strongly affect the quality of reservoirs. Kootenai sandstone reservoirs (2nd and 3rd Cat Creek sands of drillers' usage) are well developed and of good quality where they are adjacent to and sealed by floodplain and interdistributary mudstone. Fluvial and deltaic sandstone of the Blackleaf Formation (Vaughn Member) in the western part of the play and to the south in southwestern Montana is volcanic rich and forms poor reservoirs.

Source rocks: The most important source rocks are dark-gray phosphatic shale of Jurassic age, and Cretaceous dark-gray shale in the Kootenai, Blackleaf, and Marias River Formations and their stratigraphic equivalents (Hayes, 1984). Generally, the organic material in these shale beds is thermally immature except where buried to greater depths near the disturbed belt or very near Tertiary intrusive and volcanic rocks. The TOC values average 2.4 weight percent for the Cone Member of the Marias River Shale in the disturbed belt near Glacier National Park in Glacier County, and vitrinite reflectance values average 0.6% along the crest of the Sweetgrass Arch. Dolson and others (1993) identified Bakken Shale source rocks for Cretaceous reservoirs along the Sweetgrass Arch. The Bakken Shale is thermally mature ($R_o = 1.5\%$) in the disturbed belt to the west, and hydrocarbons probably migrated updip into shallow Cretaceous reservoirs along the axis of the Sweetgrass Arch.

Traps: Most reservoir traps are stratigraphic but are structurally enhanced in the northwestern part of the province; they were filled with hydrocarbons migrating updip from source rocks in deeper parts of the disturbed belt. The relative importance of stratigraphic versus structural factors in trap definition for Jurassic and Cretaceous reservoirs is difficult to define. Updip shale beds form effective seals in the Jurassic-Cretaceous section. Drilling depths range from less than 1,000–6,000 feet.

Exploration status: The play has been moderately explored, in part, because of early attention to surface oil seeps and subsequent discoveries at shallow depths (usually less than 2,500 feet). Thirty-five significant oil and gas reservoirs have been found in the play since the 1919 discovery at the Cat Creek field. Cutbank field in Glacier and Toole Counties is one of the largest fields in the play. The field was discovered in 1926 and has produced more than 100 MMBO and 300 BCF of gas from fluvial and deltaic sandstone reservoirs of the Kootenai Formation (Cutbank sandstone). A total of 187 wells produce from an average depth of 3,300 feet in the field, which covers more than 65,000 acres. The most productive gas reservoir, the Cutbank sandstone, was deposited in a widespread fluvial channel system; the sandstone pinches out against Jurassic strata on the east to form a large valley-fill trap. Sandstone reservoirs of the Blackleaf Formation are generally less productive than sandstone reservoirs in the Kootenai Formation.

Resource potential: Future potential is estimated to be low for oil and moderate for gas because all the large stratigraphic and structural traps have been defined by exploration through the years. Future exploration opportunities exist for small reservoirs.

Shallow Cretaceous Biogenic Gas Play – 2809. (Figure 2.4-1b(H))

Late Cretaceous source rocks were generally not buried deep enough for oil generation in the NCMP. Most Late Cretaceous natural gas is methane-rich biogenic gas formed from the breakdown of organic matter by anaerobic bacteria at relatively low temperatures. Some biogenic gas in Montana occurs in widely dispersed continuous-type accumulations in low-permeability reservoirs with hydrodynamic control; this resource is considered unconventional (continuous-type). However, only conventional undiscovered accumulations in water-driven, structurally and stratigraphically trapped reservoirs are included in this play.

Reservoirs: The Shallow Cretaceous Biogenic Gas Play is characterized by accumulations in shallow reservoirs in predominantly clastic rocks of the Upper Cretaceous Montana Group (for example, Eagle Sandstone), although similar reservoirs occur in the lower Upper Cretaceous upper part of the Blackleaf Formation and equivalent strata (for example, Mowry Shale and Muddy Sandstone). Boundaries of the play are defined by the distribution of Late Cretaceous predominantly marine sandstone and siltstone as defined by Rice and Shurr (1980). Montana Group rocks are generally absent due to Tertiary erosion along the axis of the Sweetgrass Arch in the northwestern part of the province. The western boundary of the play extends along a north-south line defining the western limit of Late Cretaceous strata. Late Cretaceous strata vary in thickness from 1,000 to more than 3,000 feet within the play area. Sandstone reservoirs vary from less than 1,000 feet to about 4,000 feet deep. The best gas accumulations are in late Cretaceous reservoirs in permeable shoreface and shelf sandstone. Tiger Ridge field in Hill and Blaine Counties produces gas from regressive shoreface sandstone reservoirs in the Eagle Sandstone that are in part fault controlled. At Bowdoin Dome in Phillips County, production is from thin-bedded, low-permeability sandstone reservoirs in the Carlile Shale; however, reservoirs at Bowdoin are considered unconventional for this assessment. Reservoirs in low-permeability marine chalk of the Greenhorn Formation, which is approximately equivalent to the Marias River Shale, produce some gas at the north end of Bowdoin field and are also considered unconventional for this assessment.

Traps: Stratigraphic trapping of gas within both clastic and carbonate reservoirs may be due to permeability barriers related to facies changes, and to the distribution of fracture systems. Many stratigraphic traps are, in part, structurally controlled, such as at Bowes field.

Exploration status: Currently, seven significant fields produce biogenic gas from Late Cretaceous reservoirs in northcentral Montana. Of these seven, at least four have a poorly-developed to well-developed water drive system; these include Sherard, Leroy, Tiger Ridge, and Battle Creek fields. Tiger Ridge field in Blaine and Hill Counties is a representative example of the Shallow Cretaceous Biogenic Gas Play. The field was discovered in 1966 as the result of an offset from a dry hole that bottomed in the Madison Group. At present, more than 80 wells produce methane-rich gas (94% methane) from the Eagle Sandstone and Judith River Formation in a field area of approximately 115,000 acres. Production occurs at an average depth of 1,000 feet in a 135-foot thick pay zone that has an average porosity of 26%. Tiger Ridge has an ultimate production of 760 BCF which represents about 30% of the entire province (2.1 trillion cubic feet of gas) based on data for significant fields.

Resource potential: The play is moderately explored in the more favorable areas, and the future potential for undiscovered gas is fair. Currently, limitations exist because of economic considerations associated with biogenic-rich reservoirs and because of the existing pipeline and transportation infrastructure; many potential reservoirs are considered unconventional (continuous-type). Many of the larger structures are well drilled, but possibilities exist for small reservoirs.

2.4.2 Unconventional Plays (Hypothetical) Continuous-Type

Northern Great Plains Biogenic Gas-Low Potential Play – 2812. (Figure 2.4-1d(L))

This play is hypothetical but has a high probability that it exists. It encompasses those areas where marine-shelf sandstone and siltstone sequences are thinner and more poorly developed than in Play 2811. The general trend limits of this play are based on interpretation of regional facies mapping by Rice and Shurr (1980).

Reservoirs: The reservoirs are the same as in Play 2811 except sandstone and siltstone strata are somewhat thinner in the overall rock sequence.

Source rocks: Source rocks are marine shales interbedded with reservoir rocks. Organic richness averages about 2 percent TOC (Rice and others, 1990). The source rocks are thermally immature.

Timing and migration: Timing is not important inasmuch as the methane gas began to be generated soon after burial because it was the product of methanogenic bacteria activity (Rice and Shurr, 1980). This activity continued as long as temperature, pore space, and availability of CO₂ for respiration were optimum. The methane went into solution in formation water and was then exsolved out of solution into a free-gas phase after uplift and cooling.

Traps: Traps are micro-stratigraphic over much of the play area. The gas is trapped by changes in capillary pressure and pore sizes. Once the gas was exsolved out of the pore water, it was preferentially trapped in the relatively coarser clastics and cannot migrate out of the reservoir except by diffusion.

Exploration status and resource potential: This play is relatively unexplored in the United States by wells drilled with a biogenic gas objective. Many wildcat wells are being drilled in Canada where the play concepts are now well recognized.

3.0 Past, Present and Future Oil and Gas Exploration and Development Activity in the Monument

Until the 1960s and 1970s drilling and exploration activity was relatively low within the study area. Although gas was known to exist, it was not a primary objective or target while industry was in search of oil, due to gas prices as low as 10¢/MCF and lack of pipeline infrastructure. With gas prices now ranging between \$5 and \$7/MCF and more infrastructure available, the economic incentive exists to further explore and develop natural gas resources in the Monument. The study area contains federal, state, and private leases that have a reasonable chance of being further developed for oil and gas (specifically gas, because oil has not been discovered in the Monument).

3.1 Historical Geophysical and Chemical Surveys

Natural gas was discovered in the study area through direct and indirect exploration methods. Exploration within the region surrounding the Monument began in the early 1920s near Winifred, Montana. The industry utilized direct methods to explore for gas by conducting geologic surveys of rock outcrops, gas seeps, drilling wells to test their theories and data achieved from newly drilled wells (even though there were very few at that time) to further understand the subsurface geology and then creating early renditions of geologic maps of the area. Between 1920 and the early 1970s, natural gas was not the primary product that industry sought. Oil was the primary target. Exploration in this area remained at relatively low levels, until a sizeable discovery was made in 1971 just to the north of the study area. The discovery sparked more interest in the area to a point to where the maximum number of wells drilled in the area now included in the Monument peaked in 1974 at 26 wells. This and continued drilling efforts eventually led to the discovery of more commercial natural gas deposits and further infrastructure was built in and around the Monument (see Section 3.3, New Field and Reservoir Discoveries). Not until the late 1970s and early 1980s had seismic technology been used to gain a more thorough understanding of the area's subsurface geologic structure. Further improvements in seismic technology, such as 3-D seismic surveys and data processing techniques continued to enhance the understanding of the area's subsurface geology.

Even though seismic data is limited throughout the Monument, 2-D surveys of the fringe areas of the Monument have been made. Seismic surveys were conducted in the late 1980s in the Sherard Area and it is estimated that 25 miles of seismic line were shot over what is now Monument land in that area. More recently, in 2002 and 2003, additional 2-D type surveys were shot in the north part of the Monument (South Sawtooth Field). It is estimated that six miles of seismic line were shot over Monument land in that area. This combined with recent well activity is being used to gain a better understanding of the area's complicated subsurface. Further improvements in seismic technology such as 3-D seismic surveys and data processing techniques continue to enhance the understanding of the area's subsurface geology. No 3-D surveys have been shot in the Monument, however it is understood there is interest in conducting a 3-D survey on some of the lands in the Sherard area of the Monument in the near future. This could further define the extent of prospects that operators may want to develop.

3.2 Exploratory/Development Drilling

The following discussion regards historic drilling activities adjacent to and within the study area. The narrative also discusses potential that specific areas contain for future drilling and the potential for oil and gas to occur. The areas identified under this narrative are based on well information (drilling and electric logs), reservoir data, industry's geologic interpretation, historical production data and information provided by industry indicating plans to explore and develop natural gas in the Monument and adjacent areas. The identified areas exclude the potential for oil and gas to be discovered on state and private lands intermingled with or adjacent to the Monument. Should industry desire to explore for oil and gas on state or private lands, the environmental document to address that activity would be outside of this document and left to the private and state landowner/manager's discretion.

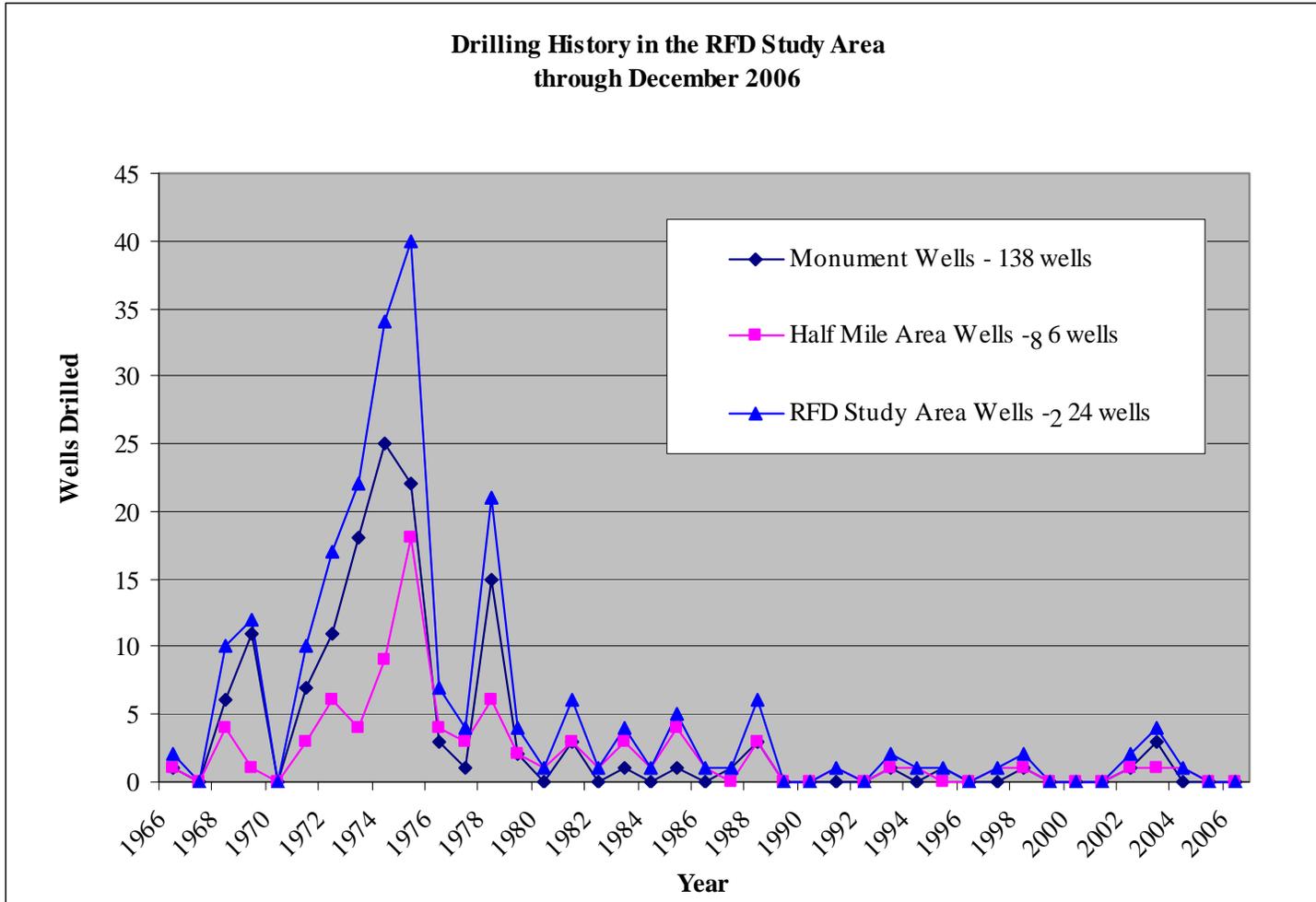
The majority of the oil and gas exploration and development activities in the region surrounding and inside the study area (namely 35 townships covered by T21-27N, R17-21E) occurred prior to the Monument. Exploration for oil and gas in the region began in 1917 (the date the first well was drilled). A total of 869 wells have been drilled within these 35 townships prior to the Monument.

The first well in the study area was drilled in 1939. Since then, 138 wells have been drilled in the Monument with an additional 86 wells (224 wells total) drilled within ½ mile of the Monument. Some activity falls outside of the study area because of a federal lease, federal Communitization Agreement (CA), or federal unit. The majority of the historic drilling in the study area occurred in the 1970s and 1980s following trends with respect to natural gas pricing and infrastructure (Figure 3.2-1). Table 3.2-1 describes the currently active wells with an APD in the Monument or within ½ mile of the Monument.

A total of 17 wells have tested/produced commercial quantities of gas for a success rate of 12.2% in the Monument. The overall success rate increases to 18% when wells within the study area are added, or 40 out of 224 wells. The success rates have improved in more recent years as knowledge of the area improves including additional seismic information, reprocessed seismic data and well information. Using the previous 20 years of drilling history, the overall success rate improves from 18% to 35%.

Although it is difficult to predict the size and the frequency of future discoveries with certainty, it can be estimated based on historical records that the average discovery will yield 390,000 MCF (0.39 BCF). This information is based on an average of ultimate recovery figures generated by production decline curve analysis of the 40 wells within the study area.

Figure 3.2-1



3.3 New Field and Reservoir Discoveries

Outside of the Judith River, Eagle and Carlile Formations within the study area there is limited chance for new fields and reservoir discoveries based on historical drilling patterns. It is not known if operators of the federal leases will perform exploratory drilling into deeper horizons prior to the expiration of the leases. Once a lease expires, no further oil or gas activity will occur on the lease. Other than the mentioned formations, no other discoveries have been made in other formations in the vicinity of the study area.

Exploration of the region began in the early 1920's in the Sherard and Winifred areas. The first study-area well was drilled in the Whiskey Ridge area. The area is considered the southernmost exploration area common to the Monument and lies approximately three miles south and west of the McClelland/Stafford Ferry. The Mauland No. 2 well was the Monument area's first exploration well. It was drilled in October 1939 by E & M Oil and Gas Company at a location in the SE $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 4, T. 22 N., R. 18 E., Fergus County. The well was drilled to a total depth (TD) of 635 feet and reached the Eagle Sandstone at 424 feet. The well was drilled as a dry hole and was subsequently plugged and abandoned (see Section 4.2.1, Whiskey Ridge Exploration/Production Area).

The discovery well for the Leroy Gas Field (the first commercially productive well within the Monument) was drilled about a mile north of the Missouri River and approximately three miles downstream of the McClelland/Stafford Ferry (see Section 4.2.7, Leroy One Exploration/Production Area). The Bearpaw Federal No. 1-18 well was spud in October 1968 by El Santo Petroleum Corp. & Royal Crest Oil Corp. at a location in the NW $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 18, T. 23 N., R. 19 E., Blaine County (see Figure 4.2.7-1). The well was completed in November 1968 as a producing gas well and later produced 476,996 MCF of natural gas between December 1980 and May 1991 before it was plugged and abandoned on June 1, 1996 as a depleted producer. Note that the well was idle (shut-in) for nearly twelve years before pipeline infrastructure was introduced to the area in 1980. Although this well was considered the first commercially productive well within the Monument, two other successful wells were drilled in the Monument prior to the above-referenced well but were never produced. See further discussion under Section 4.2.5, Leroy Bullwacker Exploration/Production Area, and Section 4.2.6, Cow Creek Exploration/Development Area.

4.0 Past and Present Oil And Gas Development Activity and Comparisons to Development Activity Located Outside the Monument

4.1 Leasing Activity, Unit Descriptions, Spacing Requirements, and Well Location by Class and Type

The study area currently includes 43 federal oil and gas leases (42,805 acres) and 3 state oil and gas leases (1,918 acres). The majority of the federal leases lie partially outside the Monument and can occur in a non-contiguous manner. Private land (surface and mineral ownership) in the area may also include oil and gas leases. The majority of the leased federal lands are in Blaine County (92% north of the river) and the remainder lie in Fergus and Chouteau Counties (5% and 3% respectively). None of the existing federal leases in the Monument are in Phillips County.

A summary of historical natural gas exploration and development in the Monument is shown in Table 4.1-1.

**Table 4.1-1
Historical Natural Gas Exploration and Development in the Monument**

<i>Natural Gas Wells</i>	<i>Leroy Gas Field</i>	<i>Sawtooth Mountain Gas Field</i>	<i>Sherard Unit Area</i>	<i>Outside of Existing Fields</i>	<i>Total</i>
Drilled	41	2	12	83	138
Dry Holes (Abandoned)	29	2	9	81	121
Completed	12	0	3	2	17
Production	11	0	3	0	14
Shut-In without Pipeline	1	0	0	2	3
Completed Wells Plugged	6	0	0	1	7
Completed Wells Active	6	0	3	1	10
Production (BCF)	1.7	0	4.0	0	5.7

A lease in the Monument may also be part of a Communitization Agreement (CA) and/or Unit Agreement. The agreements provide for an administrative method to develop the gas resources and allow a fair and equitable allocation of well production back to specific leases tied to the agreements, based on acreage within the agreements. The CAs are necessary to protect the various mineral interests (federal, state and private) involved in spacing units where normally only one well is allowed. Currently, 11 CAs are both in and outside the Monument. Another 10 CAs lie outside of the Monument, yet are common to the Monument because a portion of the lease is common to both the CA and the Monument. The CAs are formed based on standard state spacing requirements for gas wells (one well per 640 acres, statewide well spacing) and state-approved Board of Oil and Gas Conservation orders allowing reduced spacing, or one well per 320 acres to sufficiently develop the gas resource (State Board Order Nos. 19-75 and 31-87).

In addition to leases contained in the mentioned CAs, two federal leases are also located in a Unit within the Monument known as the Sherard Eagle Participating Area (PA) "E." PA "E" of the Sherard Unit was formed after the discovery of a geologic feature in Sections 27 and 28 of T. 25 N., R. 19 E., Blaine County, by drilling the U.S. No. 6-28 well in late 1974. The 1280-acre PA currently contains three active wells located in the Monument producing from the Eagle Formation.

Outside of the leased federal lands in the Monument, the chance of further oil and gas discovery is remote. Since the Proclamation withdrew all federal land in the Monument (unleased federal minerals totaling 348,824 acres), and no commercially productive oil or gas discoveries have been made within the confines of Monument lands west of McClelland/Stafford Ferry (federal, state or private), or east of the confluence of Bullwhacker Creek and the Missouri River, future exploration outside of the referenced geographic area is unlikely. Although there is no chance of further oil and gas discovery on unleased federal lands in the described area, there is potential for future exploration and development on the state and private minerals within the described lands and other state and private lands intermingled with the Monument.

Leroy Gas Field

The majority of the existing federal Monument leases lie within the Leroy Gas Field. The field was discovered in November 1968 by the Federal 1-18 well drilled by El Santo Petroleum Corp in the NW¹/₄NW¹/₄NW¹/₄ of Section 18, T. 23 N., R. 19 E.

Following the well which led to the discovery of the Leroy Gas Field in 1968, 40 additional wells were drilled on lands now in the Monument. Twenty-nine were abandoned as dry holes. Twelve were completed (11 to production and one shut-in without a pipeline). Of these twelve, six were eventually plugged (including the discovery well); leaving six active Leroy Gas Field wells in the Monument. Per State Board Order Nos. 19-75 and 31-87, the Leroy

Gas Field is allowed to be developed on 320-acre spacing units for the Judith River and Eagle/Virgelle Formations with each unit consisting of half sections lying in a north-south or east-west direction. Two active wells currently produce natural gas. Combined production from the two wells through December 2006 is 0.85 BCF. Another four wells remain shut-in awaiting the outcome of the Monument RMP/EIS. Combined production from the four wells through December 2006 is 0.23 BCF.

Sixteen peripheral wells within ½ mile of the Monument produce from the Leroy Gas Field. They have produced 2.5 BCF through December 2006.

Another 11 wells, outside the Monument yet within the Leroy Gas Field and associated with Communitization Agreements, have produced 5.1 BCF. Of these 11 wells, four have been plugged.

Sawtooth Mountain Gas Field

The Sawtooth Mountain Gas Field lies at the very north edge of the Monument's east section. It is common to the Monument because two federal leases overlap the Monument and the Sawtooth Mountain Gas Field. Currently, no active Monument wells are within the Sawtooth Mountain Gas field leases; however, two wells lie adjacent to the Monument (less than ½ mile away) and are contained in a lease and CA both in and outside the Monument. The wells were drilled in the mid 1970s and continue to produce. Geologic characteristics of the Sawtooth Mountain Gas Field are similar in nature to those of the Leroy Gas Field as they are adjacent to one another near the northern edge of the Monument.

Currently no federal wells are active in the Monument in the Sawtooth field. Two active wells currently produce natural gas within ½ mile of the Monument. Combined production from the two wells through December 2006 was 1.4 BCF.

Sherard Unit Area

Six of the leases in the Monument fall within the Sherard Unit Area. The first successful well in this area was drilled in December 1974 and continues to produce. Geologic characteristics of the Sherard Unit Area in the Monument are similar in nature to those of the Leroy Gas Field as a relatively short distance separates the two fields.

The Sherard Unit Area allows for one well per section with numerous well density and location exceptions. Because the area is so broken with fault blocks, there is a need to drill additional wells. For example, if one section of land contains ten individual fault blocks, it is highly likely that the BLM and the Montana Board of Oil and Gas Conservation would be petitioned by industry to allow wells to be drilled into each discrete fault block in order to produce the natural gas resource from each fault block.

Three federal wells are currently active in the Sherard Unit Area of the Monument. Two of the wells continue to produce and the other well is to be plugged and abandoned. Combined production from the three wells through December 2006 was 4.0 BCF.

Wells Outside Field Boundaries

In addition to the wells discussed above, two additional wells were drilled in the Monument, but outside of the described gas fields. The Federal 30-1 well was drilled east of the Leroy Gas Field and is currently shut in waiting on a pipeline. See further discussion regarding this well in Section 4.2.4 Central Leroy East Exploration/Development Area. The Cow Creek Federal No.1 well was drilled and completed in 1968; however, because of a lack of market for the gas, this well was plugged and abandoned in 1978. See further discussion regarding this well in Section 4.2.6 Cow Creek Exploration/Production Area.

4.2 Exploration/Production Areas

Each of the fields includes productive areas that are referred to as exploration/production areas. Eighteen areas within the study area are used to describe historic, current and future exploration and development. In two of the areas (Sections 4.2.6 Cow Creek and 4.2.7 Leroy One) no federal leases occur or ever will occur because of the Monument Proclamation. They are included for historical purposes to indicate the trend for oil and gas exploration and development of the area. The 18 areas are common to the Monument and are mostly contained within the Monument; however, some of the areas are both in and outside the Monument.

In addition to the wells drilled within the exploration/production areas, numerous other exploratory wells were drilled and abandoned outside of these areas because the wells had no shows of natural gas. Valuable information was gained from the abandoned wells because they further identified the subsurface resource. In some cases they are also included for informational purposes only and are referred to as Identification Wells in the tables which follow for each exploration/production area.

The potential for future drilling in each area was rated from low to high. The criteria were based on whether another well could be drilled in an already productive spacing unit or whether the spacing unit had a dry hole drilled previous to this report. The spacing units without wells drilled and adjacent to productive areas received a high potential for drilling. The spacing units with either a dry hole or a productive well received a low potential for drilling another well. Due to the complex structural geology and the possibility of drilling a producing gas well within a few acres of dry holes, exceptions could occur in the low potential drilling areas. All other areas were given a moderate potential for drilling another well (see Figure 4.2-1).

It is reasonably foreseeable that natural gas wells could be drilled in 11 of the 18 exploration/production areas. Table 4.2-1 presents each of the exploration areas by the chronological order in which the area was explored. Also see Figures 4.2-1 and 4.2-2 for the location of each exploration/production area.

Exploration/ Production Area (date 1st well drilled)	Field Name	Area Description	General Remarks
1 - Whiskey Ridge (October 1939)	Wildcat (Not part of a field within the Monument)	SE $\frac{1}{4}$ NW $\frac{1}{4}$, NE $\frac{1}{4}$ SW $\frac{1}{4}$, S $\frac{1}{2}$ NE $\frac{1}{4}$, N $\frac{1}{2}$ SE $\frac{1}{4}$ Section 7; S $\frac{1}{2}$ N $\frac{1}{2}$, N $\frac{1}{2}$ S $\frac{1}{2}$ Section 8; S $\frac{1}{2}$ N $\frac{1}{2}$, N $\frac{1}{2}$ S $\frac{1}{2}$ Section 9; S $\frac{1}{2}$ N $\frac{1}{2}$, N $\frac{1}{2}$ S $\frac{1}{2}$ Section 10; S $\frac{1}{2}$ N $\frac{1}{2}$, S $\frac{1}{2}$ Section 11; T. 22 N., R. 18 E. (1,660 acres)	Approximately a three square mile area where ten wells have been drilled including one active well (one shut-in gas well). Area approximately 40% in the Monument. Active federal leases are in the Monument in this area.
2 - North Leroy (March 1968)	Leroy	N $\frac{1}{2}$, SW $\frac{1}{4}$, W $\frac{1}{2}$ SE $\frac{1}{4}$ Section 3; NW $\frac{1}{4}$, W $\frac{1}{2}$ NE $\frac{1}{4}$, N $\frac{1}{2}$ SW $\frac{1}{4}$, NW $\frac{1}{4}$ SE $\frac{1}{4}$; Section 10; T. 25 N., R. 20 E.; Section 14; N $\frac{1}{2}$ Section 15; N $\frac{1}{2}$ Section 16; NE $\frac{1}{4}$ Section 17; E $\frac{1}{2}$ SE $\frac{1}{4}$ Section 22; Sections 23 and 26; E $\frac{1}{2}$ E $\frac{1}{2}$ Section 27; E $\frac{1}{2}$ Section 34; W $\frac{1}{2}$ W $\frac{1}{2}$ Section 35; T. 26 N., R. 20 E. (4,460 acres)	Approximately six and a half square mile area where 14 wells have been drilled including eleven active wells (two shut-in gas wells and nine producing gas wells). Area approximately 15% in the Monument. Active federal leases are in the Monument in this area.
3 - Central Leroy (July 1968)	Leroy	Section 12; N $\frac{1}{2}$ N $\frac{1}{2}$ Section 13; N $\frac{1}{2}$, SW $\frac{1}{4}$, W $\frac{1}{2}$ SE $\frac{1}{4}$ Section 14; S $\frac{1}{2}$ Section 15; SE $\frac{1}{4}$ Section 21; Section 22; NE $\frac{1}{4}$, W $\frac{1}{2}$ Section 28; Section 29; SE $\frac{1}{4}$ SE $\frac{1}{4}$ Section 30;	Approximately seven and a half square mile area where nine wells have been drilled including three active wells (two producing gas wells and one shut-in). Area all in

**Table 4.2-1
Exploration/Production Areas**

Exploration/ Production Area (date 1st well drilled)	Field Name	Area Description	General Remarks
		NE $\frac{1}{4}$, E $\frac{1}{2}$ NW $\frac{1}{4}$, N $\frac{1}{2}$ SE $\frac{1}{4}$, NE $\frac{1}{4}$ SW $\frac{1}{4}$ Section 31; NW $\frac{1}{4}$ Section 32; T. 24 N., R. 20 E.; N $\frac{1}{2}$ Section 7; T.24 N., R. 21 E.; SE $\frac{1}{4}$ Section 36; T. 25 N., R. 20 E.; SW $\frac{1}{4}$, W $\frac{1}{2}$ SE $\frac{1}{4}$ Section 31; T. 25 N., R. 21 E. (4,500 acres)	Monument. Active federal leases are in the Monument in this area.
4 - Central Leroy East (August 1968)	Leroy/Wildcat	E $\frac{1}{2}$ Section 25; N $\frac{1}{2}$, N $\frac{1}{2}$ S $\frac{1}{2}$ Section 36; T. 24 N., R. 20 E.; S $\frac{1}{2}$ Section 19; Section 20; W $\frac{1}{2}$ Section 29; Section 30; N $\frac{1}{2}$ Section 31; NW $\frac{1}{4}$ Section 32; T. 24 N., R. 21 E. (3,150 acres)	Approximately five square mile area where two wells have been drilled including two active wells (two shut-in gas wells). Area all in Monument. Active federal leases are in the Monument in this area.
5 - Leroy-Bullwacker (August 1968)	Leroy	Sections 15, 16 and 17; E $\frac{1}{2}$ SE $\frac{1}{4}$ Section 18; E $\frac{1}{2}$ E $\frac{1}{2}$ Section 19; W $\frac{1}{2}$, NE $\frac{1}{4}$ Section 20; NW $\frac{1}{4}$ NW $\frac{1}{4}$ Section 21; W $\frac{1}{2}$ W $\frac{1}{2}$ Section 29; E $\frac{1}{2}$ Section 30; Section 31; T. 25 N., R. 20 E. (3,800 acres)	Approximately six square mile area where nine wells have been drilled including three active wells (one producing gas well and two shut-in gas wells). Area approximately 90% in the Monument. Active federal leases are in the Monument in this area.
6 – Cow Creek (September 1968)	Wildcat	NW $\frac{1}{4}$ Section 2; Section 3; T. 25 N., R. 21 E. (820 acres)	Approximately one square mile area where one well was drilled as an active gas well and later plugged because the well did not justify a pipeline. Area all in Monument. No active federal leases within described area.
7 - Leroy One (Discovery well of the Leroy Gas Field October 1968)	Leroy	SE $\frac{1}{4}$ Section 12; NE $\frac{1}{4}$ Section 13; T. 23 N., R. 18 E.; SW $\frac{1}{4}$, W $\frac{1}{2}$ SE $\frac{1}{4}$ Section 7; NW $\frac{1}{4}$, W $\frac{1}{2}$ NE $\frac{1}{4}$ Section 18; T. 23 N., R. 19 E. (620 acres)	Approximately one square mile area where four wells were drilled. The first of the four wells drilled in this area was the discovery well for the Leroy field. The other three wells were drilled and abandoned. Area all in the Monument. No federal active leases within described area.
8 – Sherard/ Northwest Leroy (May 1969)	Sherard & Leroy	Sections 1, 2, 3, 10, 11, 12; N $\frac{1}{2}$ Section 13; N $\frac{1}{2}$, SW $\frac{1}{4}$ Section 14; Section 15; T. 25 N., R. 19 E.; W $\frac{1}{2}$, W $\frac{1}{2}$ E $\frac{1}{2}$ Section 6; T. 25 N., R. 20 E.; S $\frac{1}{2}$ Section 26; Section 27; E $\frac{1}{2}$ E $\frac{1}{2}$ Section 33; Sections 34, 35; S $\frac{1}{2}$ Section 36; T. 26 N., R. 19 E. (8,590 acres)	Approximately twelve and a half square mile area where twenty-one wells were drilled including eight active wells (seven producing gas wells and one shut-in gas well). Area approximately 55% in the Monument. Active federal leases within approximately 85% of the area.

**Table 4.2-1
Exploration/Production Areas**

Exploration/ Production Area (date 1st well drilled)	Field Name	Area Description	General Remarks
9 - Leroy Two (June 1969)	Leroy	N $\frac{1}{2}$ Section 13; NE $\frac{1}{4}$ Section 14; T. 25 N., R. 20 E. (470 acres)	Approximately one square mile area where two wells have been drilled, including one well that was drilled as an active gas well and later plugged because the well did not justify a pipeline. The other well was drilled and abandoned. Area all in Monument. Active federal lease in the Monument in Section 13.
10 – West Leroy (July 1969)	Leroy	N $\frac{1}{2}$ Section 2; T.23 N., R. 18 E. SE $\frac{1}{4}$ Section 9; Sections 10 and 11; SW $\frac{1}{4}$ Section 12; W $\frac{1}{2}$, W $\frac{1}{2}$ E $\frac{1}{2}$ Section 13; Section 14; N $\frac{1}{2}$ NW $\frac{1}{4}$, E $\frac{1}{2}$ Section 15; E $\frac{1}{2}$ W $\frac{1}{2}$, E $\frac{1}{2}$ Section 22; Section 23; W $\frac{1}{2}$, W $\frac{1}{2}$ SE $\frac{1}{4}$ Section 24; W $\frac{1}{2}$ Section 25; Section 26; E $\frac{1}{2}$ Section 27; E $\frac{1}{2}$ Section 34; Section 35; W $\frac{1}{2}$ W $\frac{1}{2}$ Section 36; T. 24 N., R. 18 E. (7,120 acres)	Approximately eleven and a half square mile area where 40 wells have been drilled including nine active wells (six producing gas wells and three are shut-in). Area approximately 10% in the Monument. Active federal leases are in the Monument in this area.
11 - Sawtooth (June 1971)	Sawtooth Mountain	W $\frac{1}{2}$ Section 1; Section 2; Section 3, S $\frac{1}{2}$ Section 4; SE $\frac{1}{4}$ Section 5, E $\frac{1}{2}$ Section 8; Section 9; Section 10; Section 11; NW $\frac{1}{4}$ Section 12; T. 26 N., R. 20 E.; S $\frac{1}{2}$ Section 35; SW $\frac{1}{4}$ Section 36; T. 27 N., R. 20 E.; T. 26 N., R. 20 E. (4,990 acres)	Approximately eight square mile area where eleven wells have been drilled including four active wells (producing gas wells). Area approximately 40% in the Monument. Active federal leases are in the Monument in this area.
12- Sherard Unit Area East (September 1971)	Sherard & Leroy	S $\frac{1}{2}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SW $\frac{1}{4}$ Section 23; Sections 24 and 25; E $\frac{1}{2}$, E $\frac{1}{2}$ W $\frac{1}{2}$ Section 26; N $\frac{1}{2}$ NE $\frac{1}{4}$, NE $\frac{1}{4}$ NW $\frac{1}{4}$ Section 35; N $\frac{1}{2}$ N $\frac{1}{2}$ Section 36; T. 25 N., R. 19 E.; NW $\frac{1}{4}$ Section 19; T. 25 N., R. 20 E. (2,330 acres)	Approximately four square mile area where three wells have been drilled. Area includes no active wells. Area all in Monument. Area is held by production based on the Sherard Unit Production (allocated production). Active federal leases are in the Monument in this area.
13 - Southeast Leroy (August 1972)	Leroy	N $\frac{1}{2}$ N $\frac{1}{2}$ Section 6; T. 22 N., R. 19 E.; SE $\frac{1}{4}$ Section 21; Section 22; NW $\frac{1}{4}$ Section 25; Sections 26, 27 and 28; E $\frac{1}{2}$ Section 29; S $\frac{1}{2}$ Section 31; N $\frac{1}{2}$, N $\frac{1}{2}$ S $\frac{1}{2}$ Section 32; N $\frac{1}{2}$ Section 33; N $\frac{1}{2}$ Section 34; NW $\frac{1}{4}$ Section 35; T. 23 N., R. 19 E. (5,380 acres)	Approximately eight square mile area where 21 wells have been drilled including eight active wells (five producing gas wells and three are shut-in). Area approximately 25% in the Monument. Active federal leases are in the Monument in this area.
14 - Chase Hill South	Wildcat	SW $\frac{1}{4}$ Section 4; Section 5; N $\frac{1}{2}$	Approximately eight square mile

**Table 4.2-1
Exploration/Production Areas**

Exploration/ Production Area (date 1st well drilled)	Field Name	Area Description	General Remarks
(July 1973)		Section 8; Section 9; N½ Section 16; T. 23 N., R. 17 E.; Sections 29, 30, 31 and 31; T. 24 N., R. 17 E. (5,230 acres)	area where six wells have been drilled including four active wells (four are shut-in). Area approximately 25% in the Monument. Active federal leases are in the Monument in this area.
15 - Leroy Three (August 1973)	Leroy	SE¼ Section 1; NE¼ Section 12; T. 25 N., R. 20 E.; SW¼ Section 6; NW¼ Section 7; T. 25 N., R. 21 E. (650 acres)	Approximately one square mile area where three wells have been drilled including one active well (one shut-in gas well). Area all in Monument. Active federal lease in Section 7.
16 - West Central Leroy (November 1974)	Leroy	SW¼SW¼ Section 15; SE¼ Section 16; E½ Section 20; Section 21; NW¼NW¼ Section 22; N½, SW¼, W½SE¼ Section 28; N½NE¼ Section 29; N½NW¼, NW¼NE¼ Section 33; T. 24 N., R. 19 E. (1,950 acres)	Approximately three square mile area where nine wells have been drilled including three active wells (two producing gas wells and one shut-in). Area approximately 35% in Monument. Active federal leases are in the Monument in this area.
17 - Sherard Unit (December 1974)	Sherard	Sections 27, 28 and 29; T. 25 N., R. 19 E. (1,910 acres)	Approximately three square mile area where eight wells have been drilled including four active wells (two producing gas wells and two shut-in gas wells). Area approximately 65% in Monument. Active federal leases are in the Monument in this area.
18 – Johnsons (July 1975)	Leroy/Sherard	Sections 9 and 10; N½N½ Section 15; N½N½ Section 16; T. 24 N., R. 19 E.; S½S½ Section 33; S½SW¼ Section 34; T. 25 N., R. 19 E. (1,620 acres)	Approximately two and a half square mile area where seven wells have been drilled including two wells that were drilled as active producing gas wells and later plugged because of depleted production. The other five wells were drilled and abandoned. Area approximately 20% in Monument. No active federal leases within described area.

Figure 4.2-1

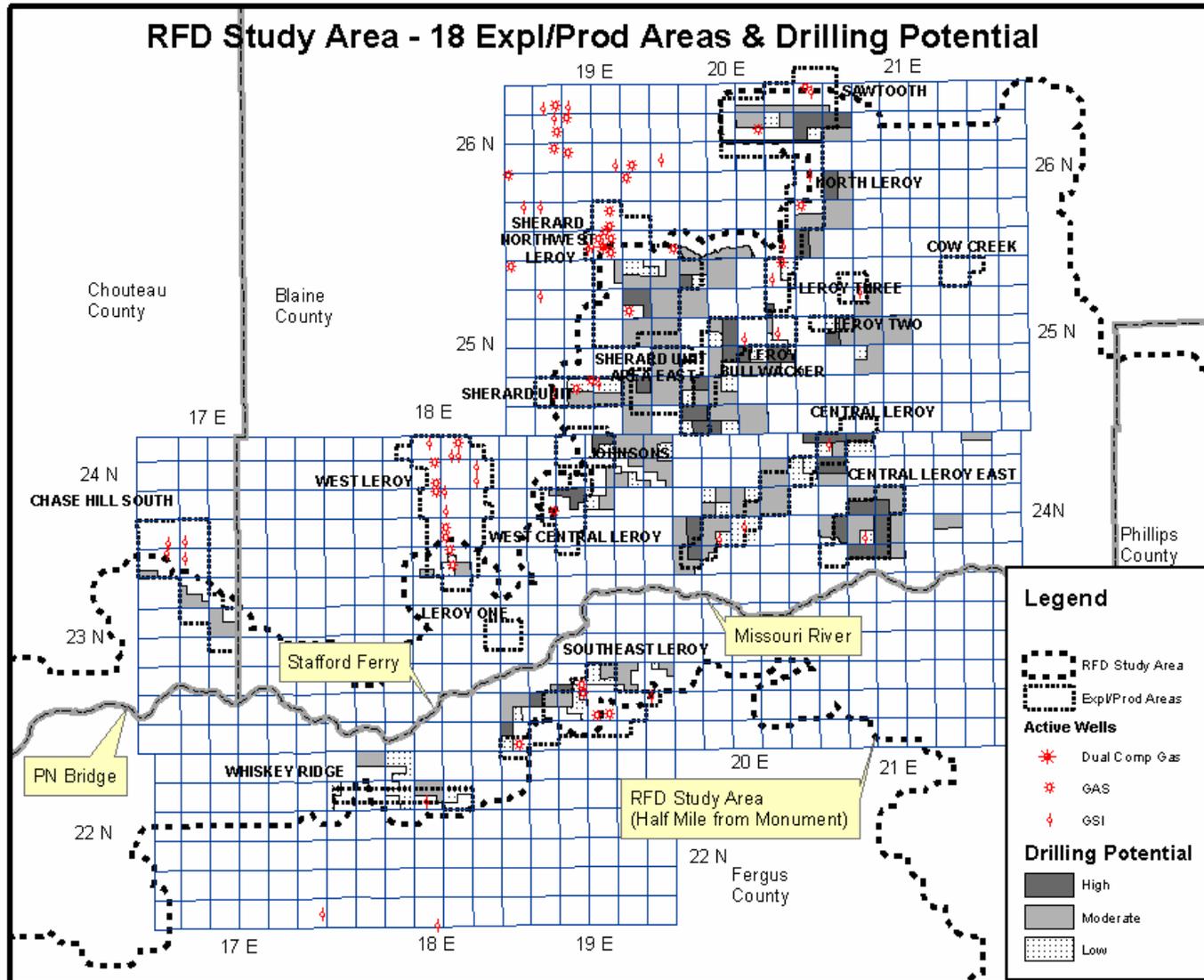
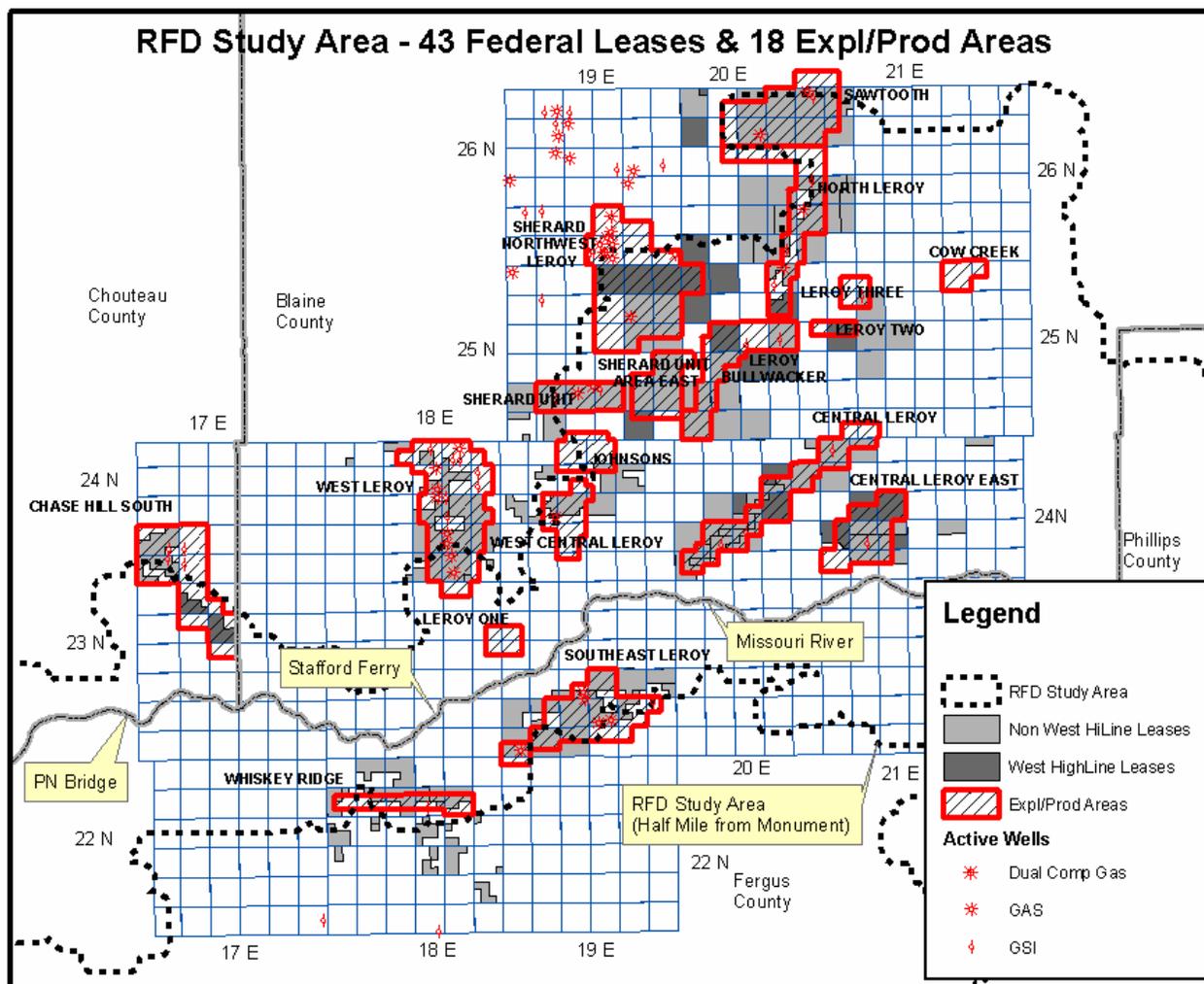


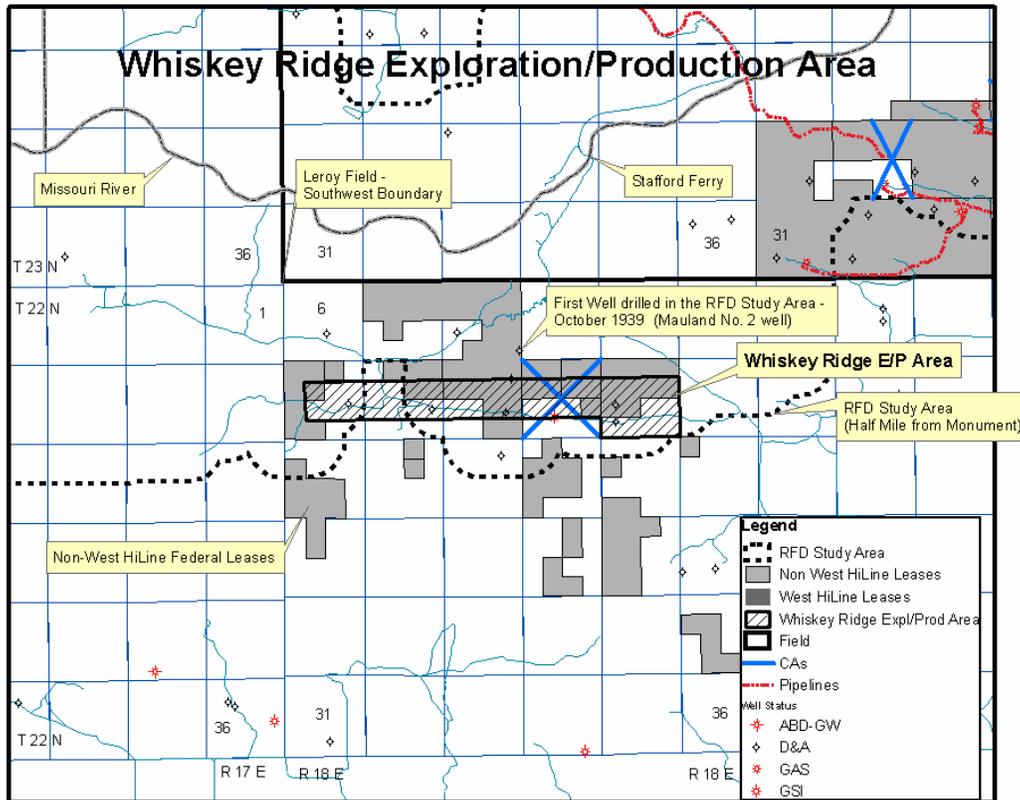
Figure 4.2-2
West HiLine and Non-West HiLine Leases



4.2.1 Whiskey Ridge Exploration/Production Area

The Whiskey Ridge area encompasses approximately 1,660 acres with about half of the area located in the Monument. Currently, three active federal leases remain in this area (MTM16617, MTM18274 and MTM89460). The area is located in Fergus County, approximately three miles south of the McClelland/Stafford Ferry. It is elongated in an east-west direction completely outside and south of the Leroy Gas Field by approximately one and one-half miles south (Figure 4.2.1-1).

Figure 4.2.1-1



The Mauland No. 2 well was the study area's first exploratory well drilled (in the Monument). The well was spud in October 1939 by E & M Oil and Gas Company at a location in the SE $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 4, T. 22 N., R. 18 E., Fergus County. The well was drilled to a TD of 635 feet and reached the Eagle Sandstone at 424 feet. The well was drilled as a dry hole and was plugged and abandoned. The prospect was based on regional geology, surface geology and geologic information gained from wells drilled to the south in the Winifred area that were drilled in the 1920s and 1930s. Following the drilling of Mauland No. 2 well, two additional wells were drilled and abandoned prior to the discovery of gas in the Whiskey Ridge area. They were:

The Ray Mann No. 1 well (Spud April 22, 1956), located in the NE $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 8, T. 22 N., R. 18 E., Fergus County (non-Monument well) was drilled and reached a TD of 4,610 feet. The well penetrated the Eagle Sandstone at 1,345 feet and bottomed in the Mississippian's Mission Canyon without encountering shows of oil or gas. It was abandoned on May 27, 1956 as a dry hole.

The U.S. Government A1-9 well (spud July 23, 1969), located in the NE $\frac{1}{4}$ of Section 9, T. 22 N., R. 18 E., Fergus County (Monument well) was drilled to a TD of 1,550 feet and penetrated the Eagle at 1,130 feet without encountering shows of oil or gas. It was abandoned on July 26, 1969 as a dry hole.

The fourth well drilled in the Whiskey Ridge area discovered commercial gas in August 1972. The Manuel No. 1 well (private surface, private minerals CA-NRM1739 well) located in the NE¹/₄SW¹/₄ of Section 10, T. 22 N., R. 18 E. was spud on July 20, 1972 and completed in the Eagle sand (lower section) on August 9, 1972 with an initial potential (IP) of 652 MCFPD. No commercial gas has produced from the well or area because there is no gas pipeline servicing the area. The well is approximately four miles from the nearest pipeline to the northeast. In May 1998 the well tested at 384 MCFPD during a 24-hour test bearing a shut-in tubing pressure of 210 psi. Reservoir pressures in the Whiskey Ridge area appear to be lower than other neighboring reservoirs to the north, likely because of the depth of the reservoir.

All together, seven wells have been drilled within the Whiskey Ridge area and of those wells, one remains active as a shut-in gas well waiting on pipeline (see Tables 4.2.1-1 and 4.2.1-2). The other six wells were drilled and abandoned on the same structural trend. Four other wells were identified as drilled in the vicinity of the Whiskey Ridge area and they were useful for information identifying the structure; however, they are located outside of the Whiskey Ridge area. Geology indicates that the many of the wells drilled in the Whiskey Ridge area penetrated two sections of Eagle formation indicating the area has experienced thrust faulting. Three of the five wells had gas shows in the lower Eagle section, but no commercial volumes were discovered and the wells were plugged. The three wells were: State No. 1-7, NE¹/₄SE¹/₄ of Section 7, T. 22 N., R. 18 E.; Federal No. 1, NE¹/₄SE¹/₄ of Section 9, T. 22 N., R. 18 E.; and Bergum No. 1-11, SW¹/₄SW¹/₄ of Section 11, T. 22 N., R. 18 E.

The potential for natural gas to occur in this area is high based on well tests and log analysis of many of the wells; however, the commercial potential is on a localized basis because of the number of dry holes drilled in and the geology of the area. The potential for drilling more wells in this area is rated low to moderate. With the three federal leases in this area, there is a minimal chance that future wells would be drilled within the next ten to fifteen years; therefore, no additional wells are foreseen to be drilled on the Federal leases at this time.

The Whiskey Ridge area contains 400 acres of state minerals and 480 acres of private minerals. Further drilling could also occur on those lands, although no additional wells are foreseen at this time.

**Table 4.2.1-1
Whiskey Ridge Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Texas Gas Exploration Corporation	TED B MANUEL 2-4	25-027-21067-00-00	Y	Dry Hole	P&A - Approved	Wildcat Fergus	Fergus	22N-18E	4	SE NW SW	1840 S	1030 W	No		7/1/1973				
Empire Petroleum	RAY MANN 1	25-027-05175-00-00		Dry Hole	P&A - Approved	Wildcat Fergus	Fergus	22N-18E	8	C NE SE	1980 S	660 E	No 3	4/22/1956	5/27/1956		5/27/1956		
Texas Gas Exploration Corporation	STATE 1-7	25-027-21084-00-00		Dry Hole	P&A - Approved	Wildcat Fergus	Fergus	22N-18E	7	NW NE SE	2400 S	990 E	No 3	9/10/1973	9/12/1973		9/12/1973		
Texas Gas Exploration Corporation	BERGUM 1-11	25-027-21085-00-00		Dry Hole	P&A - Approved	Wildcat Fergus	Fergus	22N-18E	11	NE SW SW	1070 S	1060 W	No 3	8/6/1974	8/8/1974		8/8/1974		
Texas Gas Exploration Corporation	BERGUM 1-6	25-027-21083-00-00	Y	Dry Hole	P&A - Approved	Wildcat Fergus	Fergus	22N-18E	6	SW NW SE	1800 S	2400 E	No 3	9/13/1973	9/15/1973		9/15/1973		
Fuel Resources Development Co	STATE 16-22-1	25-027-21099-00-00	Y	Dry Hole	P&A - Approved	Wildcat Fergus	Fergus	22N-18E	16	SW NE NE	1140 N	1300 E	No 3	11/13/1974	11/16/1974		11/16/1974		
Macum Energy Inc.	MANUEL 1	25-027-21043-00-00		Gas	Shut In - WOPL	Wildcat Fergus	Fergus	22N-18E	10	SE NE SW	1400 S	2245 W	No 1/3	7/20/1972	8/9/1972	8/9/1972		652	
Texas Pacific Coal & Oil Co.	US-GOVT-A 1-9	25-027-21014-00-00		Dry Hole	P&A - Approved	Wildcat Fergus	Fergus	22N-18E	9	E2 NE	1320 N	660 E	Yes	7/23/1969	7/26/1969		7/26/1969		
Texas Gas Exploration Corporation	FEDERAL 1-11	25-027-21053-00-00		Dry Hole	P&A - Approved	Wildcat Fergus	Fergus	22N-18E	11	NE NW SW	2165 S	1080 W	Yes	11/7/1972	11/12/1972		11/12/1972		
Texas Gas Exploration Corporation	FEDERAL 9-2-1	25-027-21072-00-00		Dry Hole	P&A - Approved	Wildcat Fergus	Fergus	22N-18E	9	SW NE SE	1730 S	1035 E	Yes	7/6/1973	7/21/1973		7/23/1973		
E & M Oil & Gas Co.	MAULAND 2	25-027-05176-00-00	Y	Dry Hole	P&A - Approved	Wildcat Fergus	Fergus	22N-18E	4	E2 SE SE	570 S	60 E	Yes	10/25/1939	12/3/1939		12/3/1939		

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
- 2 - Well lies within a narrow finger protruding in the Monument.
- 3 - Well lies within ½ mile of the Monument.
- 4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
- 5 - Well lies within a federal lease that lies both in and outside the Monument.
- 6 - Well lies within a state land section intermingled with the Monument.

**Table 4.2.1-2
Summary of Whiskey Ridge
Exploration/Production Area Wells**

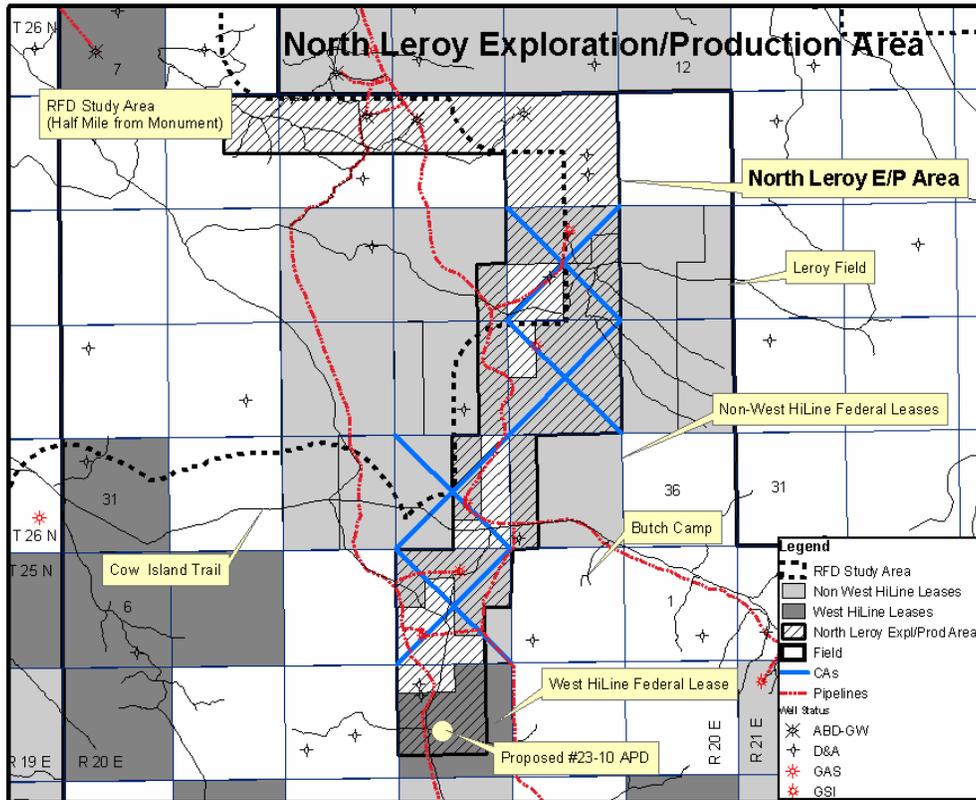
Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
3	4	0	7	4

* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

4.2.2 North Leroy Exploration/Production Area

The North Leroy area encompasses approximately 4,460 acres with approximately 15% of the area located within the Monument. Currently, eight active federal leases remain in this area (Monument leases: MTM1903, MTM1903A, MTM16102, MTM16103, MTM16458 and MTM89474; non-Monument leases: MTM1977 and MTM2313). The area is located approximately one mile west of Butch Camp and is elongated in a north-south direction completely within the Leroy Gas Field (Figure 4.2.2-1).

Figure 4.2.2-1



The first well drilled in this area was the Federal No. 14X-35 well (within the Monument) which was the second exploratory well drilled in the study area, and the first deep well test within the Monument (+2,000 feet). The well was spud in March 1968 by Montana-Dakota Utilities Company at a location in the SW $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 35, T. 26 N., R. 20 E., Blaine County. The well was drilled to a TD of 4,570 feet and bottomed in the Madison Formation. No oil or gas was found in the Madison or other formations between the Madison and the Eagle. The well was also tested for the potential of gas within the Eagle Formation. No gas was found and the well was drilled and abandoned as a dry hole. The area prospect was based on regional geology and local surface geology. The nearest well drilled to a similar depth prior to this well was the Faber No. 1 well, approximately 29 miles to the northwest of the North Leroy area. Following the drilling of Federal No. 14X-35, two additional wells were drilled and abandoned as dry holes prior to the discovery of gas in the North Leroy area. They were:

The Federal No. 2-1 well (spud November 4, 1971), located in the SW $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 2, T. 25 N., R. 20 E., Blaine County (Monument well) was drilled and reached a TD of 1,848 feet. The well penetrated the Eagle Sandstone at 1,573 feet and bottomed in the Telegraph Creek without encountering shows of oil or gas. It was abandoned on November 9, 1971 as a dry hole.

The Federal 11-14 well (spud December 11, 1971), located in the NW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 14, T. 26 N., R. 20 E., Blaine County (non-Monument well) was drilled to a TD of 1,920 feet and penetrated the Eagle at 530 feet without encountering shows of oil or gas. It was abandoned on December 17, 1971 as a dry hole.

The fourth well drilled in the North Leroy area discovered commercial gas in July 1972. The Federal No. 34-1 well (non-Monument well: private surface, federal Lease MTM16103) located in the NW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 34, T. 26 N., R. 20 E. was spud on June 29, 1972 and completed as an Eagle Formation producing gas well. It later produced 28,211 MCF of natural gas between September 1994 and June 2002. The well was idle (shut-in) for nearly 22 years before pipeline infrastructure was introduced to the area in 1994. The well is currently shut-in awaiting the installation of a compression system on the Macum pipeline to further aid in the production of natural gas from the well.

All together, 14 wells were drilled within the North Leroy area (see Tables 4.2.2-1 and 4.2.2-2). Of the 14 wells, five were completed as commercial gas wells and the other nine were drilled and abandoned as dry holes. Four other wells were identified as drilled in the vicinity of the North Leroy area. They were useful for information identifying the structure; however, they are located outside of the North Leroy area. As of December 2006 this area had produced 501,943 MCF of gas from the five active wells (see the highlighted cumulative production figures in Table 4.2.2-1).

The area is also unique to natural gas production because it includes the only well in the study area (Federal 23-26-20 well, NW $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 23, T. 26 N, R.20 E.) producing from the Carlile Formation (older than Eagle Formation), which is part of the Colorado Group. The formation is normally found deeper than the Eagle formation; however, because of local faulting the Carlile rests on top of the Eagle Formation in this case. The well is minimally prolific with a cumulative production of 14,394 MCF before it was shut-in in 1994.

The potential for natural gas to occur in this area is high based on well tests and log analysis of many of the wells. Commercial potential is localized within the area because of the number of dry holes drilled and the geology of the area. The potential for drilling more wells in this area is rated moderate to high. With the eight Federal leases in this area, there is a reasonable chance that five wells could be drilled on the federal land (one Monument well and four non-Monument wells) within the next 10 to 15 years. The drilling of these wells would depend on many factors, of which the price of the product and the nature of the business environment will be major contributing factors controlling if and when the wells would be drilled.

The North Leroy area contains approximately 400 acres of state minerals and 480 acres of private minerals. Further drilling could also occur on those lands, although no additional wells are foreseen at this time.

**Table 4.2.2-1
North Leroy Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well* Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Montana Power Company	FEDERAL 4-15	25-005-21843-00-00		Gas	P&A - Approved	Leroy	Blaine	26N-20E	15	SE NW NW	1160 N	1180 W	No >½ mile	7/1/1976	7/20/1976		9/14/1982	1400	0
Montana Power Company	STATE 1-16	25-005-21860-00-00		Gas	P&A - Approved	Leroy	Blaine	26N-20E	16	SW NE NE	990 N	1133 E	No >½ mile	9/9/1976	9/17/1976	9/17/1976	10/10/1984	800	0
Energetics Inc	STATE 33X-16	25-005-21407-00-00	Y	Dry Hole	P&A - Approved	Leroy	Blaine	26N-20E	16	SE NW SE	1321 S	1404 E	No >½ mile	7/10/1972	8/17/1972				
Montana Power Company	Federal 4-14	25-005-22241-00-00		Gas	P&A - Approved	Leroy	Blaine	26N-20E	14	SE NW NW	931 N	953 W	No 3	8/8/1981	8/10/1981	8/10/1981	7/1/1983	13.4	0
Bond, Roland, Etal.	FEDERAL 11-14	25-005-21310-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	26N-20E	14	NE NW SE	2320 S	1480 E	No 3	12/11/1971	12/17/1971		12/17/1971		
Texas Gas Exploration Corporation	FEDERAL 1	25-005-21459-00-00		Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	25N-20E	10	NE SW NW	1515 N	1125 W	No 3	9/8/1972	9/11/1972		9/11/1972		
Texas Gas Exploration Corporation	KINCAID 2-10 (FEE)	25-005-21625-00-00		Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	25N-20E	10	SE NW NW	990 N	990 W	No 3	7/28/1974	7/31/1974		7/31/1974		
Montana Power Company	FED 10-14-26-20	25-005-21818-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	26N-20E	14	SE NW SE	1430 S	1450 E	No 3	12/7/1975	12/11/1975		12/11/1975		
Fuel Resources Development Co	FED 027-26-20-N	25-005-22036-00-00	Y	Dry Hole	P&A - Approved	Leroy	Blaine	26N-20E	27	NW SW SE	1187 S	2079 E	No 3	10/21/1978	10/23/1978		10/23/1978		
Devon Energy Corporation	FEDERAL 21X-26	25-005-21467-00-00		Gas	Producing	Leroy	Blaine	26N-20E	26	SW NE NW	1182 N	1377 W	No 1/3	9/16/1972	9/19/1972	7/3/1973		313	154,979
Macum Energy Inc.	D. Kincaid 1	25-005-21456-00-00		Gas	Shut In	Leroy	Blaine	25N-20E	3	W2 SW	1320 S	1200 W	No 1/3	9/5/1972	9/7/1972	10/18/1972		226	53,608
Macum Energy Inc.	Macum Federal 23-10	25-005-22898-00-00	APD	Gas	Permit to Drill	Leroy	Blaine	25N-20E	10	NE SW	2086 S	1952 W	No 2/3/5	N/A	N/A	N/A			
Macum Energy Inc.	Macum Federal 42-34	25-005-22900-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	26N-20E	34	SE NE	3716 S	1175 E	No 3	10/29/2003	10/31/2003		10/31/2003		
Macum Energy Inc.	Federal 34-1	25-005-21369-00-00		Gas	Shut In	Leroy	Blaine	26N-20E	34	N2 SW SE	2110 S	1980 E	No 1/3/4/5	6/29/1972	7/1/1972	7/12/1972		1000	28,211
Klabzuba Oil & Gas, Inc.	FED 23-26-20	25-005-21656-00-00		Gas	Shut In	Leroy	Blaine	26N-20E	23	SW NW NE	1095 N	2328 E	No 1/3/4/5	10/14/1974	10/15/1974	11/24/1974		21	14,394
Macum Energy Inc.	Macum Federal 31-3	25-005-22897-00-00		Gas	Producing	Leroy	Blaine	25N-20E	3	NW NE	1044 N	2319 E	Yes	10/23/2003	10/25/2003			200	250,751
Mon-Dak Utilities Co. & Fidelity Gas Co.	FEDERAL 14X-35	25-005-21098-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	26N-20E	35	SW SW SW	410 S	410 W	Yes	3/20/1968	4/2/1968		4/2/1968		
Brown, J. Burns Operating Company	FEDERAL 2-1	25-005-21295-00-00	Y	Dry Hole	P&A - Approved	Leroy	Blaine	25N-20E	2	NE SW SW	990 S	990 W	Yes	11/4/1971	11/9/1971		11/9/1971		
Fuel Resources Development Co	USA (9-25-20) 1	25-005-21655-00-00	Y	Dry Hole	P&A - Approved	Leroy	Blaine	25N-20E	9	C NW SE	1980 S	1980 E	Yes	9/5/1974	9/8/1974		9/8/1974		
Cumulative of the highlighted production figures =																			501,943

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
- 2 - Well lies within a narrow finger protruding in the Monument.
- 3 - Well lies within ½ mile of the Monument.
- 4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
- 5 - Well lies within a federal lease that lies both in and outside the Monument.
- 6 - Well lies within a state land section intermingled with the Monument.

**Table 4.2.2-2
Summary of North Leroy
Exploration/Production Area Wells**

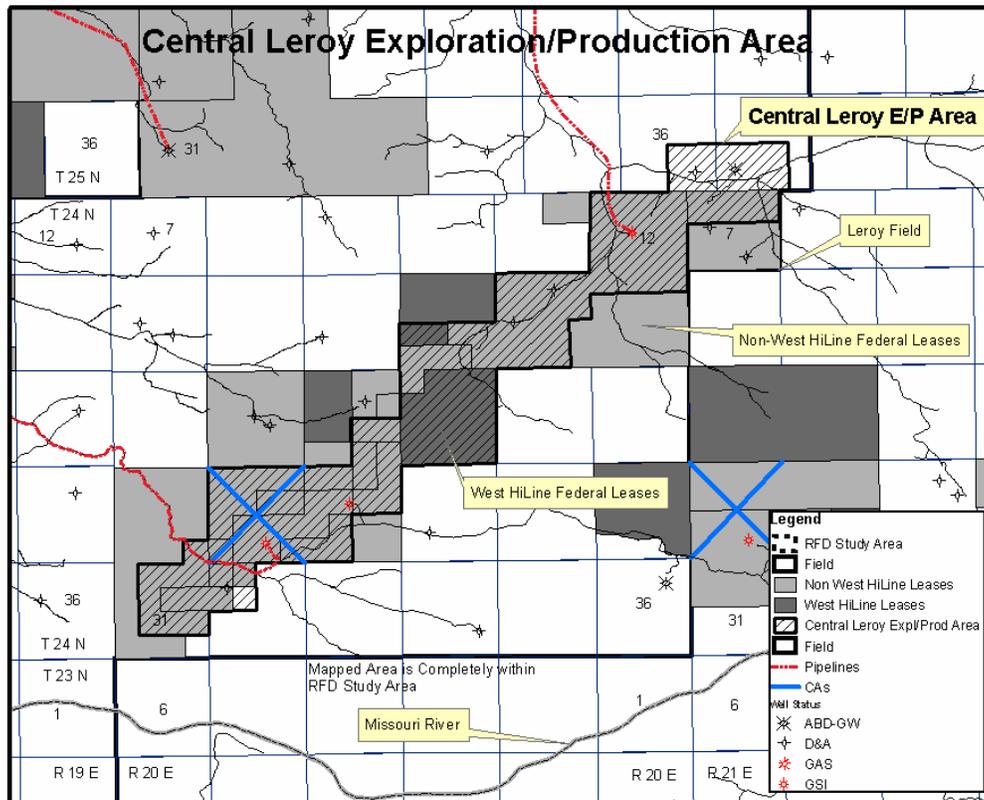
Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
2	10	2	14	4

* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

4.2.3 Central Leroy Exploration/Production Area

The Central Leroy area encompasses approximately 4,500 acres located entirely in the Monument. Currently, five federal leases are active in this area (Monument leases: MTM2060, MTM2061, MTM13816, MTM13818 and MTM89473). The area is located in the central part of the Monument and is generally located north of Ervin Ridge. It is elongated in a southwest-northeast direction completely within the Leroy Gas Field (Figure 4.2.3-1).

Figure 4.2.3-1



The first well drilled in this area was the Federal No. 7-1 well (in the Monument), which was the third exploratory well drilled in the study area and the second deep well test in the Monument (+2,000 feet). The well was spud in July 1968 by Gulf Oil Corporation at a location in the SW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 7, T. 24 N., R. 21 E., Blaine County. The well was drilled to a TD of 4,252 feet and bottomed in the Madison Formation. No oil or gas was found in the Madison or other formations between the Madison and the Eagle. The well was also tested for the potential of gas within the Eagle Formation. No gas was found and the well was abandoned as a dry hole. The area prospect was based on regional geology, local surface geology and knowledge gained from the Federal 14X-35 well in the North Leroy area, which was drilled to a similar depth approximately six miles to the northwest of the Central Leroy area. Following the drilling of Federal No. 7-1 well, two additional wells were drilled and abandoned as dry holes prior to the discovery of gas in the Central Leroy area. They were:

The Federal No. 25-24-19-1 well (spud June 9, 1969), located in the SW $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 25, T. 24 N., R. 19 E., Blaine County (Monument well) was drilled and reached a TD of 1,631 feet. The well penetrated the Eagle Sandstone at 1,433 feet and bottomed in the Niobrara Formation without encountering shows of oil or gas. It was abandoned on June 13, 1969 as a dry hole.

The Federal 14-24-21-1 well (spud July 5, 1969), located in the NW $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 14, T. 24 N., R. 20 E., Blaine County (Monument well) was drilled to a TD of 1,396 feet and penetrated the Eagle twice, once at 664

feet and again at 1,144 feet, indicating that the area experienced shallow thrust faulting. The well encountered no shows of oil or gas. It was abandoned on July 11, 1969 as a dry hole.

The fourth well drilled in the Central Leroy area discovered commercial gas in July 1973. The Federal No. 1-12 well (federal surface, federal Lease MTM13816) located in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 12, T. 24 N., R. 20 E. (Monument well) was spud on July 25, 1973 and completed as an Eagle Formation producing gas well. It produced 177,304 MCF of natural gas between June 1996 and May 2004. The well was idle (shut-in) for nearly 23 years before pipeline infrastructure was introduced to the area in 1996.

All together, nine wells have been drilled within the Central Leroy area (see Tables 4.2.3-1 and 4.2.3-2). Of those nine wells, three remain active as shut-in gas wells (two of the shut-in wells have pipeline service and the other well is waiting on pipeline service). The other six wells were drilled and abandoned on the same structural trend. Ten additional wells were identified as drilled in the vicinity of the Central Leroy area. They were useful for information identifying the structure; however, they are located outside of the Central Leroy area. As of December 2006 the area has produced 214,948 MCF of gas from two of the three completed wells (see the highlighted cumulative production figures in Table 4.2.3-1).

The potential for natural gas to occur in this area is high based on well tests and log analysis of many of the wells. Commercial potential is on a localized basis because of the number of dry holes drilled and the geology of the area. The potential of drilling more wells in this area ranges from low to high. With the five federal leases in this area, there is a reasonable chance that six wells could be drilled on the federal land (all on Monument lands) over the next 10 to 15 years. The drilling of these wells would depend on many factors, of which the price of the product and the nature of the business environment would be major contributing factors controlling if and when the wells would be drilled.

The Central Leroy area contains approximately 40 acres of State minerals and 80 acres of private minerals and further drilling could also occur on those lands, although no additional wells are foreseen at this time.

**Table 4.2.3-1
Central Leroy Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well* Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Macum Energy Inc.	Federal 1-12	25-005-21542-00-00		Gas	Shut In	Leroy	Blaine	24N-20E	12	NE SW	2115 S	2315 W	Yes	7/25/1973	7/26/1973	7/27/1973		1057	177,304
Macum Energy Inc.	Federal 29-15	25-005-21712-00-00		Gas	Shut In	Leroy	Blaine	24N-20E	29	NW SW SE	1045 S	2095 E	Yes	12/6/1974	12/7/1974	N/C		380	37,644
Whiting Petroleum Corp	USA 31-25-2-1	25-005-21654-00-00		Gas	P&A - Approved	Leroy	Blaine	25N-21E	31	NE SW SW	1185 S	1100 W	Yes	9/1/1974	9/4/1974	11/24/1974	9/1/1990	24	0
Gulf Oil Corporation	FED 14-24-20-1	25-005-21137-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-20E	14	NE NW SW	2470 S	1000 W	Yes	7/5/1969	7/11/1969		7/11/1969		
Texas Gas Exploration Corporation	FEDERAL 1-14	25-005-21590-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-20E	14	SW NW NE	1000 N	2000 E	Yes	7/17/1974	7/20/1974		7/20/1974		
Investestate	FEDERAL 32-4	25-005-21740-00-00		Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	24N-20E	32	NE SW NW	1400 N	990 W	Yes	6/12/1975	6/14/1975		6/14/1975		
Fuel Resources Development Co	STATE 36-25-1	25-005-21774-00-00		Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-20E	36	NW SE SE	990 S	1168 E	No 6	8/27/1975	8/30/1975		8/30/1975		
Macum Energy Inc.	Macum Federal 22-28	25-005-22895-00-00		Gas	Shut In - WOPL	Leroy	Blaine	24N-20E	28	SE NW	3220 S	2520 W	Yes	10/13/2003	10/16/2003	10/17/2003			
Macum Energy Inc.	Macum Federal 13-14	25-005-22893-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-20E	14	NW SW	2457 S	1059 W	Yes	10/19/2003	10/22/2003		10/23/2003		
Gulf Oil Corporation	FEDERAL 7-1	25-005-21104-00-00	Y	Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	24N-21E	7	NE SW SE	3690 N	1849 E	Yes	7/25/1968	8/10/1968		8/10/1968		
Gulf Oil Corporation	FED 25-24-19-1	25-005-21130-00-00	Y	Dry Hole	P&A - Approved	Leroy	Blaine	24N-19E	25	NW SW NE	1500 N	2120 E	Yes	6/9/1969	6/13/1969		6/13/1969		
Texas Gas Exploration Corporation	FEDERAL 20-1	25-005-21534-00-00	Y	Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	24N-20E	20	SE SE NW	2480 N	2600 W	Yes	7/16/1973	7/17/1973		7/17/1973		
Texas Gas Exploration Corporation	Federal 7-24-21 1	25-005-21539-00-00	Y	Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	24N-21E	7	NE SW	2287 S	1280 W	Yes	7/21/1973	7/23/1973		7/23/1973		
Montana Power Company	FEDERAL 7-21	25-005-21572-00-00	Y	Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	24N-20E	21	NE SW NE	1760 N	1890 E	Yes	10/6/1973	10/11/1973		10/11/1973		
Texas Gas Exploration Corporation	FEDERAL 2-20	25-005-21592-00-00	Y	Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	24N-20E	20	NE NW SE	2192 S	1892 E	Yes	7/31/1974	8/4/1974		8/4/1974		
Fuel Resources Development Co	STATE 16-24-20	25-005-21653-00-00	Y	Dry Hole	P&A - Approved	Sherard, Area	Blaine	24N-20E	16	SE NW SW	1830S	1020 W	No 6	10/30/1974	11/2/1974		11/2/1974		
Fuel Resources Development Co	STATE 36-24-1	25-005-21680-00-00	Y	Dry Hole	P&A - Approved	Leroy	Blaine	24N-19E	36	SE SW NW	2080 N	1240 W	No 6	11/10/1974	11/11/1974		11/11/1974		
Texas Gas Exploration Corporation	FEDERAL 8-2-1	25-005-21768-00-00	Y	Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	24N-21E	8	SE NW NW	1135 N	1123 W	Yes	7/18/1975	7/24/1975		7/24/1975		
Fuel Resources Development Co	FEDERAL 27-1	25-005-21767-00-00	Y	Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	24N-20E	27	SW NE SW	1529 S	1525 W	Yes	7/24/1975	7/29/1975		7/29/1975		
Cumulative of the highlighted production figures =																			214,948

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
- 2 - Well lies within a narrow finger protruding in the Monument.
- 3 - Well lies within 1/2 mile of the Monument.
- 4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
- 5 - Well lies within a federal lease that lies both in and outside the Monument.
- 6 - Well lies within a state land section intermingled with the Monument.

**Table 4.2.3-2
Summary of Central Leroy
Exploration/Production Area Wells**

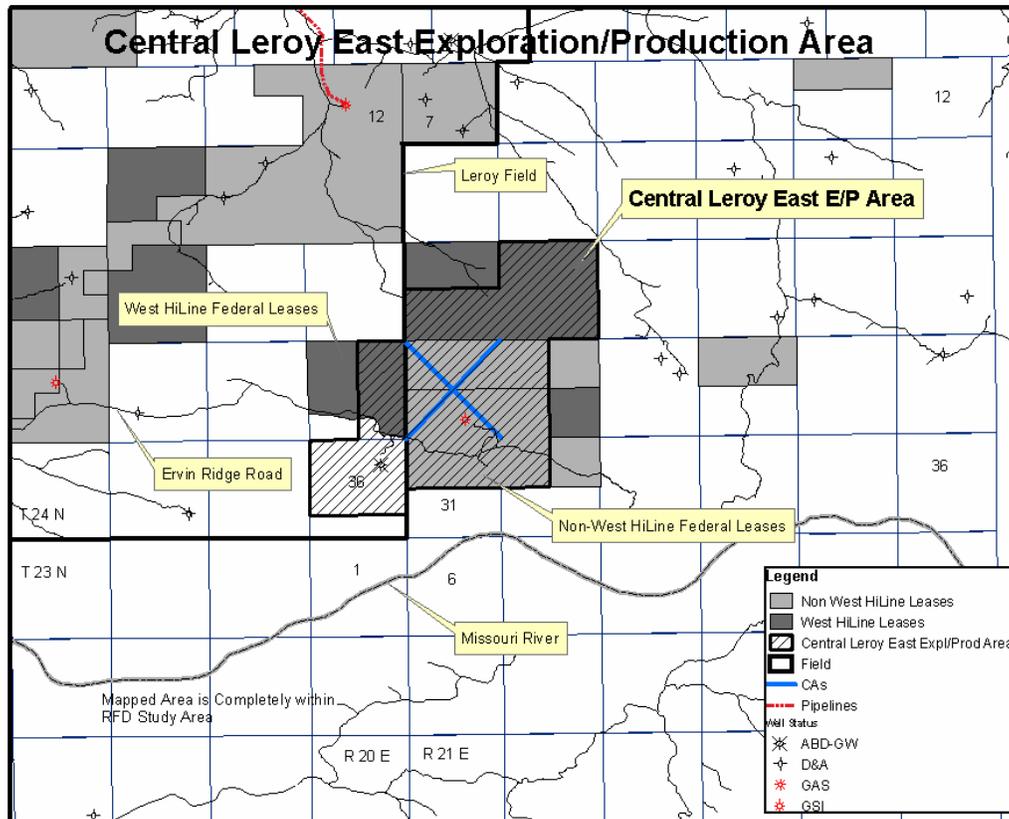
Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
8	1	0	9	10

* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

4.2.4 Central Leroy East Exploration/Production Area

The Central Leroy East area encompasses approximately 3,150 acres located entirely in the Monument. Currently, four federal leases are active in this area (Monument leases MTM13821A, MTM13827, MTM87658 and MTM89482). The area is in the central part of the Monument, approximately two miles west/northwest of the confluence of Bullwhacker Creek and the Missouri River. It is elongated in a southwest-northeast direction and lies both within and outside the Leroy Gas Field (Figure 4.2.4-1).

Figure 4.2.4-1



The first well drilled in this area was the Federal No. 28-1 well (in the Monument), which was the fourth exploratory well drilled in the study area and the third deep well test in the Monument (+2,000 feet). The well was spud in August 1968 by Gulf Oil Corporation at a location in the NW $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 28, T. 24 N., R. 21 E., Blaine County. The well was drilled to a TD of 2,604 feet and bottomed in the Blackleaf Formation of the Colorado Group. No oil or gas was found in the Blackleaf or other formations between the Blackleaf and the Eagle. The well was also tested for the potential of gas within the Eagle Formation. No gas was found and the well was abandoned as a dry hole. The area prospect was based on regional geology, local surface geology and knowledge gained from the Federal No. 7-1 well in the Central Leroy area, which was drilled to a similar depth approximately three miles to the northwest of the Central Leroy East area. After the Federal No. 28-1 well, the next well drilled in this area was completed as a productive well.

The second well drilled in the Central Leroy East area discovered commercial gas in February 1972. The Federal No. 30-1 well (federal surface, federal Lease MTM13821A) located in the SW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 30, T. 24 N., R. 21 E. (Monument well) was spud on February 21 1972 and completed as an Eagle Formation producing gas well with an initial production test of 725 MCFPD. No gas has been sold from this well due to lack of pipeline infrastructure. The well has remained shut-in for nearly 32 years since its completion in March 1972.

A total of two wells have been drilled in the Central Leroy area and completed as commercial gas wells: Federal 30-1 well, SW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 30, T. 24 N., R. 21 E., drilled and completed in 1972; and State 36-24-20 well, SE $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 36, T. 24 N., R. 20 E., completed in 1975 (see Tables 4.2.4-1 and 4.2.4-2). As of December 2006 the area has produced no commercial gas from the two completed wells and is awaiting pipeline infrastructure. In November 2004 the State 36-24-20 well was plugged and abandoned; therefore, only one well remains in this area. Two additional wells were identified as drilled in the vicinity of the Central Leroy East area. They were useful for information identifying the structure, although they are located outside of the Central Leroy area.

The potential for natural gas to occur in this area is high based on well tests and log analysis of many of the wells; however, the commercial potential is on a localized basis because of the two dry holes drilled and the geology of the area. The potential for drilling more wells ranges from low to high. With the four federal leases in this area, there is a reasonable chance that three wells could be drilled on the federal land (all in the Monument) over the next 10 to 15 years. The drilling of these wells would depend on many factors, of which the price of the product and the nature of the business environment would be major contributing factors controlling if and when the wells would be drilled.

The Central Leroy East area contains approximately 480 acres of state minerals and no private minerals. Further drilling could also occur on those lands, although no additional wells are foreseen at this time.

**Table 4.2.4-1
Central Leroy East Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well* Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Macum Energy Inc.	Federal 30-1	25-005-21333-00-00		Gas	Shut In - WOPL	Wildcat Blaine	Blaine	24N-21E	30	NE SW SE	996 S	1850 E	Yes	2/21/1972	2/27/1972	3/22/1972		725	
Klabzuba Oil & Gas, Inc.	STATE 36-24-20	25-005-21651-00-00		Gas	P&A - Approved	Leroy	Blaine	24N-20E	36	NW SE NE	1360 N	1290 E	No 6	11/10/1974	11/15/1974	5/21/1975	11/17/2004	285	
Gulf Oil Corporation	FEDERAL M-28-1	25-005-21108-00-00	Y	Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	24N-21E	28	SE NW NE	1165 N	1979 E	Yes	8/14/1968	8/27/1968		8/27/1968		
Texas Gas Exploration Corporation	FEDERAL 28-1	25-005-21537-00-00	Y	Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	24N-21E	28	SW SE NE	2000 N	1000 E	Yes	7/29/1973	7/31/1973		7/31/1973		

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
- 2 - Well lies within a narrow finger protruding in the Monument.
- 3 - Well lies within 1/2 mile of the Monument.
- 4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
- 5 - Well lies within a federal lease that lies both in and outside the Monument.
- 6 - Well lies within a state land section intermingled with the Monument.

**Table 4.2.4-2
Summary of Central Leroy East
Exploration/Production Area Wells**

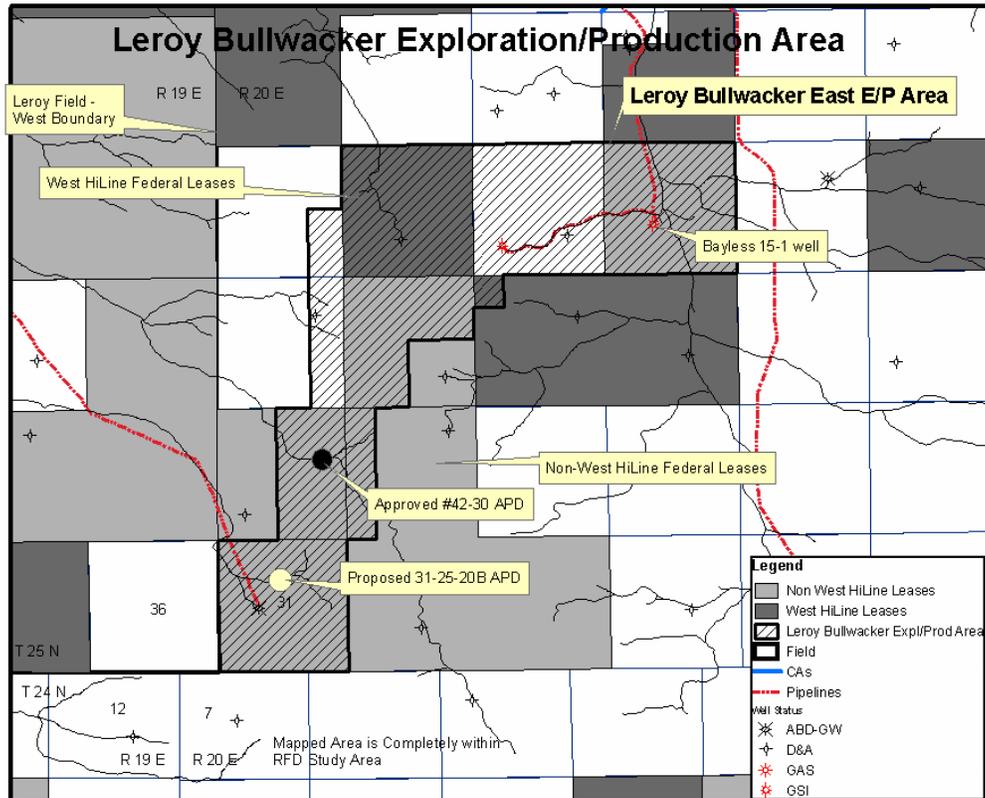
Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
1	1	0	2	2

* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

4.2.5 Leroy Bullwacker Exploration/Production Area

The Leroy Bullwacker area encompasses approximately 3,800 acres and is located mostly in the Monument. Five active federal leases and one active state lease are included in this area (Monument federal leases MTM1914, MTM16102, MTM16461, MTM89475 and MTM89476). The area extends to the west and south of the Robinsons' private land in T. 25 N., R. 20 E. It is elongated in a southwest-northeast direction, and lies both in and outside the northern edge of the Monument (see Figure 4.2.5-1).

Figure 4.2.5-1



The first well drilled in this area was the Federal No. 15-1 well, and the fifth exploratory well drilled in the study area, outside the Monument by less than ½ mile. The well was spud in August 1968 by Gulf Oil Corporation at a location in the NE¼SW¼ of Section 15, T. 25 N., R. 20 E., Blaine County. The well was drilled to a TD of 1,987 feet and bottomed in the Niobrara Formation of the Colorado Group. No oil or gas was found in the Niobrara Formation or other formations between the Niobrara and the Eagle. The Eagle Formation tested for gas at an initial rate of 974 MCFPD with a well head pressure of 530 psi. Following the completion of the well, it remained shut-in for 31 years until December 1999 when a gas pipeline was constructed to the well. The Federal No. 15-1 well produced 91,477 MCF of natural gas between December 1999 and November 2004. The prospect was based on regional geology, local surface geology and knowledge gained from the Federal 14X-35 well in Section 35, T. 26 N., R. 20 E and the Federal No. 7-1 well in Section 7, T. 24 N., R. 21 E.

A total of six wells have been drilled in the Leroy Bullwacker area (see Tables 4.2.5-1 and 4.2.5-2). Of those wells, three wells have had historic production and two remain active as shut-in gas wells (the wells have pipeline service). The first well to begin production in the area was the Federal 31-25-20 located in the NE¼SW¼ of Section 31, T. 25 N., R. 20 E. It was drilled in August of 1975 and began production 15 years later in February 1991. The well was plugged and abandoned in 2005. The other three wells were drilled and abandoned on the same structural trend. Nine additional wells were drilled in the vicinity of the Leroy Bullwacker area. They were useful for information identifying the structure; however, they are located outside of the Leroy Bullwacker area. As of December 2006 the

area has produced 126,998 MCF of gas from the three wells (see the highlighted cumulative production figures in Table 4.2.5-1).

The potential for natural gas to occur in this area is high based on well tests and log analysis of many of the wells; however, the commercial potential is on a localized basis because of the number of dry holes drilled and the geology of the area. The potential for drilling more wells ranges from low to high. With the five federal leases in this area, there is a reasonable chance that six wells could be drilled on the federal land (all in the Monument) over the next 10 to 15 years. The drilling of these wells would depend on many factors, of which the price of the product and the nature of the business environment would be major contributing factors controlling if and when the wells would be drilled.

The Leroy Bullwacker area contains approximately 640 acres of state minerals and no private minerals. Further drilling could also occur on those lands, although no additional wells are foreseen at this time.

**Table 4.2.5-1
Leroy Bullwacker Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well* Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Macum Energy Inc.	Federal 15-1	25-005-21109-00-00		Gas	Shut In	Leroy	Blaine	25N-20E	15	W2 NE SW	1980 S	1974 W	No 2/3/5	8/31/1968	9/6/1968	10/11/1968		974	91,477
Macum Energy Inc.	Macum Federal 42-30	25-005-22899-00-00	APD	Gas	Permit to Drill	Leroy	Blaine	25N-20E	30	SE NE	3095 S	1041 E	Yes	N/A	N/A	N/A			
Macum Energy Inc.	State 1	25-005-21652-00-00		Gas	Shut In	Leroy	Blaine	25N-20E	16	NE SW SW	1160 S	1200 W	No 6	9/8/1974	9/11/1974	11/26/1974		318	14,573
Klabzuba Oil & Gas, Inc.	Federal 31-25-20	25-005-21790-00-00		Gas	P&A - Approved	Leroy	Blaine	25N-20E	31	NW NE SW	2588 S	1621 W	Yes	8/23/1975	8/27/1975	12/5/1975	10/26/2005	318	20,948
Gulf Oil Corporation	STATE 1	25-005-21134-00-00		Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-20E	16	SE NW SE	1550 S	1500 E	No 6	7/29/1969	8/1/1969		8/1/1969		
Texas Gas Exploration Corporation	GOVT 17-1	25-005-21362-00-00		Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-20E	17	SE NE SW	1450 S	2330 W	Yes	7/4/1972	7/6/1972		7/6/1972		
Fuel Resources Development Co	USA 19-25-20-1	25-005-21673-00-00		Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-20E	19	NW SE NE	1580 N	1140 E	Yes	10/27/1974	10/30/1974		10/30/1974		
Gulf Oil Corporation	FED. 22-25-20#1	25-005-21135-00-00	Y	Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-20E	22	C NW SE	1980 S	1980 E	Yes	7/13/1969	7/14/1969		7/14/1969		
Gulf Oil Corporation	FED 22-25-201X	25-005-21141-00-00	Y	Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-20E	22	NW SE	1980 S	1993 E	Yes	7/18/1969	7/27/1969		7/27/1969		
U S Signal Oil & Gas Co.	Federal 7-F-1	25-005-21330-00-00	Y	Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	24N-20E	7	SE SE NW	2000 N	2350 W	Yes	2/14/1972	2/18/1972		2/18/1972		
Fuel Resources Development Co	USA	25-005-21659-00-00	Y	Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-20E	21	NW SE NE	1755 N	1095 E	Yes	9/12/1974	9/15/1974		9/15/1974		
Fuel Resources Development Co	USA 29-25-2-1	25-005-21674-00-00	Y	Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-20E	29	SW NE NE	1000 N	1100 E	Yes	10/21/1974	10/23/1974		10/23/1974		
Fuel Resources Development Co	FEDERAL 20-1	25-005-21769-00-00	Y	Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-20E	20	NW SE SE	1187 S	1225 E	Yes	8/3/1975	8/8/1975		8/8/1975		
Fuel Resources Development Co	FEDERAL 30-25-20	25-005-21955-00-00	Y	Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-20E	30	NE SW SW	990 S	1104 W	Yes	7/16/1978	7/21/1978		7/21/1978		
Fuel Resources Development Co	FEDERAL 32-25-20	25-005-21954-00-00	Y	Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-20E	32	SW NW SE	1712 S	2306 E	Yes	7/23/1978	7/25/1978		7/25/1978		
Fuel Resources Development Co	N M L-9-25-20-	25-005-22028-00-00	Y	Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-20E	9	SE NW SW	1329 S	1027 W	Yes	8/23/1978	8/25/1978		8/25/1978		
Cumulative of the highlighted production figures =																			126,998

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
- 2 - Well lies within a narrow finger protruding in the Monument.
- 3 - Well lies within ½ mile of the Monument.
- 4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
- 5 - Well lies within a federal lease that lies both in and outside the Monument.
- 6 - Well lies within a state land section intermingled with the Monument.

**Table 4.2.5-2
Summary of Leroy Bullwacker
Exploration/Production Area Wells**

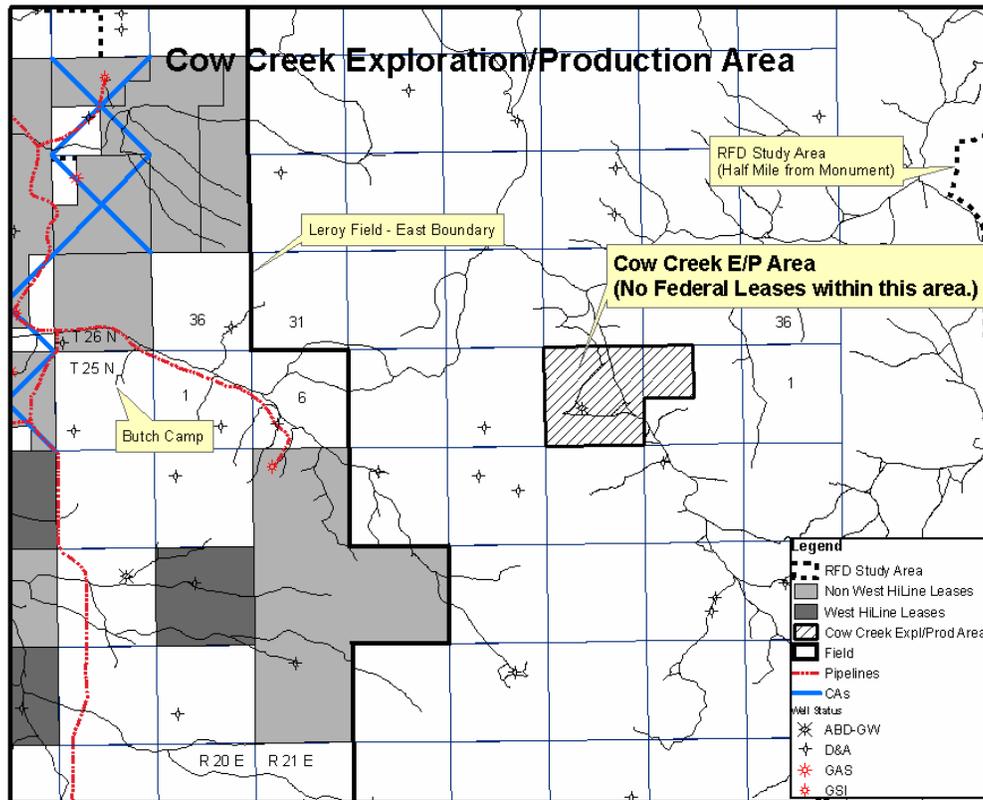
Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
3	3	0	6	9

* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

4.2.6 Cow Creek Exploration/Production Area

The Cow Creek area encompasses approximately 820 acres entirely in the Monument. The area includes only federal surface and federal minerals. No active leases remain in the area. It is located approximately one and one-half miles east of where the Cow Island Trail crosses Cow Creek and is elongated in an east-west direction (Figure 4.2.6-1).

Figure 4.2.6-1



The first well drilled in this area was the Cow Creek Federal No. 1 (Monument well). It was spud in September 1968 by Basin Petroleum Corporation at a location in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 3, T. 25 N., R. 21 E., Blaine County. The well was drilled to a TD of 4,011 feet and bottomed in the Swift Formation. No oil or gas was found in the Swift Formation or other formations between the Swift and the Eagle. The Eagle Formation was tested for gas at an IP rate of 500 MCFPD and a well head pressure of 275 psi. The well is considered the Monument's first well capable of producing commercial volumes of gas; however, it remained shut-in for 10 years and was plugged and abandoned on July 1, 1978 for lack of economics to build a gas pipeline to the well. The prospect was based on regional geology, surface geology and knowledge gained from the nearest well to the west (the Federal 14X-35 well in Section 35, T. 26 N., R. 20 E.). The nearest commercial gas well drilled prior to the Cow Creek Federal No. 1 was the Federal 15-1 well located approximately six miles to the southwest in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 15, T. 25 N., R.20 E., Blaine County.

Following the drilling and completion of the Cow Creek Federal No. 1 well, four wells were drilled outside the Cow Creek area (see Tables 4.2.6-1 and 4.2.6-2). Each of those wells were drilled to the Eagle Formation and plugged and abandoned as dry holes. As of December 2006 no gas has been produced from this area.

The potential for natural gas to occur in this area is high based on well test and log analysis of the Cow Creek Federal No. 1 well; however, there is no chance that a well will ever be drilled because no leases exist in the area (no private or state lands are contained within this area).

**Table 4.2.6-1
Cow Creek Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well* Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Basin Petroleum Corp.	COW CRK FED 1	25-005-21112-00-00		Gas	P&A - Approved	Sherard, Area	Blaine	25N-21E	3	C NE SW	1980 S	2280 W	Yes	9/28/1968	10/8/1968	11/19/1968	7/1/1978	500	500
Brown, J. Burns Operating Company	FEDERAL 9-1	25-005-21291-00-00	Y	Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-21E	9	NW SE NW	1650 N	1650 W	Yes	10/26/1971	10/30/1971		10/30/1971		
Basin Petroleum Corp.	FEDERAL 11-1	25-005-21298-00-00	Y	Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-21E	11	SE NW NW	990 N	990 W	Yes	11/10/1971	11/12/1971		11/12/1971		
Ohio Fuel Supply	LIDDLE 14-4 FEE	25-005-21589-00-00	Y	Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-21E	4	W2 SE SW	990 S	1980 W	Yes	12/5/1973	12/10/1973		12/10/1973		
Ohio Fuel Supply	FEDERAL 8-9	25-005-21600-00-00	Y	Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-21E	9	SE SW NE	2545 N	1135 E	Yes	12/10/1973	12/14/1973		12/14/1973		

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
- 2 - Well lies within a narrow finger protruding in the Monument.
- 3 - Well lies within ½ mile of the Monument.
- 4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
- 5 - Well lies within a federal lease that lies both in and outside the Monument.
- 6 - Well lies within a state land section intermingled with the Monument.

**Table 4.2.6-2
Summary of Cow Creek
Exploration/Production Area Wells**

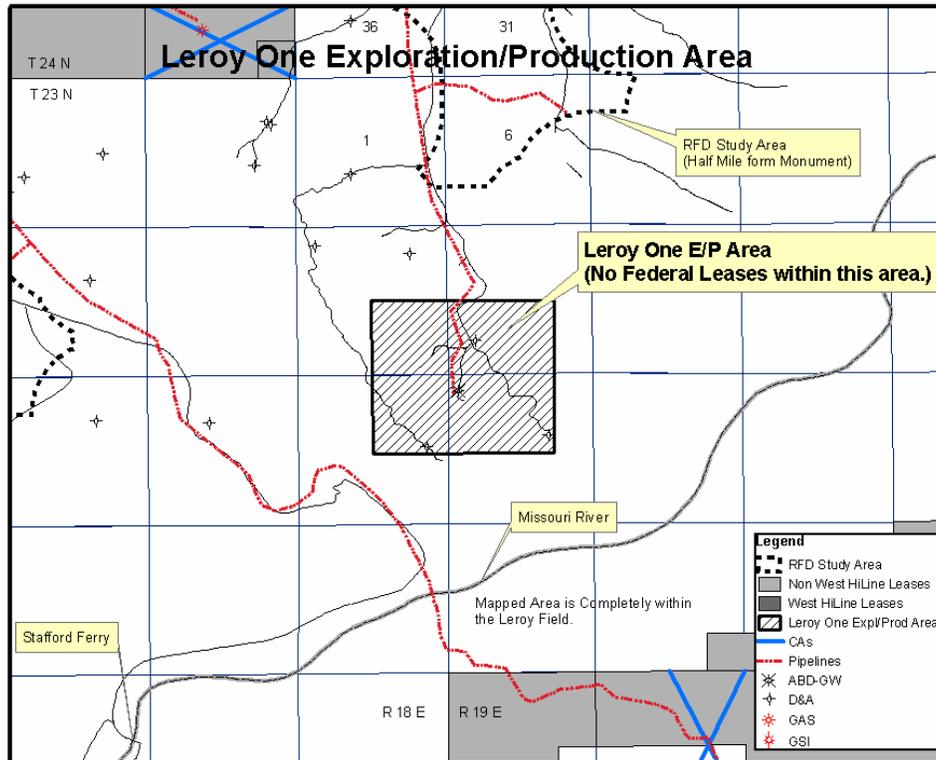
Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
1	0	0	1	4

* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

4.2.7 Leroy One Exploration/Production Area

The Leroy One area encompasses approximately 620 acres entirely in the Monument. The area includes only federal surface and federal minerals. No active leases remain in the area. It is located about a mile north of the Missouri River, approximately three miles downstream of the McClelland/Stafford Ferry, and is not elongated in any specific direction (Figure 4.2.7-1).

Figure 4.2.7-1



The first well drilled in this area was the Federal No. 1-18 well (Monument well). The well was spud in October 1968 by Basin Petroleum Corporation at a location in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 3, T. 24 N., R. 21 E., Blaine County. The well was drilled to a TD of 1,506 feet and bottomed in the Telegraph Creek Formation of the Montana Group. The Eagle Formation was tested at an IP rate of 960 MCFPD and a well head pressure of 275 psi. The well was completed as an Eagle Formation producing gas well and produced 476,996 MCF of natural gas between December 1980 and May 1991 before it was plugged and abandoned on June 1, 1996 as a depleted producer. The well was idle (shut-in) for nearly 12 years before pipeline infrastructure was introduced to the area in 1980. The well is considered the Monument's first well to have produced commercial volumes of gas. The prospect was based on regional geology, surface geology and knowledge gained from nearby wells to northwest and southwest of the well (the Federal 1-28 well in the SE $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 28, T. 24 N., R. 18 E. and the Mauland No. 2 well in SE $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 4, T. 22 N., R. 18 E., respectively). The nearest commercial gas well drilled prior to the Federal No. 1-18 well was the Federal No. 15-1 well located approximately 13 miles to the northeast in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 15, T. 25 N., R. 20 E., Blaine County.

Following the drilling and completion of the Federal No. 1-18 well, three other wells were drilled within the Leroy One Area (see Tables 4.2.7-1 and 4.2.7-2). Each of those wells were drilled to the Eagle Formation and plugged and abandoned as dry holes. One other well was identified as drilled in the vicinity of the Leroy One. It was useful for information identifying the structure; however, it is located outside of the Leroy Bullwacker area. As of December 2006, 476,996 MCF of gas was produced from this area.

The potential for natural gas to occur in this area is high based on well test and log analysis of the Cow Creek Federal No. 1 well; however, there is no chance that a well will ever be drilled because no leases exist in the area (no private or state lands are contained within this area).

**Table 4.2.7-1
Leroy One Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well* Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Fuel Resources Development Co	BIRD FED 12-23-18	25-005-21745-00-00	Y	Dry Hole	P&A - Approved	Leroy	Blaine	23N-18E	12	SW NE NE	990 N	1260 E	No 3	8/11/1975	8/13/1975		8/13/1975		
Brown, J. Burns Operating Company	FEDERAL 1-18	25-005-21113-00-00		Gas	P&A - Approved	Leroy	Blaine	23N-19E	18	NW NW NW	550 N	410 W	Yes	10/21/1968	10/27/1968	11/17/1968	6/1/1996	960	476,996
Fuel Resources Development Co	FEDERAL 7-23-19	25-005-21753-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	23N-19E	7	NE SW SW	1160 S	990 W	Yes	6/26/1975	6/28/1975		6/28/1975		
Fuel Resources Development Co	FEDERAL 13-23-18-1	25-005-21762-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	23N-18E	13	SW SE NE	2566 N	756 E	Yes	6/28/1975	7/2/1975		7/2/1975		
El Santo Petroleum Corporation	BEARPAW FED 2-18	25-005-22206-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	23N-19E	18	SE SW NE	2216 N	1543 E	Yes	2/4/1981	2/7/1981		2/7/1981		

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
- 2 - Well lies within a narrow finger protruding in the Monument.
- 3 - Well lies within ½ mile of the Monument.
- 4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
- 5 - Well lies within a federal lease that lies both in and outside the Monument.
- 6 - Well lies within a state land section intermingled with the Monument.

**Table 4.2.7-2
Summary of Leroy One
Exploration/Production Area Wells**

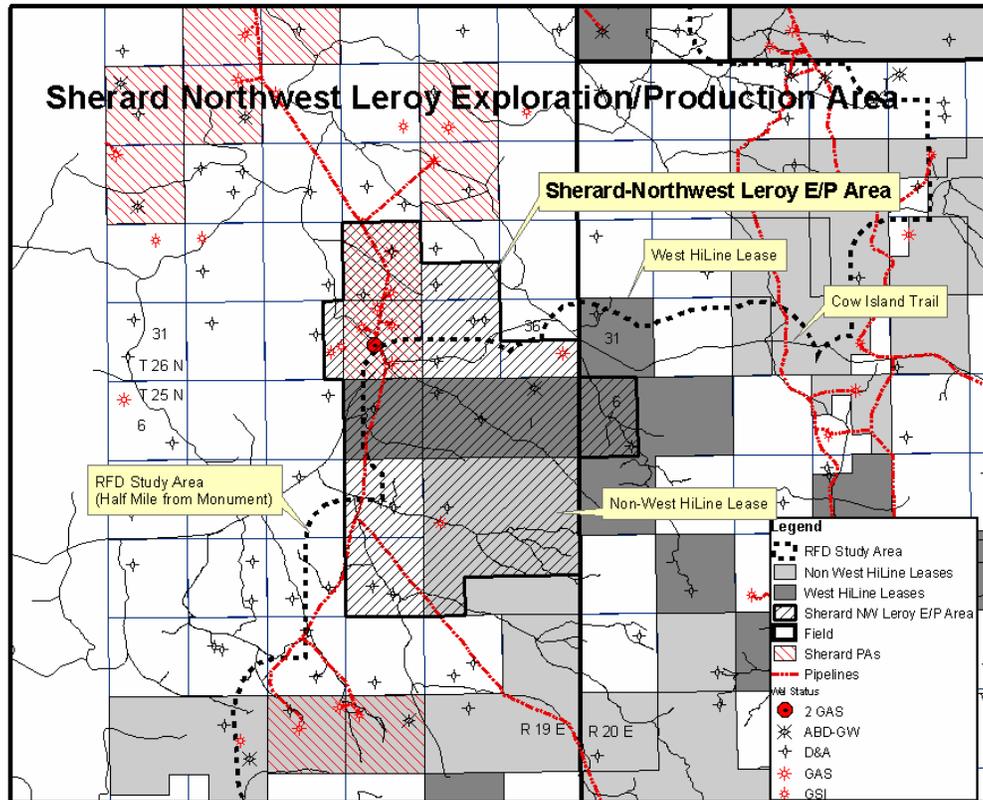
Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
4	0	0	4	1

* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

4.2.8 Sherard/Northwest Leroy Exploration/Production Area

The Sherard/Northwest Leroy area encompasses approximately 8,590 acres of which about 4,200 acres are in the Monument. Currently, seven leases remain active in the area (Federal Monument Leases: MTM84559, MTM87212, MTM89082 and MTM1568; Federal non-Monument Leases: MTM1569, MTM1571, MTM1572 and MTM87212). The area is located approximately one mile west of where the Cow Island Trail crosses Bullwhacker Creek. It is elongated in a north-south direction with 480 acres in the Leroy Gas Field and 7,520 acres in the Sherard Productive area (Figure 4.2.8-1).

Figure 4.2.8-1



The first well drilled in this area was the Federal No. 10-14 (non-Monument well). The well was spud in May 1969 by High Crest Oils, Inc. at a location in the NW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 10, T. 25 N., R. 19 E., Blaine County. The well was drilled to a TD of 1,974 feet and bottomed in the Niobrara Formation of the Colorado Group. No oil or gas was found in the Niobrara Formation or other formations between the Niobrara and the Eagle. The well was drilled as a dry hole and plugged and abandoned on May 28, 1968. The area prospect was based on regional geology and local surface geology. Three years following the drilling of Federal No. 10-14, the Robinson No. 11-34C/T well (spud August 19, 1971) located in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 34, T. 26 N., R. 19 E., Blaine County (non-Monument well) discovered commercial gas on August 30, 1971 in both the Judith River and Eagle Formations. The well was drilled to a TD of 1694 feet (bottomed in the Eagle Formation) and was dually completed to isolate and account for production from both formations. The well produced a combined volume from the Eagle and Judith River Formations of 2,021,389 MCF between January 1974 and December 2006.

All together, 27 wells have been drilled within the Sherard/Northwest Leroy area (see Tables 4.2.8-1 and 4.2.8-2). Of the 27 wells, nine have historic production. All remain active as either producing gas wells or shut-in gas wells (all the wells have pipeline service). Fourteen other wells drilled adjacent to the Sherard/Northwest Leroy area were useful for information identifying the structure. As of December 2006 the area had produced 9,739,994 MCF of gas from the nine wells. Excluding wells outside the study area (December 2006), the area has produced 1,446,416 MCF of gas from three wells (see the highlighted cumulative production figures in Table 4.2.8-1).

The potential for natural gas to occur in this area is high based on production histories, well tests and log analysis of many of the wells. The commercial potential is on a localized basis because of the segmented geology of the area. The potential for drilling more wells is mostly moderate with limited low and high potentials. With the three federal leases in this area, there is a reasonable chance that fifteen wells could be drilled in the area on federal and private lands (eight Monument wells and seven non-Monument wells, including one private well) within the next 10 to 15 years. The drilling of these wells would depend on many factors, of which the price of the product and the nature of the business environment will be major contributing factors controlling if and when the wells would be drilled in this area.

The Sherard/Northwest Leroy area contains approximately 320 acres of state minerals and 720 acres of private minerals outside the Monument, and further drilling could also occur on those lands; however, other than the private well mentioned above, no additional state or private wells are foreseen at this time.

**Table 4.2.8-1
Sherard/Northwest Leroy Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well* Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Devon Energy Corporation	ROBINSON 11-34C	25-005-21256-00-00		Gas	Producing	Sherard, Area	Blaine	26N-19E	34	NE SW	2280 S	2120 W	No >½ mile	8/19/1971	8/30/1971			5889	2,021,389
Wise, William, F.	FEDERAL 7-27-27	25-005-21285-00-00		Dry Hole	P&A - Approved	Sherard Unit	Blaine	26N-19E	27	C SW NE	1980 N	1980 E	No >½ mile	10/21/1971	2/21/1972				
Devon Energy Corporation	U.S. 7A-27	25-005-21292-00-00		Gas	Producing	Sherard, Area	Blaine	26N-19E	27	SW NE	2030 N	1980 E	No >½ mile	10/28/1971	10/29/1971			5313	834,862
Wise, William, F.	FEDERAL 70-26	25-005-21371-00-00		Dry Hole	P&A - Approved	Sherard Unit	Blaine	26N-19E	26	NE SW SW	990 S	990 W	No >½ mile	6/7/1972	6/14/1972				
Norfolk Energy Inc.	FEDERAL 35-8	25-005-22223-00-00		Dry Hole	P&A - Approved	Sherard Unit	Blaine	26N-19E	35	NW SE NE	1407 N	1063 E	No >½ mile	5/6/1981	6/9/1981				
Brown, J. Burns Operating Company	FED 35-26-19	25-005-22347-00-00		Dry Hole	P&A - Approved	Sherard Unit	Blaine	26N-19E	35	NE SW NE	1459 N	1811 E	No >½ mile	11/15/1984	3/17/1985				
Devon Energy Corporation	U.S. 34-7	25-005-22463-00-00		Gas	Producing	Sherard, Area	Blaine	26N-19E	34	NE SW NE	1693 N	1872 E	No >½ mile	8/29/1988	10/13/1988			6500	5,055,386
Devon Energy Corporation	ROBINSON 34-5 FEE	25-005-22464-00-00		Gas	Producing	Sherard, Area	Blaine	26N-19E	34	NE SW NW	1809 N	1253 W	No >½ mile	8/29/1988	10/13/1988			315	137,001
Norfolk Energy Inc.	ROBINSON 27-14 FEE	25-005-22465-00-00		Dry Hole	P&A - Approved	Sherard, Area	Blaine	26N-19E	27	SW SE SW	294 S	1410 W	No >½ mile	8/29/1988	9/28/1988				
Devon Energy Corporation	U.S. 27-15	25-005-22538-00-00		Gas	Producing	Sherard, Area	Blaine	26N-19E	27	SW SE	500 S	2000 E	No >½ mile	10/16/1990	10/18/1990			425	195,376
Ocean Energy, Inc.	U.S. 35-13	25-005-22720-00-00		Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	26N-19E	35	SW SW	1100 S	990 E	No 3	7/28/1997	7/30/1997				
Devon Energy Corporation	O'Connell 34-3 FEE	25-005-23250-00-00		Gas	Producing	Sherard, Area	Blaine	26N-19E	34	NE NW	538 N	2371 W	No >½ mile	7/30/2003	8/15/2003			5897	49,564
Ocean Energy, Inc.	U.S. 27-2	25-005-23265-00-00		Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	26N-19E	27	NW NE	721 N	2517 E	No >½ mile	8/15/2003	8/18/2003				
Devon Energy Corporation	U.S. 33-9B	25-005-23261-00-00	Y	Gas	Shut In	Wildcat Blaine	Blaine	26N-19E	33	NE SE	1804 S	755 E	No >½ mile	7/30/2003	8/22/2003				24
Wise, William, F.	ROBINSON 7-33 FEE	25-005-21290-00-00	Y	Dry Hole	P&A - Approved	Sherard Unit	Blaine	26N-19E	33	SE SW NE	2310 N	1830 E	No >½ mile	10/27/1971	11/6/1971				
Wise, William, F.	O'CONNELL 73-21 FEE	25-005-21451-00-00	Y	Dry Hole	P&A - Approved	Sherard Unit	Blaine	26N-19E	21	W2 NW SE	1980 S	2080 E	No >½ mile	8/17/1972	10/21/1972				
Wise, William, F.	O'CONNELL 11-22 FEE	25-005-21707-00-00	Y	Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	26N-19E	22	NW NE SW	2300 S	1700 W	No >½ mile	11/22/1974	11/27/1974				
Wise, William, F.	ROBINSON 16-28 FEE	25-005-21898-00-00	Y	Dry Hole	P&A - Approved	Sherard Unit	Blaine	26N-19E	28	NW SE SE	990 S	990 E	No >½ mile	11/17/1976	11/24/1976				
Fuel Resources Development Co	FED.D-31-26-20N	25-005-22034-00-00	Y	Dry Hole	P&A - Approved	Sawtooth Mountain	Blaine	26N-20E	31	SE NW NW	1099 N	1162 W	No 3	7/31/1978	8/21/1978				
Norfolk Energy Inc.	U.S. 26-5	25-005-22256-00-00	Y	Dry Hole	P&A - Approved	Sherard Unit	Blaine	26N-19E	26	NE SW NW	1897 N	1013 W	No >½ mile	9/14/1981	2/20/1982				
Brown, J. Burns Operating Company	FED. 22-26-19	25-005-22340-00-00	Y	Dry Hole	P&A - Approved	Sherard Unit	Blaine	26N-19E	22	NW SE SE	1054 S	1054 E	No >½ mile	8/22/1984	9/6/1984				
Brown, J. Burns Operating Company	FEDERAL 4-25-19	25-005-22374-00-00	Y	Dry Hole	P&A - Approved	Sherard Unit	Blaine	25N-19E	4	SW NE NE	1100 N	995 E	No >½ mile	8/2/1985	8/28/1985				
Norfolk Energy Inc.	MAGDA 9-3 FEE	25-005-22437-00-00	Y	Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-19E	9	SE NE NW	1200 N	2200 W	No >½ mile	11/12/1987	12/10/1987				
Brown, J. Burns Operating Company	21-25-19A FED	25-005-22448-00-00	Y	Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-19E	21	SW NW NE	990 N	2530 E	No >½ mile	4/22/1988	5/4/1988				
Devon Energy Corporation	FED 33-9-26-19	25-005-22641-00-00	Y	Gas	Shut In	Sherard, Area	Blaine	26N-19E	33	NE SE	2234 S	60 E	No >½ mile	10/22/1993	11/22/1993				**16,715
Norfolk Energy Inc.	STATE 16-14	25-005-22154-00-00	Y	Dry Hole	P&A - Approved	Sherard Unit	Blaine	25N-19E	16	NW SE SW	1147 S	1730 W	No >½ mile		8/29/1980				
Brown, J. Burns Operating Company	FED. 11-25-19B	25-005-22677-00-00		Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	25N-19E	11	NE SW	1976 S	1636 W	No 3	11/30/1994	12/2/1994		12/2/1994		
High Crest Oils, Inc.	FEDERAL 10-14	25-005-21126-00-00		Dry Hole	P&A - Approved	Sherard Unit	Blaine	25N-19E	10	C NW SE	1980 S	1980 E	No 3	5/26/1969	5/28/1969		5/28/1969		
Wise, William, F.	US 44-3	25-005-21393-00-00		Dry Hole	P&A - Approved	Sherard Unit	Blaine	25N-19E	3	SE NW	2071 N	1980 W	No 3	6/15/1972	6/19/1972		6/19/1972		
Brown, J. Burns Operating Company	FED 10-25-19	25-005-22452-00-00		Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-19E	10	NE NE SW	2400 S	2400 W	No 3	5/18/1988	5/20/1988		5/20/1988		
Fuel Resources Development Co	STATE 1	25-005-21758-00-00	Y	Dry Hole	P&A - Approved	Sherard Unit	Blaine	25N-19E	16	SW NE SE	1871 S	1107 E	No 3	8/21/1975	8/25/1975		8/25/1975		
Klabzuba Oil & Gas, Inc.	11-25-19 FED	25-005-22453-00-00		Gas	Producing	Sherard, Area	Blaine	25N-19E	11	NE SW SW	1000 S	1250 W	No 2/3/5	5/23/1988	5/25/1988	N/C		NO IP	77,768
Devon Energy Corporation	34-15	25-005-22574-00-00		Gas	Producing	Sherard Area	Blaine	26N-19E	34	SWSE	1000 S	2000 E	No 3	10/13/1991	10/14/1991	1/13/1992		2064	806,362
Klabzuba Oil & Gas, Inc.	State 36-26-19	25-005-22784-00-00		Gas	Producing	Wildcat Blaine	Blaine	26N-19E	36	NESE	1650 S	990 E	No 3	8/27/1998	8/29/1998	8/29/1998		297	562,286
Klabzuba Oil & Gas, Inc.	Fed. Robinson 1-25-19	25-005-22920-00-00		Gas	P&A - Approved	Wildcat Blaine	Blaine	25N-19E	1	NE NW	750 N	2300 W	No 3/5	8/26/2002	8/29/2002		9/8/2003	5	
Wise, William, F.	US 28-2	25-005-21327-00-00		Dry Hole	P&A - Approved	Sherard Unit	Blaine	25N-19E	2	SE NW NW	1020 N	990 W	Yes	2/11/1972	2/17/1962		2/17/1962		
Wise, William, F.	U S 11-15	25-005-21874-00-00		Dry Hole	P&A - Approved	Sherard Unit	Blaine	25N-19E	15	SW NE SW	1928 S	1873 W	Yes	10/2/1976	10/4/1976		10/4/1976		
Norfolk Energy Inc.	US 2-9	25-005-22438-00-00		Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-19E	2	NW NE SE	2550 S	1300 E	Yes	12/12/1987	12/16/1987		12/16/1987		
Brown, J. Burns Operating Company	FED 15-25-19	25-005-22450-00-00		Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-19E	15	SE NW SE	1400 S	1900 E	Yes	5/11/1988	5/13/1988		5/13/1988		
Klabzuba Oil & Gas, Inc.	FEDERAL 6-25-20	25-005-22789-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	25N-20E	6	SW SE	643 S	1572 E	Yes	9/4/1998	9/7/1998		9/7/1998		
Klabzuba Oil & Gas, Inc.	Federal 6-25-20B	25-005-22921-00-00		Gas	Permit to Drill	Leroy	Blaine	25N-20E	6	SE SW	661 S	1948 W	Yes	N/A	N/A	N/A			
Cumulative of the highlighted production figures =																			1,446,416
Nine wells production =																			9,739,994

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
- 2 - Well lies within a narrow finger protruding in the Monument.
- 3 - Well lies within ½ mile of the Monument.
- 4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
- 5 - Well lies within a federal lease that lies both in and outside the Monument.
- 6 - Well lies within a state land section intermingled with the Monument.

Table 4.2.8-2
Summary of Sherard/Northwest Leroy
Exploration/Production Area Wells

Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
6	10	11	27	14

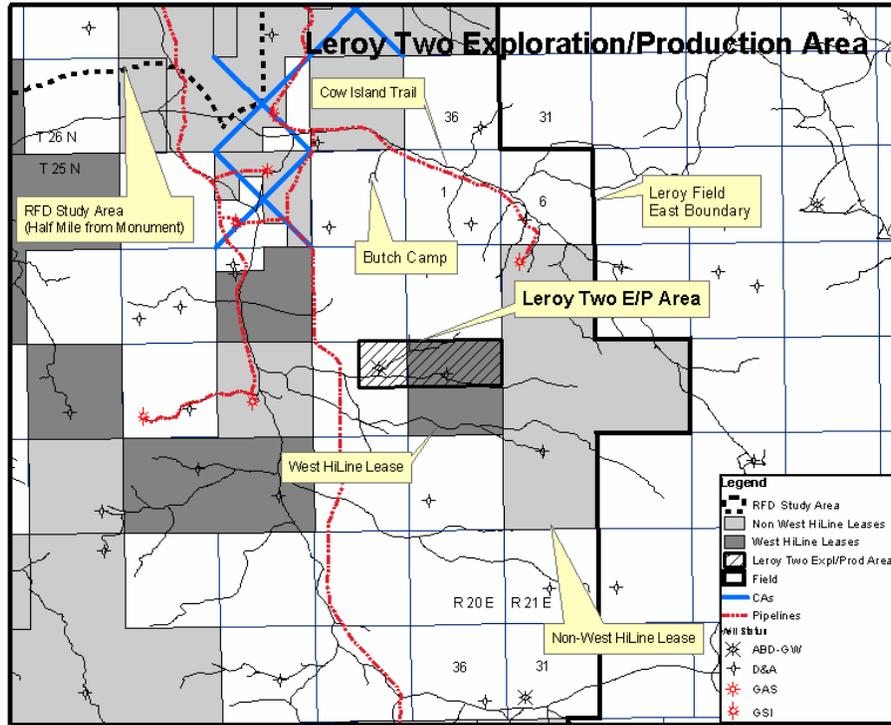
* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

** Considered an identification well, even though it produced 16,715 MCF before being shut in.

4.2.9 Leroy Two Exploration/Production Area

The Leroy Two area encompasses approximately 470 acres entirely in the Monument. The area includes federal surface and federal minerals and one lease remains (Federal Lease MTM89476). The area is located a half mile east of Robinsons' between Right and Middle Coulees and is elongated in an east-west direction (see Figure 4.2.9-1).

Figure 4.2.9-1



The first well drilled in this area was the Federal No. 1 (Monument well) spud in June 1969 by Gulf Oil Corporation at a location in the SE $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 13, T. 25 N., R. 20 E., Blaine County. The well was drilled to a TD of 1,800 feet and bottomed in the Telegraph Creek Formation. The well was drilled as a dry hole and plugged and abandoned on June 20, 1969. The prospect was believed to be a step out to the Federal No. 15-1 well located in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 15, T. 25 N., R. 20 E., Blaine County, in the Leroy/Bullwacker Area.

The second well drilled in the Leroy Two area discovered commercial gas in September 1974. The Federal No. 14-25-20 well located in the SW $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 14, T. 25 N., R. 20 E. (Monument well) was spud on September 17, 1974 and completed as an Eagle Formation producing gas well with an initial production test of 189 MCFPD. No gas was sold from this well for a lack of pipeline infrastructure and it was subsequently plugged and abandoned on September 19, 1974. The well was re-entered on August 26, 1978 and completed for production on October 3, 1978. The well again was tested at 189 MCFPD and a reservoir pressure of 151 psi. It remained shut-in until it was plugged again in October 2002 because of the lack of pipeline infrastructure in the area. This was the last well on the lease and the lease subsequently terminated.

Following the drilling and completion of the Federal No. 14-25-20 well, no other wells were drilled in the area (see Tables 4.2.9-1 and 4.2.9-2). As of December 2006 this area had produced no commercial gas from the mentioned wells.

The potential for natural gas to occur in this area is high based on well tests and log analysis of the two wells drilled. The potential for drilling more wells is mostly low to moderate. With the one federal lease in the area, there is a reasonable chance that no wells will be drilled on the federal land (all in the Monument) in the next 10 to 15 years (no private or state lands are contained in this area).

**Table 4.2.9-1
Leroy Two Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well* Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Fuel Resources Development Co	FEDERAL 14-25-20	25-005-21658-00-00		Gas	P&A - Approved	Leroy	Blaine	25N-20E	14	NE SW NE	1520 N	1520 E	Yes	9/17/1974	9/18/1974		9/18/1974	189	
Gulf Oil Corporation	FEDERAL	25-005-21131-00-00		Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-20E	13	NE SE NW	1960 N	2150 W	Yes	6/15/1969	6/20/1969		6/20/1969		

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
2 - Well lies within a narrow finger protruding in the Monument.
3 - Well lies within ½ mile of the Monument.
4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
5 - Well lies within a federal lease that lies both in and outside the Monument.
6 - Well lies within a state land section intermingled with the Monument.

**Table 4.2.9-2
Summary of Leroy Two
Exploration/Production Area Wells**

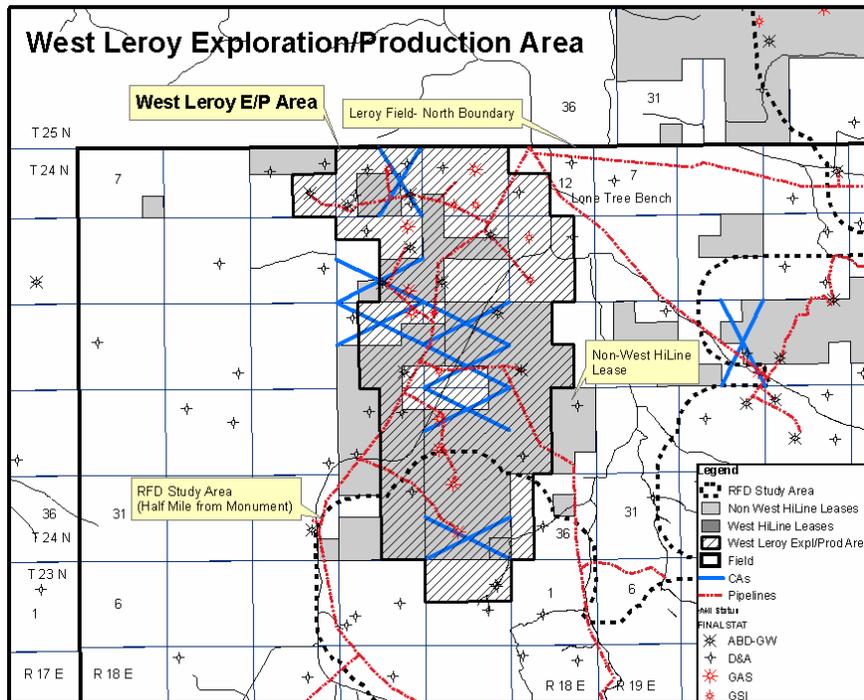
Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
2	0	0	2	0

* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

4.2.10 West Leroy Exploration/Production Area

The West Leroy area encompasses approximately 7,120 acres, of which approximately 720 acres are in the Monument. Currently, three leases remain active in the area and are contained both in and outside of the Monument (Federal Leases: MTM16618, MTM16327 and MTM17376). The area is located in the vicinity of Lone Tree Bench. The geologic features trend north-south with beds gently dipping to the east and faults on the west (see Figure 4.2.10-1).

Figure 4.2.10-1



The area was first explored in July 1969 by Texas Pacific Coal and Oil Company when the Government No. 1-2 well (Monument well) was drilled at a location in the SE $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 2, T. 23 N., R. 18 E., Blaine County, on the south edge of the structure. The area prospect was based on regional geology, local surface geology, and an offset to the Federal 1-18 well (discussed above under the Leroy One area) drilled approximately two miles north the year prior. The 1-2 well was drilled to a TD of 1,710 feet and bottomed in the Telegraph Creek Formation. The well was also tested for the potential of gas within the Eagle Formation. No gas was found and the well was plugged and abandoned as a dry hole in July 1969. Following the drilling of the 1-2 well, the Federal No. 26-24-18 well (spud October 21, 1974), located in the NW $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 26, T. 24 N., R. 18 E., Blaine County (non-Monument well), was drilled to further define the prospect. The well discovered commercial gas on November 22, 1974 in the Eagle Formation. It was drilled to a TD of 1,649 feet (bottomed in the Telegraph Creek Formation) and produced 787,965 MCF from the Eagle Formation from June 1978 through December 2006.

All together, 39 wells have been drilled in the West Leroy area (see Tables 4.2.10-1 and 4.2.10-2). Of those wells, 24 have historic production and 13 remain active as either producing gas wells or shut-in gas wells (all the wells have pipeline service). Three other wells drilled adjacent to the West Leroy area were useful for information identifying the structure. As of December 2006 the area had produced 8,746,401 MCF of gas from the 24 wells. Excluding the wells outside the study area, the area has produced 1,016,869 MCF from two wells (see the highlighted cumulative production figures in Table 4.2.10-1).

The potential for natural gas to occur in this area is high based on production histories, well tests and log analysis of many of the wells; however, the commercial potential is on a localized basis because the gas resource has been depleted and due to the geology of the area. The potential of drilling more wells is rated mostly low to moderate.

With the three federal leases in this area, there is a reasonable chance that one well could be drilled on federal land (one non-Monument well) within the next 10 to 15 years. The drilling of this well would depend on many factors, of which the price of the product and the nature of the business environment would be major contributing factors controlling if and when the well would be drilled.

The West Leroy area contains approximately 160 acres of state minerals and 3,000 acres of private minerals outside the Monument. Further drilling could also occur on those lands, although no additional wells are foreseen at this time.

**Table 4.2.10-1
West Leroy Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well* Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Klabzuba Oil & Gas, Inc.	Magda 22-24-18 FEE	25-005-21747-00-00		Gas	P&A - Approved	Leroy	Blaine	24N-18E	22	NW SE SE	1018 S	1094 E	No 4 >½ mile	7/7/1975	8/3/1975	7/25/1975		1184	310,989
Klabzuba Oil & Gas, Inc.	Federal 14-24-18	25-005-21728-00-00		Gas	P&A - Approved	Leroy	Blaine	24N-18E	14	NE SW SW	1211 S	1214 W	No 4 >½ mile	7/26/1975	8/3/1975	8/3/1975	4/25/2001	8377	1,047,267
Klabzuba Oil & Gas, Inc.	Bleha 14-24-18B FEE	25-005-21796-00-00		Gas	Abd - Unapproved	Leroy	Blaine	24N-18E	14	SW NE NE	1176 N	1034 E	No 4 >½ mile	11/8/1975	11/11/1975	11/11/1975	post 1998	1191	168,560
Brown, J. Burns Operating Company	OLSON 10-24-18B FEE	25-005-21952-00-00		Gas	P&A - Approved	Leroy	Blaine	24N-18E	10	NE SW SW	692 S	808 W	No 4 >½ mile	5/8/1978	7/13/1978	10/7/1978	4/1/1992	442	10,900
Brown, J. Burns Operating Company	J-9-24-18N FEE	25-005-22058-00-00		Gas	P&A - Approved	Leroy	Blaine	24N-18E	9	SE NW SE	1490 S	1508 E	No 4 >½ mile	9/27/1978	11/1/1978			89	233
Fuel Resources Development Co	MCCRKN L-12-24-18-N FEE	25-005-22344-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-18E	12	S2 NW SW	1379 S	660 W	No >½ mile	9/4/1984	10/8/1984		10/11/1984		
Guthrie, A. K.	2-A MAGDA FEE	25-005-22346-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-18E	10	SE SE	660 S	660 E	No >½ mile	9/17/1984	10/3/1984		10/3/1984		
Brown, J. Burns Operating Company	BLEHA 10-24-18B FEE	25-005-22371-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-18E	10	SW	1410 N	1967 W	No >½ mile	5/28/1985	5/28/1985		6/17/1985		
Brown, J. Burns Operating Company	OLSON 10-24-18 FEE	25-005-22372-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-18E	10	NE SW SW	1233 S	1236 W	No >½ mile	6/6/1985	6/8/1985		7/1/1985		
Brown, J. Burns Operating Company	BLEHA 11-24-18B FEE	25-005-22667-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-18E	11	SW NW	1326 N	1292 W	No >½ mile	12/20/1994	12/21/1994		12/22/1994		
Fuel Resources Development Co	FEDERAL 15-24	25-005-21729-00-00		Gas	P&A - Approved	Leroy	Blaine	24N-18E	15	NW SW SE	1143 S	2393 E	No 4 >½ mile	7/16/1975	7/29/1975	7/28/1975	9/8/1987	238	5,084
Fuel Resources Development Co	FEDERAL 27-24-18	25-005-21731-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-18E	27	NE SW NE	1568 N	1342 E	No >½ mile		6/18/1975				
Fuel Resources Development Co	FED 23-24-18B	25-005-21782-00-00		Gas	P&A - Approved	Leroy	Blaine	24N-18E	23	C NE NE	660 N	660 E	No 4 >½ mile		9/9/1975			2820	166,170
Fuel Resources Development Co	MAGDA 15-24-18B FEE	25-005-21797-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-18E	15	SW NE NW	945 N	1897 W	9/6/1975		9/6/1975				
Brown, J. Burns Operating Company	R. Magda 15-24 FEE	25-005-21848-00-00		Gas	P&A - Approved	Leroy	Blaine	24N-18E	15	NW SE NE	1957 N	683 E	No >½ mile		8/17/1976			1750	225,647
Brown, J. Burns Operating Company	10-24 (1-A) FEE	25-005-21855-00-00		Gas	P&A - Approved	Leroy	Blaine	24N-18E	10	S2 NE SE	1330 S	660 E	No 4 >½ mile		10/18/1976			1558	1,761
Klabzuba Oil & Gas, Inc.	Bleha 11-24-18 FEE	25-005-21856-00-00		Gas	Shut In	Leroy	Blaine	24N-18E	11	W2 SE SW	660 S	1969 W	No 4 >½ mile		10/18/1976			2300	1,137,395
Klabzuba Oil & Gas, Inc.	CASE 15-11	25-005-21890-00-00		Gas	Shut In	Leroy	Blaine	24N-18E	11	SW SE	660 S	1969 E	No 4 >½ mile		8/23/1981			400	421
Fuel Resources Development Co	FEDERAL 25-24-18-B	25-005-21958-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-18E	25	NE SW SW	1021 S	817 W	No >½ mile		6/18/1978				
Fuel Resources Development Co	FEDERAL 24-24-18	25-005-21959-00-00		Gas	P&A - Approved	Leroy	Blaine	24N-18E	24	NE SW SW	1058 S	777 W	No 5 >½ mile		7/16/1978			225	6,413
Klabzuba Oil & Gas, Inc.	A. Johnson 13-2 FEE	25-005-22051-00-00		Gas	Shut In	Leroy	Blaine	24N-18E	13	C SW	1320 S	1320 W	No >½ mile		10/26/1978			696	606,476
Mobil Exploration & Producing North America Inc	L. S BIRD 13-3 FEE	25-005-22052-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-18E	13	C NE	1320 N	1320 E	No >½ mile		10/5/1978				
Klabzuba Oil & Gas, Inc.	Case 11-24-18 FEE	25-005-22231-00-00		Gas	Producing	Leroy	Blaine	24N-18E	11	N2 SW NE	1400 N	1980 E	No >½ mile		6/13/1981			750	173,118
Fuel Resources Development Co	FEDERAL 34-24-18	25-005-21732-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-18E	34	SW NE NE	1165 N	760 E	No 3	7/9/1975	7/12/1975		7/12/1975		
Fuel Resources Development Co	STATE 36-24-18	25-005-21801-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-18E	36	C NE SW	1980 S	1980 W	No 3	9/6/1975	9/8/1975		9/8/1975		
Fuel Resources Development Co	FEDERAL 1-23-18	25-005-21744-00-00	Y	Dry Hole	P&A - Approved	Leroy	Blaine	23N-18E	1	SW NE SW	1847 S	1926 W	No 3	6/24/1975	6/26/1975		6/26/1975		
Klabzuba Oil & Gas, Inc.	FEDERAL 35-24-18	25-005-21739-00-00		Gas	Producing	Leroy	Blaine	24N-18E	35	W2 NE NW	660 N	177 W	No 3/5	6/9/1975	6/11/1975	6/26/1975		894	415,584
Klabzuba Oil & Gas, Inc.	22-24 FEE	25-005-21849-00-00		Gas	Producing	Leroy	Blaine	24N-18E	22	SW NE NE	661 N	661 E	No 4 >½ mile	7/31/1976	8/17/1976	8/17/1976		10959	1,800,521
Klabzuba Oil & Gas, Inc.	FEDERAL 26-24-18B	25-005-21730-00-00		Gas	Producing	Leroy	Blaine	24N-18E	26	NE SW NW	1933 N	1001 W	No 4 >½ mile	6/12/1975	6/14/1975	6/26/1975		930	665,618
Klabzuba Oil & Gas, Inc.	23-24 FEE	25-005-21748-00-00		Gas	Shut In	Leroy	Blaine	24N-18E	23	NE SW SW	1010 S	1010 W	No 4 >½ mile	7/5/1975		7/28/1975		872	118,983
Klabzuba Oil & Gas, Inc.	FEDERAL P-15-24-18N	25-005-22404-00-00		Gas	Producing	Leroy	Blaine	24N-18E	15	W2 SE SE	660 S	805 E	No 4 >½ mile	6/17/1986		9/7/1986		200	357,155
Klabzuba Oil & Gas, Inc.	D-23-24-18N FEE	25-005-22405-00-00		Gas	Shut In	Leroy	Blaine	24N-18E	23	NW NW	662 N	762 W	No 4 >½ mile	9/2/1986	9/8/1986			140	96,418
Klabzuba Oil & Gas, Inc.	Bleha 10-24-18 FEE	25-005-22366-00-00		Gas	Shut In	Leroy	Blaine	24N-18E	10	S2 W2 NE	1324 N	1979 E	No 4 >½ mile	5/6/1985		5/6/1985		50	24,596
Klabzuba Oil & Gas, Inc.	FEDERAL 26-24-18	25-005-21692-00-00		Gas	Producing	Leroy	Blaine	24N-18E	26	SE NW SW	1460 S	990 W	No 5 >½ mile	10/21/1974	10/24/1974	11/22/1974		2790	787,965
Klabzuba Oil & Gas, Inc.	FEDERAL 35-24-18A	25-005-21724-00-00		Gas	Producing	Leroy	Blaine	24N-18E	35	SE NE SW	1690 S	2060 W	Yes	11/3/1974	11/6/1974	11/22/1974		1490	601,285
Texas Pacific Coal & Oil Co.	GOVT 1-2	25-005-21140-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	23N-18E	2	NW SE NE	1701 N	872 E	Yes	7/26/1969	7/31/1969		7/31/1969		
Fuel Resources Development Co	FEDERAL 2-23-18B	25-005-21751-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	23N-18E	2	S2 NE NE	838 N	660 E	Yes	7/2/1975	7/4/1975		7/4/1975		
Fuel Resources Development Co	USA 2-23-18-1	25-005-21696-00-00	Y	Dry Hole	P&A - Approved	Leroy	Blaine	23N-18E	2	NE NW SE	2130 S	1440 E	Yes	11/18/1974	11/19/1974		11/19/1974		
Fuel Resources Development Co	FEDERAL 3-23-18B	25-005-21770-00-00	Y	Dry Hole	P&A - Approved	Leroy	Blaine	23N-18E	3	NE NW SE	2577 S	1521 E	Yes	7/14/1975	7/17/1975		7/17/1975		
Klabzuba Oil & Gas, Inc.	Pinwheel Ranch 13-6-24-18B FEE	25-005-23523-00-00		Gas	Shut In	Leroy	Blaine	24N-18E	13	SE NW	1544 N	1575 W	No >½ mile	10/6/2005	10/18/2005				
Klabzuba Oil & Gas, Inc.	Magda 15-1-24-18C FEE	25-005-23524-00-00		Gas	Producing	Leroy	Blaine	24N-18E	15	NE NE	1202 N	1173 E	No >½ mile	10/10/2005	10/18/2005				17,842
Klabzuba Oil & Gas, Inc.	Lonetree Cattle-Fed 10-8-24-18F FEE	25-005-23536-00-00		Dry Hole	Abandoned - Unapproved	Leroy	Blaine	24N-18E	10	NE NE	711 N	857 E	No 4 >½ mile	11/20/2005	11/23/2005				
Cumulative of the highlighted production figures =																			1,016,869

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
- 2 - Well lies within a narrow finger protruding in the Monument.
- 3 - Well lies within ½ mile of the Monument.
- 4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
- 5 - Well lies within a federal lease that lies both in and outside the Monument.
- 6 - Well lies within a state land section intermingled with the Monument.

**Table 4.2.10-2
Summary of West Leroy
Exploration/Production Area Wells**

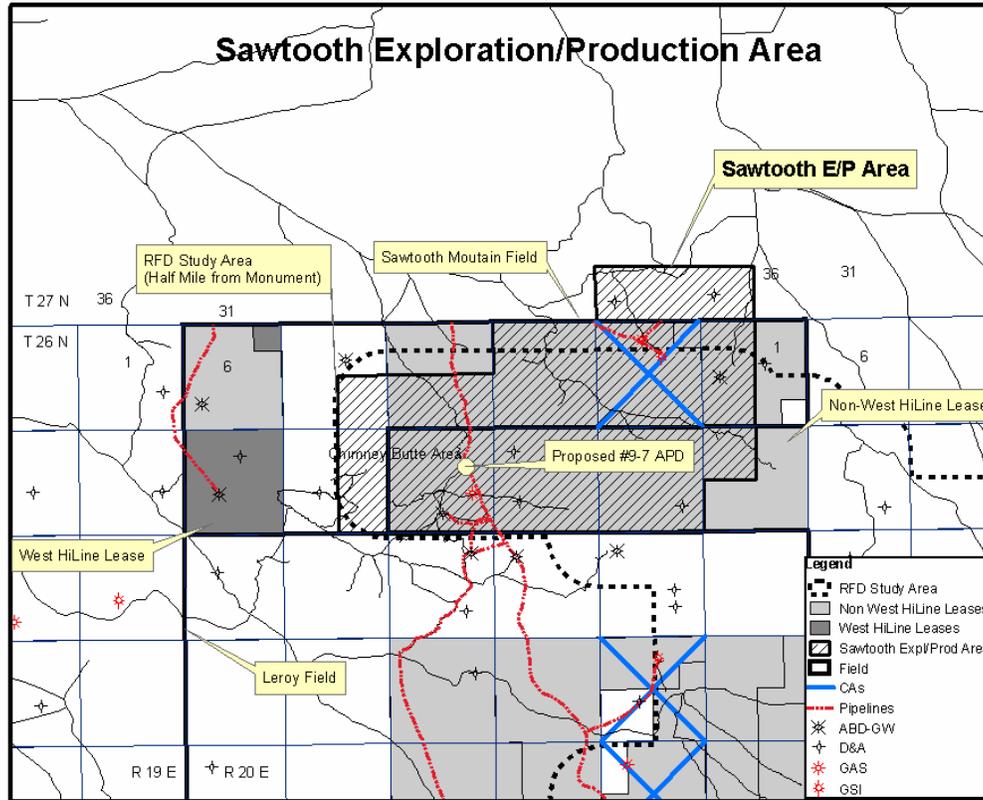
Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
3	3	33	39	3

* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

4.2.11 Sawtooth Exploration/Production Area

The Sawtooth area encompasses approximately 4,990 acres of which about 1,960 acres (40%) is in the Monument. Four active federal leases are included in this area (Monument Federal leases: MTM1885, MTM1886 and MTM1888; non-Monument Federal lease MTM1882). The area lies in the Chimney Butte area and the feature is elongated in an east-west direction (Figure 4.2.11-1).

Figure 4.2.11-1



Initial exploration in the Sawtooth Mountain Field proper began in November 1967 when two productive wells were drilled approximately four miles northwest of the South Sawtooth area (Government No. 24-18 well in the SE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 18, T. 27 N., R. 20 E., completed December 4, 1967; and the Campbell No. 2 well in the SE $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 4, T. 27 N., R. 19 E., completed December 9, 1967). Two additional productive wells were drilled nine miles northwest of the Sawtooth area in May 1971 (State 1-16 well in the SE $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 16, T. 27 N., R. 19 E., completed August 20, 1971 and the Federal No. 1-5 well in the NE $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 5, T. 27 N., R. 19 E., completed September 2, 1971).

The Sawtooth area was first explored in June 10, 1971 by Lone Star Exploration, Inc. when the Federal No. 1-2 well (less than a half mile outside the Monument) was drilled at a location in the SW $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 2, T. 26 N., R. 20 E., Blaine County. The well was drilled to a TD of 1,339 feet and bottomed in the Telegraph Creek Formation. The Eagle Formation tested for gas at an initial rate of 2,357 MCFPD with a well head pressure of 417 psi. Following the completion of the well on September 1, 1971, it remained shut-in for five years until October 1976 when a gas pipeline was constructed to the well. The nearest gas well prior to drilling the Federal No. 1-2 well was the Government No. 24-18 well (discussed above) located approximately six miles to the northeast in the SE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 18, T. 27 N., R. 20 E. The prospect was based on regional geology, local surface geology and knowledge gained from the previous wells drilled in the area.

All together, 11 wells have been drilled in the Sawtooth area and of those wells, four have historic production and three remain active as producing gas wells (all the wells have pipeline service) (see Tables 4.2.11-1 and 4.2.11-2).

As of December 2006 the area has produced 2,280,385 MCF of gas from the four wells. Excluding the well outside the study area, the area has produced 1,831,188 MCF from three wells (see the highlighted cumulative production figures in Table 4.2.11-1).

The potential for natural gas to occur in this area is high based on production histories, well tests and log analysis of many of the wells. The potential for drilling more wells in this area is rated from low to high with the majority rated moderate and high. With the four federal leases in this area, there is a reasonable chance that 17 wells could be drilled on federal land (four Monument wells and thirteen non-Monument wells) within the next 10 to 15 years. The drilling of these wells would depend on many factors, of which the price of the product and the nature of the business environment would be major contributing factors controlling if and when the wells would be drilled.

The Sawtooth area contains no state or private minerals.

**Table 4.2.11-1
Sawtooth Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well* Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Lone Star Exploration	FEDERAL 24-35	25-005-21416-00-00		Dry Hole	P&A - Approved	Sawtooth Mountain	Blaine	27N-20E	35	NE SW SW	1115 S	1075 W	No >½ mile	8/8/1972	8/12/1972		2/3/1983		
Energetics Inc	STATE 14-36	25-005-21374-00-00		Dry Hole	P&A - Approved	Sawtooth Mountain	Blaine	27N-20E	36	NE SW SW	990 S	990 W	No >½ mile	6/8/1972	8/8/1972	8/8/1972	8/9/1979		
Bond, Roland, Etal.	FEDERAL 8-1	25-005-21304-00-00		Gas	P&A - Approved	Sawtooth Mountain	Blaine	26N-20E	1	NE NW SW	2470 S	990 W	No 3	12/2/1971	12/2/1971	12/2/1971	3/1/1979	91	
Montana Power Company	FEDERAL 7-1	25-005-22232-00-00		Dry Hole	P&A - Approved	Sawtooth Mountain	Blaine	26N-20E	1	SW SW NE	2256 N	2104 E	No 3	7/20/1981	7/23/1981		7/25/1981		
Devon Energy Corporation	U.S. 9-9	25-005-23309-00-00		Gas	Producing	Wildcat	Blaine	26N-20E	9	NE SE	1980 S	1000 E	No 3/5	8/20/2004	8/20/2004	9/2/2004		552	280,920
Montana Power Company	FEDERAL 12-10	25-005-22311-00-00		Dry Hole	P&A - Approved	Sawtooth Mountain	Blaine	26N-20E	10	SE NW SW	1557 S	1298 W	No 3/5	9/7/1983	9/9/1983		9/9/1983		
Devon Energy Corporation	FEDERAL 1-2	25-005-21238-00-00		Gas	Shut-in	Sawtooth Mountain	Blaine	26N-20E	2	W2 SW NE	1800 N	1980 E	No 1/3/4/5	6/10/1971	6/13/1971	9/1/1971		2357	1,110,991
Devon Energy Corporation	U.S. 2-3	25-005-23245-00-00		Gas	Producing	Sawtooth Mountain	Blaine	26N-20E	2	NE NW	942 N	2340 W	No 1/4/5 >½ mile	10/10/2003	10/13/2003	10/17/2003		1056	449,197
Ocean Energy, Inc.	FEDERAL 15-9	25-005-21892-00-00		Gas	P&A - Approved	Sawtooth Mountain	Blaine	26N-20E	9	NW SW SE	990 S	2540 E	No 3/5	11/16/1976	11/18/1976	11/19/1976	7/28/2006	374	439,277
Bond, Roland, Etal.	FEDERAL 9-11	25-005-21302-00-00		Dry Hole	P&A - Approved	Sawtooth Mountain	Blaine	26N-20E	11	NW SE SE	1250 S	1050 E	Yes	12/6/1971	12/10/1971		12/10/1971		
Montana Power Company	FEDERAL 4-10	25-005-22233-00-00		Dry Hole	P&A - Approved	Sawtooth Mountain	Blaine	26N-20E	10	SE NW NW	1283 N	1058 W	Yes	7/26/1981	7/29/1981		7/29/1981		
Cumulative of the highlighted production figures =																		1,831,188	
Cumulative of all production =																		2,280,385	

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
- 2 - Well lies within a narrow finger protruding in the Monument.
- 3 - Well lies within ½ mile of the Monument.
- 4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
- 5 - Well lies within a federal lease that lies both in and outside the Monument.
- 6 - Well lies within a state land section intermingled with the Monument.

**Table 4.2.11-2
Summary of Sawtooth
Exploration/Production Area Wells**

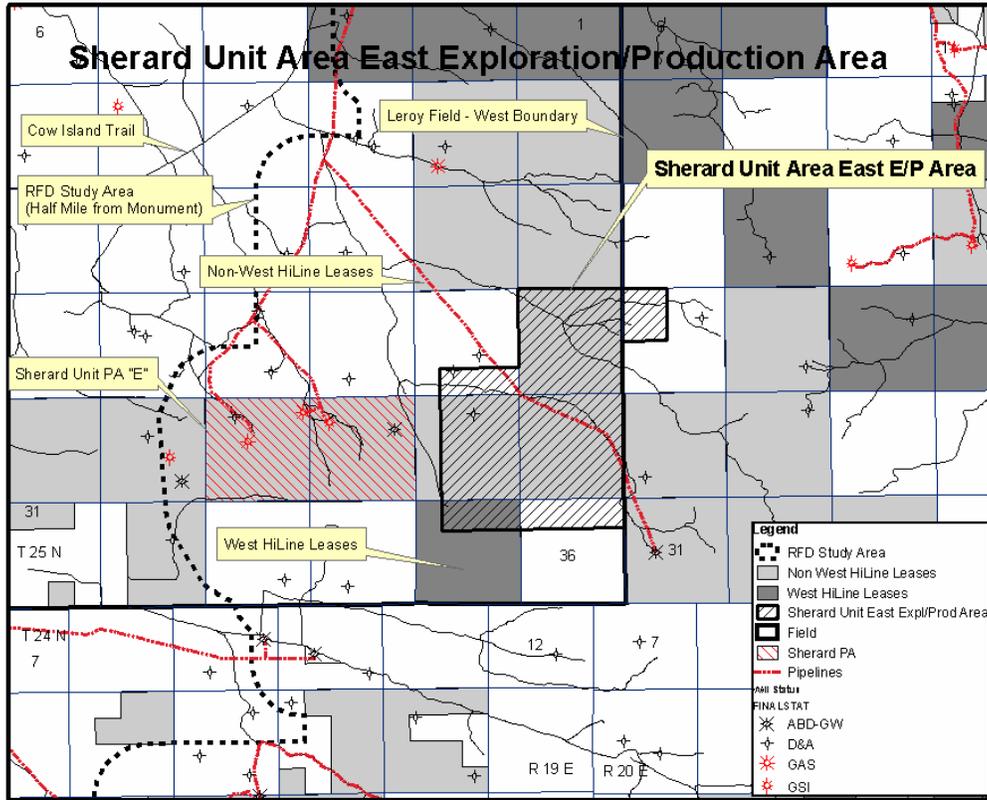
Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
2	6	3	11	0

* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

4.2.12 Sherard Unit Area East Exploration/Production Area

The Sherard Unit Area East encompasses approximately 2,330 acres entirely in the Monument. Two active federal leases are included in this area (Monument Federal leases: MTM1565 and MTM89469). The area lies approximately four miles east/northeast of the community of Leroy and the feature is elongated in a northeast-southwest direction (see Figure 4.2.12-1).

Figure 4.2.12-1



Exploration in the Sherard Unit Area East began in September 1971 when the Federal 10-23 well was drilled and abandoned in the NW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 23, T. 25 N., R 19 E., Blaine County. Two other wells later drilled since on the same structural trend adjacent to the area were useful in further delineating the area. Of the three wells drilled, all were plugged and abandoned as dry holes (see Tables 4.2.12-1 and 4.2.12-2). As of December 2006 the area had produced no gas from either of the wells.

The potential for natural gas to occur in this area is high based on drilling histories and structural interpretation of the area's geology. The potential for drilling more wells in this area is rated from moderate to high. With the two federal leases in this area, there is a reasonable chance that 10 wells could be drilled on the federal land (five on private surface/federal minerals and three on federal surface/federal minerals) and two on state minerals in the next 10 to 15 years. The drilling of these wells would depend on many factors, of which the price of the product and the nature of the business environment would be major contributing factors controlling if and when the wells would be drilled.

The Sherard Unit Area East area also contains 160 acres of state minerals and no private minerals, and further drilling could also occur on those lands. Two additional wells are foreseen at this time on the state minerals as mentioned above.

**Table 4.2.12-1
Sherard Unit Area East Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well* Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Norfolk Energy Inc.	U.S. 26-2	25-005-22240-00-00		Dry Hole	P&A - Approved	Sherard Unit	Blaine	25N-19E	26	SW NW NE	990 N	2304 E	Yes	8/26/1981	8/29/1981		8/29/1981		
Brown, J. Burns Operating Company	FED. 23-25-19	25-005-22380-00-00		Dry Hole	P&A - Approved	Sherard Unit	Blaine	25N-19E	23	NW SE SW	1179 S	1957 W	Yes	12/19/1985	12/21/1985		12/21/1985		
Wise, William, F.	FEDERAL 10-23	25-005-21264-00-00	Y	Dry Hole	P&A - Approved	Sherard Unit	Blaine	25N-19E	23	C NW SE	1980 S	1980 E	Yes	9/12/1971	9/17/1971		9/17/1971		

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
- 2 - Well lies within a narrow finger protruding in the Monument.
- 3 - Well lies within ½ mile of the Monument.
- 4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
- 5 - Well lies within a federal lease that lies both in and outside the Monument.
- 6 - Well lies within a state land section intermingled with the Monument.

**Table 4.2.12-2
Summary of Sherard Unit Area East
Exploration/Production Area Wells**

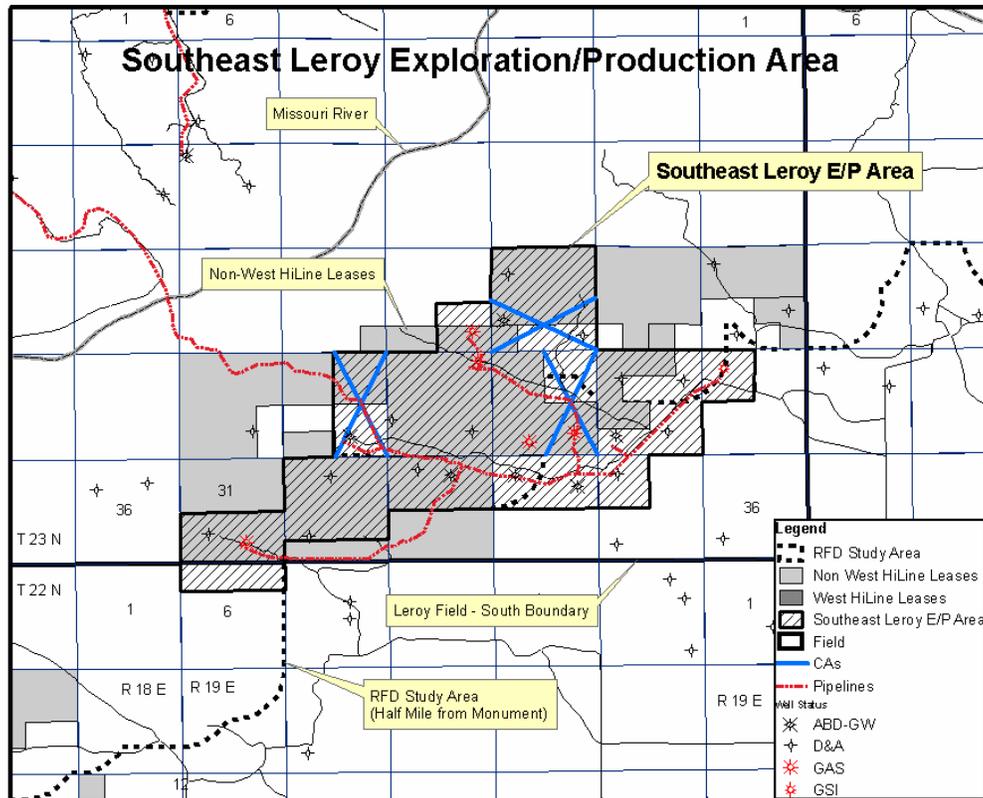
Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
2	0	0	2	1

* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

4.2.13 Southeast Leroy Exploration/Production Area

The Southeast Leroy area encompasses approximately 5,380 acres, of which about 1,240 acres are in the Monument. Currently, three leases remain active in the area and are contained both in and outside of the Monument (Federal Leases: MTM18282, MTM18283 and MTM53751) and one lease that is not common with the Monument (Federal Lease MTM91331). Geographically, the area is located approximately three and half miles east of the McClelland/Stafford Ferry. The feature is elongated in an east-west direction and is contained fully within Fergus County (see Figure 4.2.13-1).

Figure 4.2.13-1



The area was first explored in August 1972 by Texas Gas Exploration Corp. when the Osburnsen No. 2 well (non-Monument, private well) was drilled at a location in the NW $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 25, T. 23 N., R. 19 E., Fergus County, on the east edge of the feature. The well's prospect was based on regional geology and local surface geology and was drilled as an offset to the Federal 1-18 well (in the Leroy One area) drilled approximately five and half miles northwest four years prior. The Osburnsen No. 2 well was drilled to a TD of 1,980 feet and bottomed in the Telegraph Creek Formation. The well tested gas within the Eagle Formation at an initial rate of 3,496 MCFPD and a well head pressure of 360 psi. The well was completed as an Eagle Formation producing gas well and later produced 103,927 MCF of natural gas between November 1983 and May 1988 before it was shut-in November 1990. The well was idle (shut-in) for nearly 11 years before pipeline infrastructure was introduced to the area in 1980. Following the drilling of the Osburnsen No. 2 well, the Federal No. 31-23-19 well (spud November 19, 1974), located in the SW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 31, T. 23 N., R. 19 E., Fergus County, (non-Monument well) was drilled to further define the prospect. The well discovered commercial gas November 21, 1974 in the Eagle Formation. It was drilled to a TD of 1,830 feet (bottomed in the Telegraph Creek) and produced 94,820 MCF of natural gas from the Eagle Formation from November 1983 through December 2005.

All together, 24 wells have been drilled in the Southeast Leroy area (see Tables 4.2.13-1 and 4.2.13-2). Of the 24 wells, 12 have historic production and six remain active as either producing gas wells or shut-in gas wells (all the wells have pipeline service). Six other wells drilled adjacent to, but outside of the Southeast Leroy area were useful in identifying the structure. As of December 2006 the area had produced 1,936,044 MCF of gas from the twelve wells. Excluding the wells outside the study area, the area has produced 1,920,799 MCF of gas from ten wells (see the highlighted cumulative production figures in Table 4.2.13-1).

The potential for natural gas to occur in this area is high based on production histories, well tests and log analysis for many of the wells; however, the commercial potential is on a localized basis because the gas resource has been depleted and, based on the geology, the area is very segmented by fault blocks. The potential for drilling more wells in this area is rated from low to moderate. With the three federal leases in this area, there is a reasonable chance that two wells could be drilled in the area in the next 10 to 15 years: one on federal lease in the Monument and one on private land just outside the Monument. The drilling of these wells would depend on many factors, of which the price of the product and the nature of the business environment would be major contributing factors controlling if and when the wells would be drilled in this area.

The Southeast Leroy area contains no state mineral acreage and approximately 1,560 acres of private minerals (outside the Monument). Further drilling could occur on the private lands, and one additional well is foreseen at this time on private minerals.

**Table 4.2.13-1
Southeast Leroy Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well* Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Brown, J. Burns Operating Company	34-23-19 FEE	25-027-21124-00-00		Gas	P&A - Approved	Leroy	Fergus	23N-19E	34	NW SE NE	1570 N	990 E	No >½ mile	7/10/1975	11/8/1975		9/26/1990	994	3,304
Brown, J. Burns Operating Company	KNOX M26-23-19N FEE	25-027-21205-00-00		Gas	P&A - Approved	Leroy	Fergus	23N-19E	26	NE SW SW	948 S	1053 W	No 4 >½ mile	9/5/1984	10/4/1984		9/26/1990	290	11,941
Fuel Resources Development Co	USA 32-23-19-1	25-027-21103-00-00		Dry Hole	P&A - Approved	Leroy	Fergus	23N-19E	32	SE NE NW	1030 N	2380 W	No >½ mile		12/2/1974				
Fuel Resources Development Co	FEDERAL 32-23-19A	25-027-21117-00-00		Dry Hole	P&A - Approved	Leroy	Fergus	23N-19E	32	NE SW SW	1265 S	1240 W	No >½ mile		9/20/1975				
Fuel Resources Development Co	OSBURNSN 35-1 FEE	25-027-21132-00-00		Dry Hole	P&A - Approved	Leroy	Fergus	23N-19E	35	SE NW NW	990 N	990 W	No >½ mile		10/11/1975				
Devon Corporation	OLSON C ET AL 1 FEE	25-027-21153-00-00		Dry Hole	P&A - Approved	Leroy	Fergus	23N-19E	26	NE SW SE	1107 S	1716 E	No >½ mile		6/13/1979				
Fuel Resources Development Co	M-35-23-19-N FEE	25-027-21211-00-00	Y	Dry Hole	P&A - Approved	Leroy	Fergus	23N-19E	35	SW SW	827 S	889 W	No >½ mile	8/27/1985	10/4/1985				
Fuel Resources Development Co	F-30-23-20-N FEE	25-027-21212-00-00	Y	Dry Hole	P&A - Approved	Leroy	Fergus	23N-20E	30	SE NW	1375 N	1375 W	No >½ mile	9/16/1985	9/27/1985				
Texas Gas Exploration Corporation	BERGUM 2-5 FEE	25-027-21086-00-00	Y	Dry Hole	P&A - Approved	Wildcat Fergus	Fergus	22N-19E	5	SW SW NE	2080 N	2000 E	No >½ mile		11/5/1973				
Fuel Resources Development Co	OSBURNSN 24-1 FEE	25-027-21130-00-00	Y	Dry Hole	P&A - Approved	Leroy	Fergus	23N-19E	24	SE SW	720 S	1780 W	No >½ mile		10/23/1975				
Fuel Resources Development Co	OSBURNSN 36-1 FEE	25-027-21133-00-00	Y	Dry Hole	P&A - Approved	Leroy	Fergus	23N-19E	36	NE SW SW	990 S	990 W	No >½ mile		10/9/1975				
Brown, J. Burns Operating Company	FED 33-23-19	25-027-21104-00-00		Gas	P&A - Approved	Leroy	Fergus	23N-19E	33	SW NW NE	995 N	2040 E	No 3/5	12/5/1974	12/5/1974	5/17/1975	9/1/1990	490	5,355
Fuel Resources Development Co	FED C-33-23-19-B	25-027-21196-00-00		Dry Hole	P&A - Approved	Leroy	Fergus	23N-19E	33	SW NE NW	739 N	1486 W	No 3/5	8/15/1983	8/18/1983		8/18/1983		
Brown, J. Burns Operating Company	FED. 34-23-19-B	25-027-21135-00-00		Gas	P&A - Approved	Leroy	Fergus	23N-19E	34	SE NW NW	1017 N	1203 W	No 3	9/30/1975	10/1/1975	11/4/1975	9/1/1990	490	1,293
Fuel Resources Development Co	FEDERAL 26-23-19	25-027-21123-00-00		Dry Hole	P&A - Approved	Leroy	Fergus	23N-19E	26	NE SW NW	1485 N	1220 W	No 3/5	10/26/1975	10/29/1975		10/29/1975		
Devon Corporation	OLSON C ET AL 2 FEE	25-027-21149-00-00		Dry Hole	P&A - Approved	Leroy	Fergus	23N-19E	26	NW SE NE	1597 N	899 E	No 3	6/13/1979	6/17/1979		6/17/1979		
Fuel Resources Development Co	FED L-28-23-19-N	25-027-21210-00-00		Dry Hole	P&A - Approved	Leroy	Fergus	23N-19E	28	NW SW	1771 S	255 W	No 3/5	9/3/1985	9/6/1985		9/6/1985		
Fuel Resources Development Co	P-22-23-19-N FEE	25-027-21209-00-00		Dry Hole	P&A - Approved	Leroy	Fergus	23N-19E	22	SE SE	660 S	660 E	No 1/3	9/21/1985	9/22/1985		9/22/1985		
Klabzuba Oil & Gas, Inc.	OSBURNSN 29-23-19 FEE	25-027-21131-00-00		Gas	Plugged	Leroy	Fergus	23N-19E	29	NE SW SE	1025 S	1830 E	No 1/3	9/26/1975	9/28/1975	11/10/1975		1205	32,959
Macum Energy Inc.	Osburnsen 2 FEE	25-027-21046-00-00		Gas	Shut In	Leroy	Fergus	23N-19E	25	SE NW NW	990 N	1120 W	No 3	7/31/1972	8/2/1972	8/12/1972		3496	103,927
Klabzuba Oil & Gas, Inc.	FEDERAL 27-23-19	25-027-21115-00-00		Gas	Producing	Leroy	Fergus	23N-19E	27	SESE	1123 S	1097 E	No 3/4	10/12/1975	10/15/1975	11/18/1975		788	356,886
Klabzuba Oil & Gas, Inc.	FED N 27-23-19-B	25-027-21197-00-00		Gas	Producing	Leroy	Fergus	23N-19E	27	NESESW	661 S	1860 W	No 3/5	6/23/1983	8/19/1983	8/26/1983		1034	251,109
Klabzuba Oil & Gas, Inc.	Federal A-28-23-19-N	25-027-21206-00-00		Gas	Producing	Leroy	Fergus	23N-19E	28	NW NE NE	443 N	660 E	No 3/5	9/24/1984	9/27/1984	10/6/1984		850	200,619
Klabzuba Oil & Gas, Inc.	FEDERAL 31-23-19	25-027-21102-00-00		Gas	Producing	Leroy	Fergus	23N-19E	31	NE SW SE	990 S	1880 E	No 3/5	11/19/1974	11/21/1974	5/17/1975		697	100,677
Klabzuba Oil & Gas, Inc.	FEDERAL P21-23-19N	25-027-21208-00-00		Gas	Producing	Leroy	Fergus	23N-19E	21	SE SE	1013 S	892 E	No 3/5	9/17/1985	9/18/1985	10/23/1985		116	788,964
Klabzuba Oil & Gas, Inc.	FED L-22-23-19N	25-027-21222-00-00		Gas	Plugged	Leroy	Fergus	23N-19E	22	SE NW SW	1566 S	693 W	Yes	11/6/1988	11/9/1988	11/30/1988		120	79,010
Fuel Resources Development Co	FEDERAL 31-23-19B	25-027-21121-00-00		Dry Hole	P&A - Approved	Leroy	Fergus	23N-19E	31	SW NE SW	1440 S	1460 W	Yes	9/15/1975	9/17/1975		9/17/1975		
Fuel Resources Development Co	FED. 28-23-19	25-027-21116-00-00		Dry Hole	P&A - Approved	Leroy	Fergus	23N-19E	28	NW SE SE	1170 S	1000 E	Yes	9/20/1975	9/22/1975		9/22/1975		
Fuel Resources Development Co	FEDERAL E-22-23-19-N	25-027-21223-00-00		Dry Hole	P&A - Approved	Leroy	Fergus	23N-19E	22	NE SW NW	1423 N	877 W	Yes	11/12/1988	11/14/1988		11/14/1988		
Fuel Resources Development Co	STATE 36-23-18-1	25-027-21100-00-00	Y	Dry Hole	P&A - Approved	Leroy	Fergus	23N-18E	36	SE NW NE	1220 N	1610 E	Yes	11/24/1974	11/26/1974		11/26/1974		
Cumulative of the highlighted production figures =																		1,920,799	
Cumulative of all production =																		1,936,044	

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
- 2 - Well lies within a narrow finger protruding in the Monument.
- 3 - Well lies within ½ mile of the Monument.
- 4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
- 5 - Well lies within a federal lease that lies both in and outside the Monument.
- 6 - Well lies within a state land section intermingled with the Monument.

**Table 4.2.13-2
Summary of Southeast Leroy
Exploration/Production Area Wells**

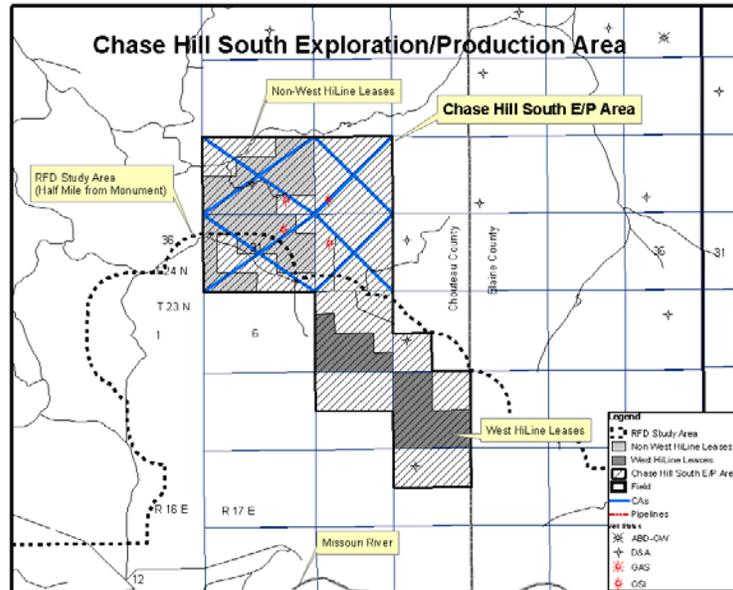
Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
4	14	6	24	6

* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

4.2.14 Chase Hill South Exploration/Production Area

The Chase Hill South area encompasses approximately 5,230 acres of which about 1,240 acres are located in the Monument. Currently, six leases remain active in the area with two having lands in the Monument (MTM19446 and MTM89452) and the other four leases outside the Monument (MTM19492, MTM19445, MTM19445A and MTM89453). Geographically, the area is located two miles north of the river in Chouteau County in the vicinity of Chase Hill area, or two miles north of the junction of Chouteau, Blaine and Fergus Counties. Structurally, the geologic features trend northwest-southeast. (See Figure 4.2.14-1.)

Figure 4.2.14-1



The area was first explored in July 1973 by Coastal Oil and Gas Corp. when the State 16-23-17 well (Monument well) was drilled in the NW $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 16, T. 23 N., R. 17 E., Chouteau County, on the south edge of the structure. The area prospect was based on regional geology, local surface geology and a wildcat extension to the State 17 well drilled approximately ten miles north in the Sherard Field the year prior. The State 16-23-17 well was drilled to a TD of 1,500 feet and bottomed in the Greenhorn Formation. The well was also tested for the potential of gas within the Eagle Formation. No gas was found and the well was plugged and abandoned as a dry hole in December 1973. Following the drilling of the State 16-23-17, the US 31-24-17-1 well (spud November 26, 1974), in the NW $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 31, T. 24 N., R. 17 E., Chouteau County (non-Monument well) was drilled further exploring a prospect. The well discovered commercial gas December 9, 1974 in the Eagle Formation. It was drilled to a TD of 1,580 feet (bottomed in the Telegraph Creek Formation). The well was tested in the Eagle Formation at an initial production rate of 442 MCFPD and a shut-in reservoir pressure of 236 psi. Since the completion of the well, it has remained shut-in because of the lack of pipeline infrastructure in the area.

All together, seven wells have been drilled in the Chase Hill South area (see Tables 4.2.14-1 and 4.2.14-2). Three of the seven wells have tested production and remain as shut-in gas wells (none of the wells have pipeline service). One other well drilled adjacent to the Chase Hill South area was useful for information identifying the structure. To date the wells have not produced commercial volumes of natural gas because of a lack of pipeline infrastructure into the area.

The potential for natural gas to occur in this area is high based on the production tests of the five wells and log analysis of the wells in this area. The gas potential is on a localized basis due to the geology of the area. The potential for drilling more wells is rated moderate. With the two federal Monument leases in this area, there is a reasonable chance that two wells could be drilled in the Monument within the next 10 to 15 years. The drilling of these wells would depend on many factors, of which the price of the product, the nature of the business environment

and whether pipeline infrastructure will be built into the area, would be major contributing factors controlling if and when the wells would be drilled.

The Chase Hill-South area contains approximately 280 acres of state minerals (inside the Monument) and 1,720 acres of private minerals (both in and outside of the Monument). Further drilling could occur on those lands, although no additional wells are foreseen at this time.

**Table 4.2.14-1
Chase Hill South Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well* Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Klabzuba Oil & Gas, Inc.	BREWER 12-32 FEE	25-015-21236-00-00		Gas	Shut In - WOPL	Sherard, Area	Chouteau	24N-17E	32	E2 SW NW	1980 N	990 W	No >½ mile		9/22/1973				
Fuel Resources Development Co	USA 30-24-17 1	25-015-21351-00-00		Dry Hole	P&A - Approved	Wildcat Chouteau	Chouteau	24N-17E	30	NE SW	2081 S	4275 E	No 5 >½ mile		12/1/1974				
Klabzuba Oil & Gas, Inc.	BROWN 29-24-17 FEE	25-015-21370-00-00		Gas	Shut In - WOPL	Sherard, Area	Chouteau	24N-17E	29	NE SW SW	990 S	990 W	No >½ mile		11/5/1975				
Fuel Resources Development Co	E-33-24-17 FEE	25-015-21481-00-00	Y	Dry Hole	P&A - Approved	Wildcat Chouteau	Chouteau	24N-17E	33	NE SW NW	1882 N	990 W	No >½ mile		11/16/1978				
Fuel Resources Development Co	N B L 4-23-17 FEE	25-015-21483-00-00		Dry Hole	P&A - Approved	Wildcat Chouteau	Chouteau	23N-17E	4	NE NW SW	2074 S	990 W	No 3	11/9/1978	11/12/1978		11/12/1978		
Klabzuba Oil & Gas, Inc.	USA 31-24-17-1	25-015-21352-00-00		Gas	Shut In - WOPL	Sherard, Area	Chouteau	24N-17E	31	SW NW NE	990 N	2096 E	No 1/5 >½ mile	11/26/1974	11/28/1974	12/9/1974		442	
Klabzuba Oil & Gas, Inc.	BROWN 30-24-17 FEE	25-015-21371-00-00		Gas	Shut In - WOPL	Sherard, Area	Chouteau	24N-17E	30	NE SW SE	990 S	1934 E	No 4 >½ mile	11/5/1975		11/7/1975		594	
Coastal Oil & Gas Corporation	STATE 16-23-17	25-015-21213-00-00		Dry Hole	P&A - Approved	Wildcat Chouteau	Chouteau	23N-17E	16	SE NW NE	1260 N	1510 W	No 6	7/20/1973	12/31/1973		12/31/1973		

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
- 2 - Well lies within a narrow finger protruding in the Monument.
- 3 - Well lies within ½ mile of the Monument.
- 4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
- 5 - Well lies within a federal lease that lies both in and outside the Monument.
- 6 - Well lies within a state land section intermingled with the Monument.

**Table 4.2.14-2
Summary of Chase Hill South
Exploration/Production Area Wells**

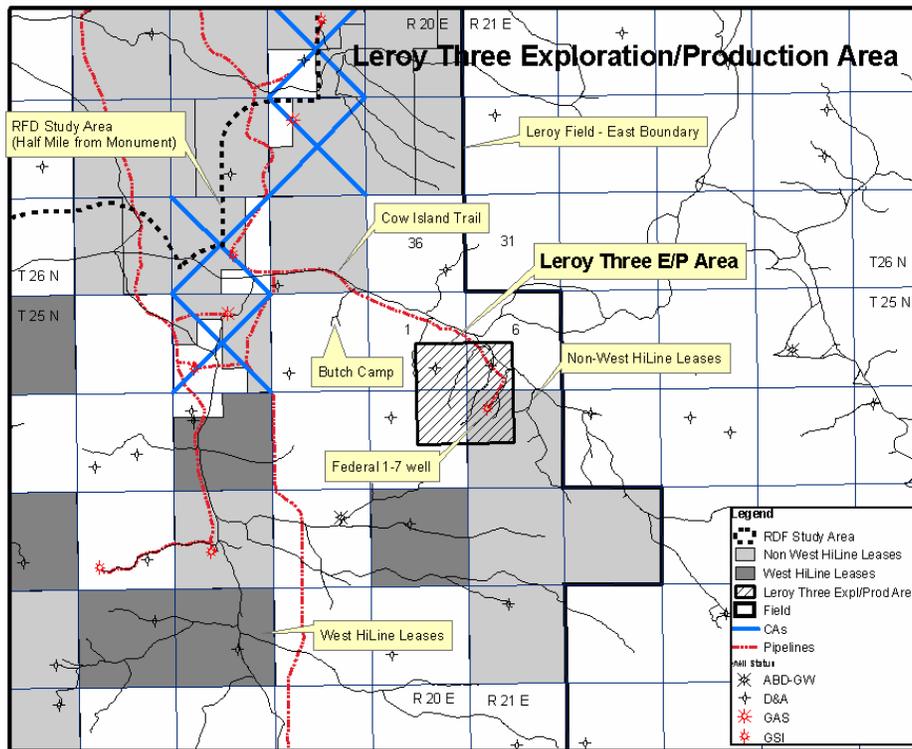
Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
0	1	6	7	1

* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

4.2.15 Leroy Three Exploration/Production Area

The Leroy Three area encompasses approximately 650 acres entirely in the Monument and includes only federal surface and federal minerals with one active lease remaining (MTM16939). The area is located about a mile east of Butch Camp just south of the Cow Island Trail and is not oriented in any specific direction (see Figure 4.2.15-1).

Figure 4.2.15-1



The first and only currently active well drilled in this area was the Federal No. 1-7 well (Monument well), spud in August 1973 by Texas Gas Exploration Corporation in the NW $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 7, T. 25 N., R. 21 E., Blaine County. The well was drilled to a TD of 1,694 feet and bottomed in the Telegraph Creek Formation of the Montana Group. The Eagle Formation was tested at an IP rate of 814 MCFPD and a shut-in pressure of 530 psi. The well was completed as an Eagle Formation producing gas well and later produced 19,235 MCF between June 1995 and November 1998 before it was shut-in. It currently awaits further work to produce again. The well was idle (shut-in) for nearly 22 years before pipeline infrastructure was constructed in the area in 1995. The prospect was based on regional geology, surface geology and knowledge gained from nearby wells to the west and northeast of the well (Federal No. 15-1 well in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 15, T. 25 N., R. 20 E., and the Cow Creek Federal No. 1 in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 3, T. 24 N., R. 21 E., Blaine County).

Following drilling and completion of the Federal No. 1-7 well, two other wells were drilled in the Leroy Three Area. Each of those wells was drilled to the Eagle Formation and plugged and abandoned failing to find natural gas. One other well drilled adjacent to the Leroy Three area was useful for information identifying the structure. As of December 2006, 19,235 MCF of gas had been produced from this one well. (See Tables 4.2.15-1 and 4.2.15-2.)

The potential for natural gas to occur in this area is high based on well test and log analysis of the Federal No. 1-7 well; however there is minimal chance that a well would be drilled because no leasing is allowed on three-quarters of the area and the area is rated low for future drilling potential. No private or state lands are contained within this area and the current well occupies the only productive spacing unit.

**Table 4.2.15-1
Leroy Three Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well* Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Macum Energy Inc.	Federal 1-7	25-005-21565-00-00		Gas	Shut In	Leroy	Blaine	25N-21E	7	SE NW NW	1000 N	1120 W	Yes	8/14/1973	8/15/1973	8/17/1973		814	19,235
Texas Gas Exploration Corporation	FEDERAL 1-6	25-005-21591-00-00		Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-21E	6	NW SE SW	1280 S	1366 W	Yes	12/3/1973	12/7/1973		12/7/1973		
Texas Gas Exploration Corporation	FEDERAL 1-1	25-005-21636-00-00		Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-20E	1	NE SW SE	1140 S	1660 E	Yes	7/24/1974	7/27/1974		7/27/1974		
Fuel Resources Development Co	USA 12-25-20-1	25-005-21675-00-00	Y	Dry Hole	P&A - Approved	Sherard, Area	Blaine	25N-20E	12	NE SW NW	1485 N	1165 W	Yes	10/18/1974	10/20/1974		10/20/1974		

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
- 2 - Well lies within a narrow finger protruding in the Monument.
- 3 - Well lies within 1/2 mile of the Monument.
- 4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
- 5 - Well lies within a federal lease that lies both in and outside the Monument.
- 6 - Well lies within a state land section intermingled with the Monument.

**Table 4.2.15-2
Summary of Leroy Three
Exploration/Production Area Wells**

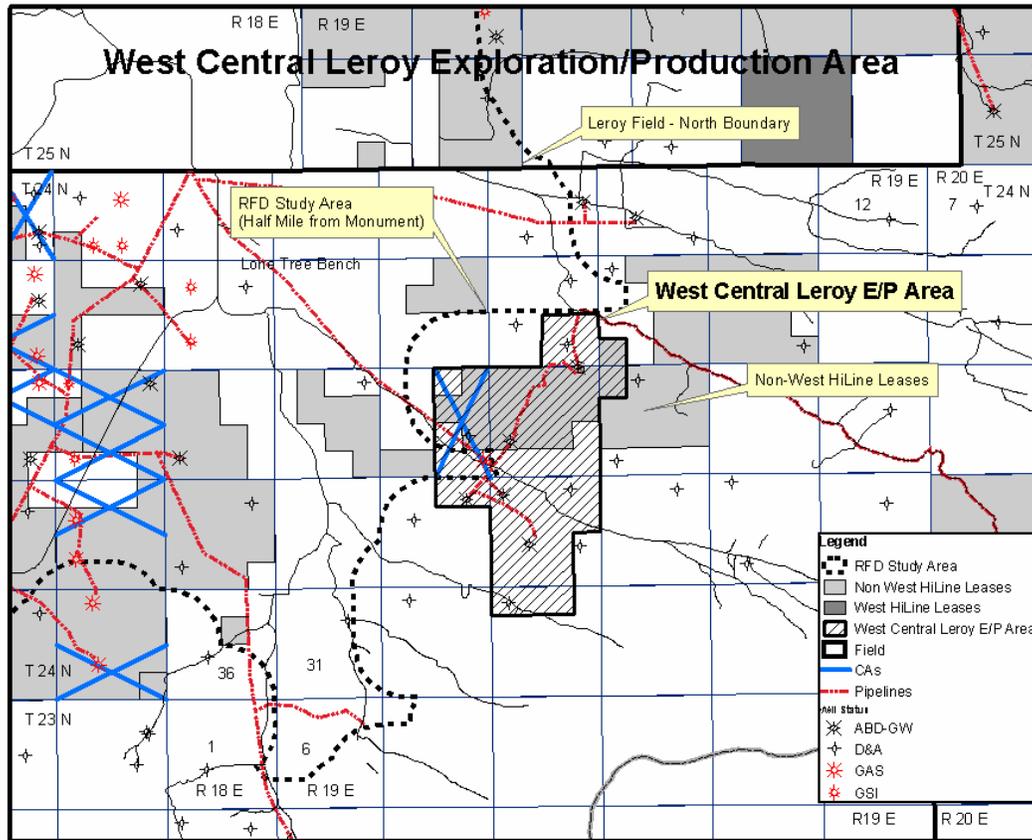
Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
3	0	0	3	1

* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

4.2.16 West Central Leroy Exploration/Production Area

The West Central Leroy area encompasses approximately 1,950 acres on the west edge of the Monument about two miles south of the town of Leroy. Approximately 700 acres of this area are contained in the Monument. One active federal lease is included in this area (Monument Federal lease MTM16098). (See Figure 4.2.16-1.)

Figure 4.2.16-1



The first well drilled in this area was the Federal No. 21-24-19 well, which is outside the Monument by less than a half mile. The well was spud in November 1974 by Fuel Resources Development Company in the NW $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 21, T. 24 N., R. 19 E., Blaine County, to a TD of 1,957 feet and bottomed in the Telegraph Creek Formation. The Eagle Formation tested for gas at an initial rate of 127 MCFPD with shut-in pressure of 400 psi. Following completion, the well remained shut-in for four years until June 1978 when a gas pipeline was constructed to the well. The Federal No. 21-24-19 well later produced 214,190 MCF of natural gas between June 1978 and March 1999. The prospect was based on regional geology, local surface geology and knowledge gained from four wells in the vicinity of the Federal 21-24-19 well. The four wells were the Federal 25-24-19-1 well in the SW $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 25, T. 24 N., R. 19 E., drilled and abandoned in June 1969; the USA 26-24-18-1 well in the NW $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 26, T. 24 N., R. 18 E., drilled and completed as a producer in October 1974 in the West Leroy Area; the USA 35-24-18-1 well in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 35, T. 24 N., R. 18 E., drilled and completed in November 1974 as a producer in the West Leroy Area; and the State 36-24-19-1 well in the SW $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 36, T. 24 N., R. 19E., drilled and abandoned in November 1974. All of the wells were drilled deep enough to test the Eagle Formation.

All together, 10 wells have been drilled in the West Central Leroy area (see Tables 4.2.16-1 and 4.2.16-2). Six of the ten wells have historic production and one well remains active as a producing gas well (the well has pipeline service). The 20-24 well is outside of the study area, but is located within the exploration and development area. Six other wells drilled adjacent to the West Central Leroy area were useful for information identifying the structure.

As of December 2006 this area has produced 1,159,259 MCF of gas from the six wells. Excluding the wells outside the study area, the area produced 727,672 MCF of gas from five wells (see the cumulative production figures in Table 4.2.16-1).

The potential for natural gas to occur in this area is high based on well tests, production histories and log analysis of many of the wells; however, the commercial potential is on a localized basis because of the number of dry holes drilled and the geology of the area. There is minimal chance that a well would be drilled because the majority of the lands in the area have been defined with a well, and the chance of seeing another well drilled is low.

The West Central Leroy area contains approximately 160 acres of state minerals and 400 acres of private minerals. Further drilling could occur on those lands, although no additional wells are foreseen at this time.

**Table 4.2.16-1
West Central Leroy Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well* Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Fuel Resources Development Co	STATE 16-24-19B	25-005-21800-00-00	Y	Dry Hole	P&A - Approved	Leroy	Blaine	24N-19E	16	NE NW SW	2008 S	1315 W	No 3		9/10/1975				
Klabzuba Oil & Gas, Inc.	Federal 28-24-19	25-005-21755-00-00		Gas	P&A - Approved	Leroy	Blaine	24N-19E	28	NW NW	837 N	660 W	No 3	8/1/1975	8/4/1975	9/20/1975	5/25/2001	923	323,276
Brown, J. Burns Operating Company	Bleha et al 29-24 FEE	25-005-21749-00-00		Gas	P&A - Approved	Leroy	Blaine	24N-19E	29	SW NE NE	1091 N	1101 E	No 3	8/6/1975	8/8/1975	9/9/1975	10/9/1990	440	169,670
Klabzuba Oil & Gas, Inc.	Federal 21-24-19	25-005-21693-00-00		Gas	P&A - Approved	Leroy	Blaine	24N-19E	21	SE NW SW	1690 S	1040 W	No 3/5	11/12/1974	11/18/1974	12/8/1974	5/1/2001	127	214,190
Fuel Resources Development Co	STATE 16-24-19	25-005-21759-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-19E	16	NE SW SE	1006 S	1494 E	No 3	7/24/1975	7/26/1975		7/26/1975		
Fuel Resources Development Co	FEDERAL 20-24-19	25-005-21754-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-19E	20	SW NE SE	1933 S	1023 E	No 3/4/5	8/30/1975	9/9/1975		9/9/1975		
Fuel Resources Development Co	FEDERAL B-28-24-19 N	25-005-22020-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-19E	28	SE NW NE	661 N	1418 E	No 3	8/9/1978	8/11/1978		8/11/1978		
Fuel Resources Development Co	FEDERAL 22-24-19	25-005-21962-00-00	Y	Dry Hole	P&A - Approved	Leroy	Blaine	24N-19E	22	SW NE NW	748 N	1887 W	No 3/5	11/22/1977	11/24/1977		8/1/1979		
Fuel Resources Development Co	FEDERAL 29-24-19B	25-005-21821-00-00	Y	Dry Hole	P&A - Approved	Leroy	Blaine	24N-19E	29	SW SE NW	2064 N	1641 W	No 3	11/13/1975	11/16/1975		11/16/1975		
Klabzuba Oil & Gas, Inc.	P 20-24-19 FEE	25-005-22185-00-00		Gas	Producing	Leroy	Blaine	24N-19E	20	NE SE SE	828 S	307 E	No 1/5 >1/2 mile	10/6/1980	10/8/1980	10/15/1980		1856	431,587
Fuel Resources Development Co	FEDERAL 21-24-19 B	25-005-21816-00-00		Gas	P&A - Approved	Leroy	Blaine	24N-19E	21	NW NE NE	36 N	942 E	Yes	12/16/1977	12/19/1977	5/27/1978	8/1/1987	351	20,497
Fuel Resources Development Co	FEDERAL K-28-24-19-N	25-005-22120-00-00		Gas	P&A - Approved	Leroy	Blaine	24N-19E	28	NW NE SW	2039 S	1901 W	Yes	11/21/1979	11/24/1979	12/18/1979	8/1/1985	216	39
Fuel Resources Development Co	FEDERAL 33-24-19	25-005-21963-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-19E	33	SE NW NW	807 N	860 W	Yes	6/13/1978	6/15/1978		6/15/1978		
Fuel Resources Development Co	FEDERAL 22-24-19-B	25-005-21961-00-00	Y	Dry Hole	P&A - Approved	Leroy	Blaine	24N-19E	22	E2 SW SW	660 S	793 W	Yes	6/6/1978	6/8/1978		6/8/1978		
Fuel Resources Development Co	FEDERAL 28-24-19B	25-005-21752-00-00	Y	Dry Hole	P&A - Approved	Leroy	Blaine	24N-19E	28	SW NE SE	1865 S	990 E	Yes	7/19/1975	7/22/1975		7/22/1975		
Fuel Resources Development Co	FEDERAL 32-24-19	25-005-21957-00-00	Y	Dry Hole	P&A - Approved	Leroy	Blaine	24N-19E	32	SW NE NW	686 N	1323 W	Yes	6/9/1978	6/11/1978		6/11/1978		
Cumulative of the highlighted production figures =																			727,672
Cumulative of all production =																			1,159,259

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
- 2 - Well lies within a narrow finger protruding in the Monument.
- 3 - Well lies within 1/2 mile of the Monument.
- 4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
- 5 - Well lies within a federal lease that lies both in and outside the Monument.
- 6 - Well lies within a state land section intermingled with the Monument.

**Table 4.2.16-2
Summary of West Central Leroy
Exploration/Production Area Wells**

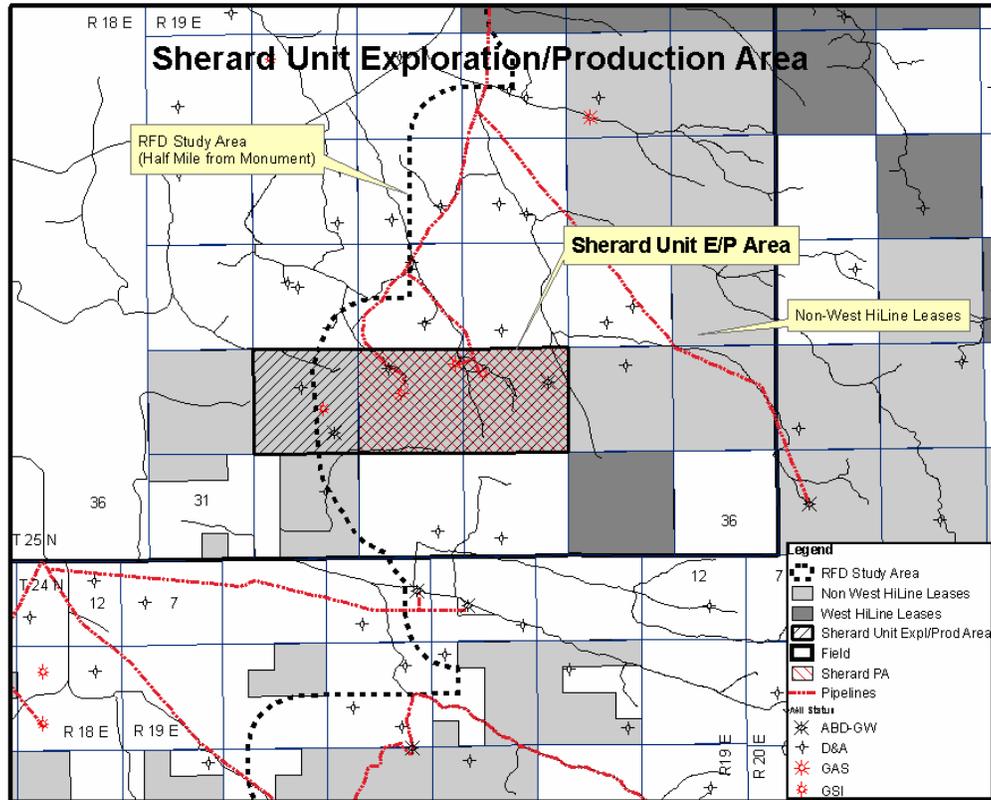
Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
3	6	1	10	6

* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

4.2.17 Sherard Unit Exploration/Production Area

The Sherard Unit area encompasses approximately 1,910 acres with about 1,240 acres (65%) of the area located in the Monument. Currently, two federal leases remain (Monument Leases: MTM1565 and MTM1578). The area is located approximately one mile north of the town of Leroy. It is elongated in an east-west direction and partly contained within the Sherard Unit as Participating Area “E” (Sections 27 and 28). (See Figure 4.2.17-1.)

Figure 4.2.17-1



The first well drilled in this area was the U.S. No. 6-28 well (in the Monument). The well was spud in December 1974 by Wise Oil Company in the SE $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 28, T. 25 N., R. 19 E., Blaine County. The well was drilled to a TD of 1,595 feet and bottomed in the Telegraph Creek Formation. The Eagle Formation tested for gas at an initial rate of 1,200 MCFPD with shut-in pressure of 440 psi. The prospect was based on regional geology, local surface geology and knowledge gained from three wells in the vicinity of the U.S. 6-28 well. The three wells were the Federal 10-23 well in the NW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 23, T. 25 N., R. 19 E., drilled and abandoned in September 1971; the Federal 10-32 well in the SW $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 32, T. 25 N., R. 19 E., drilled and abandoned in September 1971; and the U.S. 76-20 well in the SE $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 20, T. 25 N., R. 19 E., drilled and abandoned in October 1972. All of the wells were drilled deep enough to test the Eagle Formation.

All together, eight wells have been drilled in the Sherard Unit area (see Tables 4.2.17-1 and 4.2.17-2). Five of the eight wells have historic production and four remain active as a producing gas wells or shut-in gas wells (all the wells have pipeline service). Two other wells drilled adjacent to the Sherard Unit area were useful for information identifying the structure. As of December 2006 this area had produced 4,313,697 MCF of gas from the five wells (see the highlighted cumulative production figures in Table 4.2.17-1). All five wells are within the study area.

The potential for natural gas to occur in this area is high based on well tests, production history and log analysis of many of the wells; however, the commercial potential is localized because of the number of dry holes drilled and the geology of the area. The potential for drilling more wells in this area is rated low to moderate, although the operator

has rated the area at high potential for further drilling. With the two federal leases in this area, there is a reasonable chance that six wells could be drilled on federal land (five Monument wells and one non-Monument well) in the next 10 to 15 years. The drilling of these wells would depend on many factors, of which the price of the product and the nature of the business environment would be major contributing factors controlling if and when the wells would be drilled in this area.

The Sherard Unit area contains no state or private minerals.

**Table 4.2.17-1
Sherard Unit Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well* Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Wise, William, F.	US 6-29	25-005-21875-00-00		Dry Hole	P&A - Approved	Sherard Unit	Blaine	25N-19E	29	SE SE NW	2004 N	2406 W	No 5 >½ mile		10/15/1976				
Wise, William, F.	US 15-21	25-005-21876-00-00	Y	Dry Hole	P&A - Approved	Sherard Unit	Blaine	25N-19E	21	NE SW SE	1280 S	1953 E	No 3	10/9/1976	10/11/1976		10/11/1976		
Brown, J. Burns Operating Company	FED 22-25-19	25-005-22386-00-00	Y	Dry Hole	P&A - Approved	Sherard Unit	Blaine	25N-19E	22	NW SE SW	839 S	1968 W	No 3	3/21/1986	3/23/1986		3/23/1986		
Devon Energy Corporation	U.S. 29-10	25-005-22633-00-00		Gas	Shut In	Sherard, Area	Blaine	25N-19E	29	NW SE	2258 S	1750 E	No 3/5	11/2/1993	11/4/1993	11/16/1993		2000	304,613
Devon Energy Corporation	FEDERAL 29-16	25-005-22257-00-00		Gas	P&A - Approved	Sherard, Area	Blaine	25N-19E	29	NW SE SE	1044 S	1149 E	No 3/5	11/16/1981	11/18/1981	11/25/1981	1/24/2002	122	12,002
Devon Energy Corporation	U.S. 6-28	25-005-21718-00-00		Gas	Producing	Sherard, Area	Blaine	25N-19E	28	SE NW	2206 N	2179 W	Yes	12/15/1974	12/19/1974	12/23/1974		1200	3,296,759
Devon Energy Corporation	U.S. 4-27	25-005-21872-00-00		Gas	Shut In	Sherard, Area	Blaine	25N-19E	27	SE NW NW	1295 N	1004 W	Yes	10/5/1976	10/7/1976	10/13/1976		335	626,001
Devon Energy Corporation	US 27-8	25-005-22631-00-00		Gas	P&A - Approved	Sherard, Area	Blaine	25N-19E	27	SE NE	1700 N	990 E	Yes 7	10/30/1993	11/1/1993	11/16/1993	2/28/2002	6	0
Devon Energy Corporation	28-3 U.S.	25-005-22632-00-00		Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	25N-19E	28	NE NW	1031 N	1518 W	Yes	10/27/1983	10/29/1983		10/29/1983		
Devon Energy Corporation	U.S. 28-1	25-005-23044-00-00		Gas	Producing	Wildcat Blaine	Blaine	25N-19E	28	NE NE	739 N	312 E	Yes	8/23/2002	?	9/23/2002		356	74,322
Cumulative of the highlighted production figures =																			4,313,697

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
- 2 - Well lies within a narrow finger protruding in the Monument.
- 3 - Well lies within ½ mile of the Monument.
- 4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
- 5 - Well lies within a federal lease that lies both in and outside the Monument.
- 6 - Well lies within a state land section intermingled with the Monument.

**Table 4.2.17-2
Summary of Sherard Unit
Exploration/Production Area Wells**

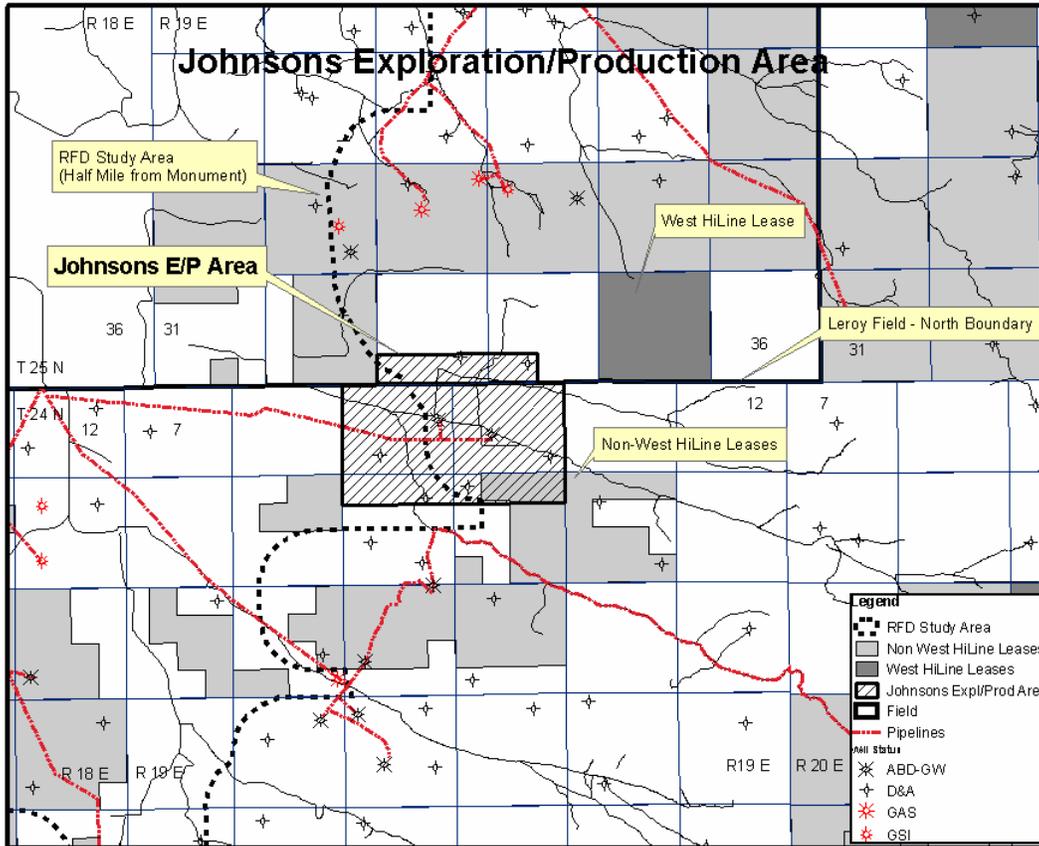
Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
5	2	1	8	2

* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

4.2.18 Johnsons Exploration/Production Area

The Johnsons area encompasses approximately 1,620 acres with about 267 acres (17%) of the area located in the Monument. Currently, one federal lease remains (Monument lease MTM16098). The area is located approximately a half mile east-southeast of the town of Leroy. It is elongated in an east-west direction and partly contained in the Leroy Gas Field. (See Figure 4.2.18-1.)

Figure 4.2.18-1



The first well drilled in this area was the Federal No. 10-24 well (in the Monument). The well was spud in July 1975 by Fuel Resources Development Company in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 10, T. 24 N., R. 19 E., Blaine County. The well was drilled to a TD of 1,794 feet and bottomed in the Eagle Formation. The Eagle Formation tested for gas at an initial rate of 1,259 MCFPD with a casing pressure of 360 psi. The prospect was based on regional geology, local surface geology and knowledge gained from four wells in the vicinity of the U.S. 10-24 well. The four wells were: the Federal 10-32 well in the SW $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 32, T. 25 N., R. 19 E., drilled and abandoned in September 1971; the Federal No. 21-24-19 well drilled and completed in November 1974 in the NW $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 21, T. 24 N., R. 19 E., Blaine County (in the West Central Leroy area); the U.S. No. 6-28 well drilled and completed in the SE $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 28, T. 25 N., R. 19 E., Blaine County (in the Sherard Unit area); and the Federal 12-24-19 well drilled and abandoned in the NW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 12, T. 24 N., R. 19 E., Blaine County. All of the wells were drilled deep enough to test the Eagle Formation.

All together, eight wells have been drilled in the Johnsons area (see Tables 4.2.18-1 and 4.2.18-2). Two of the eight wells had historic production and none of the wells remain currently active. One other well drilled adjacent to the Johnsons area was useful for information identifying the structure. As of December 2006 the area had produced 39,090 MCF of gas from two of the eight wells (see the highlighted cumulative production figures in Table 4.2.18-1).

The potential for natural gas to occur in this area is high based on well tests, production history and log analysis of many of the wells. The potential is low for further exploration and development within this area (see Figure 4.2-2). With one federal lease in this area, there is a reasonable chance that no wells would be drilled on federal land (all in the Monument) in the next 10 to 15 years.

The Johnsons area contains approximately 160 acres of state minerals and 320 acres of private minerals. Further drilling could occur on those lands; however, no additional wells are foreseen at this time.

**Table 4.2.18-1
Johnsons Exploration/Production Area**

Operator	Well Name	API Well No.	ID Well* Y/N	Well Type	Well Status	Field name	County	Location (T-R)	Sec	Spot	Ft NS	Ft EW	Well in the Monument?	Spud Date	Total Depth Date	Completion Date	Plug Date	Initial Production MCFPD	Cumulative Production MCF
Fuel Resources Development Co	JOHNSON 15-24-19 FEE	25-005-21953-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-19E	15	C NW NW	660 N	660 W	No 3	11/16/1977	11/19/1977				
Fuel Resources Development Co	FEDERAL 9-24-19	25-005-21960-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-19E	9	NW SE SW	875 S	1833 W	No >1/2 mile	12/23/1977	12/30/1977				
Texas Oil & Gas Corp	STATE 1-16	25-005-22116-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-19E	16	SW NE NE	1200 N	1300 E	No >1/2 mile	10/18/1979	10/20/1979				
Texas Oil & Gas Corp	JOHNSON 1A FEE	25-005-22078-00-00		Gas	P&A - Approved	Leroy	Blaine	24N-19E	9	N2 NE SE	1700 N	660 E	No 3	6/3/1979	6/6/1979	7/22/1979	7/1/1981	88	148
Fuel Resources Development Co	FEDERAL 10-24-19-B	25-005-21812-00-00		Dry Hole	P&A - Approved	Leroy	Blaine	24N-19E	10	N2 SE SE	721 S	660 E	No 3	11/12/1977	11/12/1977				
Norfolk Energy Inc.	US 33-16	25-005-22296-00-00		Dry Hole	P&A - Approved	Sherard Unit	Blaine	25N-19E	33	NW SE SE	1237 S	1309 E	No 3	10/22/1982	10/24/1982				
Brown, J. Burns Operating Company	JOHNSON 14-24-19-6 FEE	25-005-21889-00-00	Y	Dry Hole	P&A - Approved	Leroy	Blaine	24N-19E	14	NW SE NW	1469 N	1661 W	No 2/3	10/26/1976	10/29/1976				
Fuel Resources Development Co	FEDERAL 10-24-19	25-005-21763-00-00		Gas	P&A - Approved	Leroy	Blaine	24N-19E	10	SW NE SW	1818 S	1894 W	Yes	7/22/1975	7/24/1975	7/29/1975	8/1/1988	1259	38,942
Brown, J. Burns Operating Company	FED 34-25-19	25-005-22642-00-00		Dry Hole	P&A - Approved	Wildcat Blaine	Blaine	25N-19E	34	NW SE SW	860 S	1871 W	Yes	1/22/1995	1/23/1995		1/23/1995		
Cumulative of the highlighted production figures =																		39,090	

- 1 - Well lies within a Communitization Agreement both in and outside the Monument.
- 2 - Well lies within a narrow finger protruding in the Monument.
- 3 - Well lies within 1/2 mile of the Monument.
- 4 - Well lies within a Communitization Agreement that includes a federal lease that also lies within the Monument.
- 5 - Well lies within a federal lease that lies both in and outside the Monument.
- 6 - Well lies within a state land section intermingled with the Monument.

**Table 4.2.18-2
Summary of Johnsons
Exploration/Production Area Wells**

Monument Wells in the Exploration/Production Area	Study Area Wells in the Exploration/Production Area	Wells Outside the Study Area yet in the Exploration/Production Area	Total Wells in the Exploration/ Production Area	Identification Wells* (Not Part of Total Wells)
2	4	2	8	1

* Identification wells are exploratory wells that were drilled outside of exploration/production areas and abandoned as dry holes, yet were valuable in further identifying the subsurface resource. They are included in the tables above for informational purposes only.

4.3 Drilling and Completion Statistics

A summary of drilling in the 18 Exploration/Production areas described above (in Sections 4.2.1 through 4.2.18) is shown in Table 4.3-1. Refer also to the information in Section 3.2, Exploratory/Development Drilling.

**Table 4.3-1
Exploration/Production Area Summary**

Exploration/Production (E/P) Area	Monument Wells in E/P Area	Study Area Wells in E/P Area	Wells Outside Study Area but in E/P Area	Total Wells in E/P Area	Identification Wells Not Part of Total Wells
1 - Whiskey Ridge	3	4	0	7	4
2 - North Leroy	2	10	2	14	4
3 - Central Leroy	8	1	0	9	10
4 - Central Leroy East	1	1	0	2	2
5 - Leroy Bullwacker	3	3	0	6	9
6 - Cow Creek	1	0	0	1	4
7 - Leroy One	4	0	0	4	1
8 - Sherard Northwest Leroy	6	10	11	27	14
9 - Leroy Two	2	0	0	2	0
10 - West Leroy	3	3	33	39	3
11 - Sawtooth	2	6	3	11	0
12 - Sherard Unit Area East	2	0	0	2	1
13 - Southeast Leroy	4	14	6	24	6
14 - Chase Hill South	0	1	6	7	1
15 - Leroy Three	3	0	0	3	1
16 - West Central Leroy	3	6	1	10	6
17 - Sherard Unit	5	2	1	8	2
18 - Johnsons	2	4	2	8	1
Total	54	65	65	184	69

4.4 Production Statistics

Table 4.4-1 provides a compilation of well summaries per area and cumulative production data for all of the wells drilled around the Monument Study Area as summarized below.

**Table 4.4-1
Summary of Well Production and Activity by Exploration/Production Area
(Through December 2006)**

Area	Field/ Reservoir	Wells Produced *	Gas Production Cumulative (BCF) *	Water Production Cumulative (BBLs)	Initial Pressure (psi)	Current Pressure (psi)	Comment **
1 - Whiskey Ridge	Wildcat Eagle	1 completed 0 w/production	0	0	210	210	1 well remains shut-in and waiting on pipeline. No 1 st production.
2 - North Leroy	Leroy Eagle	5 completed 5 w/production	0.502	0	200-560	Unknown	5 wells remain. 2 wells currently producing and 3 shut-in. 1 st production 9/1994.
3 - Central Leroy	Leroy Eagle	3 completed 2 w/production	0.215	0	220-300	Unknown	3 wells remain. 2 wells are shut-in and 1 well is waiting on pipeline. 1 st production 6/1996.
4 - Central Leroy East	Leroy/Wildcat Eagle	2 completed 0 w/production	0	0	160-320	160-320	1 well remains shut-in and waiting on pipeline. No 1 st production.
5 - Leroy-Bullwacker	Leroy Eagle	3 completed 3 w/production	0.127	27,352	240-530	Unknown	2 wells remain and they are all shut-in. 1 st production 12/1999.
6 – Cow Creek	Wildcat Eagle	1 completed 1 w/production	0.001	0	275	275	Tested 1 well with an IP of 500 MCFPD. Plugged for lack of market. 1 st production 10/1968.
7 - Leroy One	Leroy Eagle	1 completed 1 w/production	0.477	0	382	Unknown	No wells remain. Well was plugged. 1 st production 12/1980.
8 – Sherard/Northwest Leroy	Sherard & Leroy Eagle	3 completed 3 w/production	1.446	284	390-550	Unknown	11 wells remain and 8 wells are currently producing and 3 shut-in. 1 st production 1/1974 (non study area well), 1 st production 5/1998 (study area well).
9 - Leroy Two	Leroy Eagle	0 completed 0 w/production	0	0	143	151	Tested 1 well with an IP of 189 MCFPD. Plugged for lack of market. No 1 st production.

10 – West Leroy	Leroy Eagle	2 completed 2 w/production	1.017	131	430	Unknown	15 wells remain and 8 wells are currently producing and 7 shut-in. 1 st production 6/1978.
11 -Sawtooth	Sawtooth Mountain Eagle	3 completed 3 w/production	1.831	21	400-530	Unknown	3 wells remain and 3 wells are currently producing and 1 shut-in. 1 st production 10/1976.
12- Sherard Unit Area East	Sherard & Leroy Eagle	0 completed 0 w/production	0	0	0	0	No productive wells exist in this structure. Area based on geologic potential. No 1 st production.
13 - Southeast Leroy	Leroy Eagle	10 completed 10 w/production	1.920	0	100-600	Unknown	6 wells remain and 5 wells are currently producing and 1 shut-in. 1 st production 11/1983.
14 - Chase Hill South	Wildcat Eagle	0 completed 0 w/production	0	0	240	Unknown	4 wells remain shut-in and waiting on pipeline. No 1 st production.
15 - Leroy Three	Leroy Eagle	1 completed 1 w/production	0.019	0	500	Unknown	1 well remains shut-in and waiting on well service. 1 st production 6/1995.
16 - West Central Leroy	Leroy Eagle	5 completed 5 w/production	0.728	0	340-415	Unknown	1 well remains as an active producing well. 1 st production 6/1978.
17 - Sherard Unit	Sherard Eagle	6 completed 5 w/production	4.314	2,780	110-440	Unknown	4 wells remain and 2 wells are currently producing and 2 shut-in. 1 st production 9/1975.
18 – Johnsons	Leroy/Sherard Eagle	2 completed 2 w/production	0.039	0	300-460	Unknown	No wells remain. Wells were plugged. 1 st production 6/1978.
Total		48 completed 43 w/production	12.6 BCF RFD study area wells. 5.7 BCF Monument wells only.	30,568	N/A	N/A	29 wells currently producing. 29 wells shut-in of which 7 are waiting on pipeline.

* - Wells and production counted on Monument lands and within ½ mile of Monument lands.

** - Includes all wells within the Exploration/Production areas that are currently active.

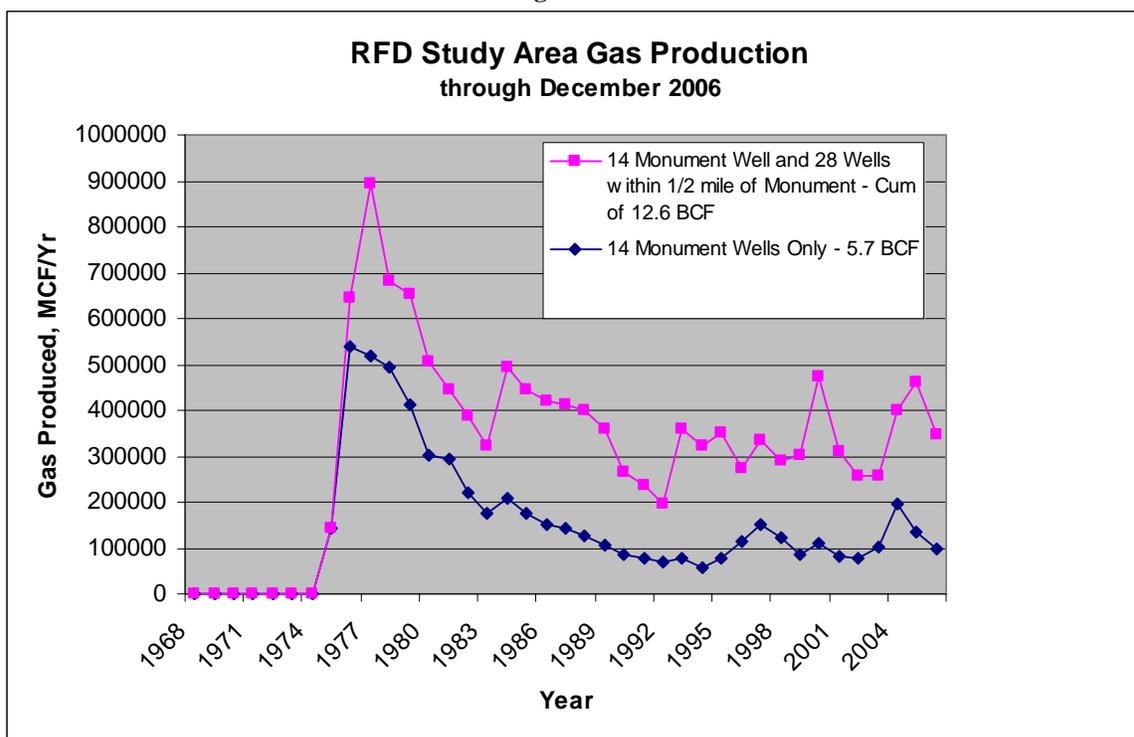
4.5 Horizontal/Deviated Drilling Practices

The practice of using horizontal and/or deviated drilling has not customarily been used on previous wells drilled in the study area. The practice is, however, being used with success on similar Eagle/Judith River wells adjacent to the study area in the Sawtooth Mountain Field. It is believed that many of the future wells drilled in the Monument may use this technology to allow further development of areas not accessible to vertical drilling technology because of unstable soils or steep slopes, and to reduce the effects on Monument resources.

4.6 Oil and Gas Production Fluid Properties

No oil or gas condensate has been produced from the Monument. The gas produced from the Monument is a dry sweet gas that does not yield condensate. No hydrogen sulfide gas (H₂S) is contained in the gas produced from the Monument. As shown in Figure 4.6-1, production of gas from the Monument began in September 1975 and continues to date. As of December 2006, 12.6 BCF had been produced from the 14 Monument wells and 28 wells within ½ mile of the Monument, and 5.7 BCF was produced from Monument wells only.

Figure 4.6-1



4.7 Oil and Gas Pricing

Exploration and development in the study area is highly dependent upon gas pricing. Initial development of the fields in the late 1960s took place at a time when gas prices were low (see Figure 4.7-1). Initial production from the study area occurred in late 1975 and participated in relatively good prices for fourteen years. The excess gas supply in North America, sometimes called the “gas bubble” of the late 1980s and throughout the 1990s, depressed natural gas prices during the later stages of production in the study area with only a few wells being drilled each year through the late 1980s and 1990s. (Also see Figure 3.2-1 for comparison.)

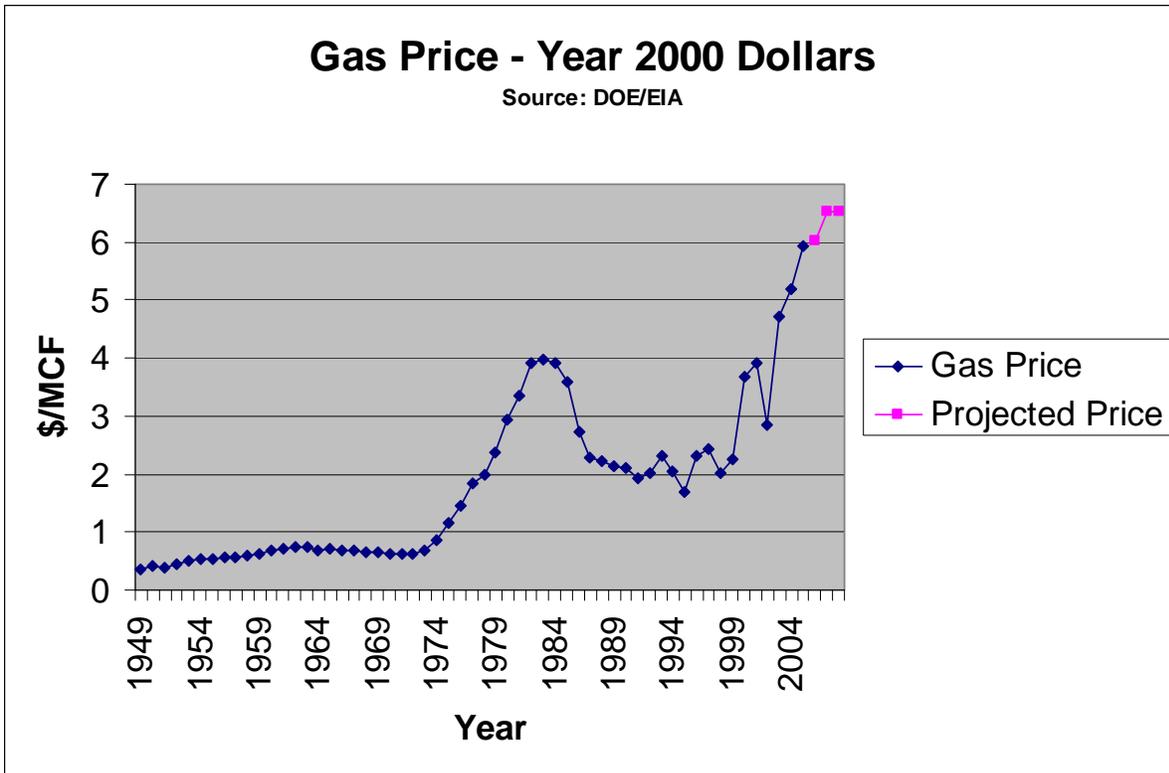
Recent events indicate that the “gas bubble” no longer exists and natural gas prices have exceeded \$3/MCF in the Montana. Current commodity prices provide a very positive economic incentive for oil and gas operators to explore

and develop natural gas prospects in the study area. For the purpose of analyzing the economics for exploring and developing natural gas in the study area, the following prices were used:

Untreated Natural Gas \$2.50/MCF to \$8.50/MCF

Since it is believed that volatility remains for natural gas pricing and natural gas is the primary revenue stream for wells in the study area, a sensitivity analysis was conducted whereby the gas price was varied from \$2.50/MCF up to \$8.50/MCF for untreated natural gas. Per the Department of Energy projections out to 2025, natural gas prices are projected to decline from the 2004 levels down to \$3.64 per MCF in 2010 and then increase to \$4.79 per MCF in 2025.

Figure 4.7-1



Source: Annual Energy Outlook with Projections to 2025, Energy Information Administration, Annual Energy Review 2005. www.eia.doe.gov/oiaf/aeo/gas

4.8 Finding and Development Costs

Given the varying degrees of reservoir sizes in the study area, production profile “type curves” were generated for a reservoirs that varied in size from 26 million cubic feet (MMCF) of natural gas up to reservoirs with greater than 500 MMCF (0.5 BCF). The productivity of each producing well was varied depending on the size of reservoir based on data from the study area. For reservoirs within the study area, three ranges were used to determined economics. The ranges were:

0 - 100 MMCF, and it was determined that production for wells in this range had average exponential decline rate of 47%;

100 – 500 MMCF, and it was determined that production for wells in this range had an average exponential decline rate of 26%; and

500 MMCF and greater and it was determined that production for wells in this range had an average exponential decline rate of 14%.

Holding well costs, monthly operating costs, economic limits, severance taxes, discount rates and royalty rates constant, and varying the price of gas and the size of the reservoir under each of the three ranges, yields economics for wells in the study area as shown in Table 4.8-1 and Figures 4.8-1 through 4.8-3. The assumed constants in this review are the following:

Well Cost	\$120,000
Monthly Operating Cost	\$1,000
Economic Limit – MCFPM	60
Severance Tax - %	9.3
Discount Rate - %	11.25
Royalty Rate - %	12.5
Well Decline rates varied between the ranges	47%, 26%, and 14%

**Table 4.8-1
Well Economics**

Natural Gas Price \$/MCF	0-100 MMCF Break Even Reserves At the Given Gas Price	100-500 MMCF Break Even Reserves At the Given Gas Price	500 MMCF and Greater Break Even Reserves At the Given Gas Price
	Decline of 47%	Decline of 26%	Decline of 14%
\$2.50	106,800 MCF	146,200 MCF	191,100 MCF
\$4.50	55,600 MCF	78,200 MCF	101,600 MCF
\$6.50	34,500 MCF	63,000 MCF	67,800 MCF
\$8.50	25,800 MCF	39,000 MCF	46,100 MCF
	Figure 4.8-1	Figure 4.8-2	Figure 4.8-3

Figure 4.8-1

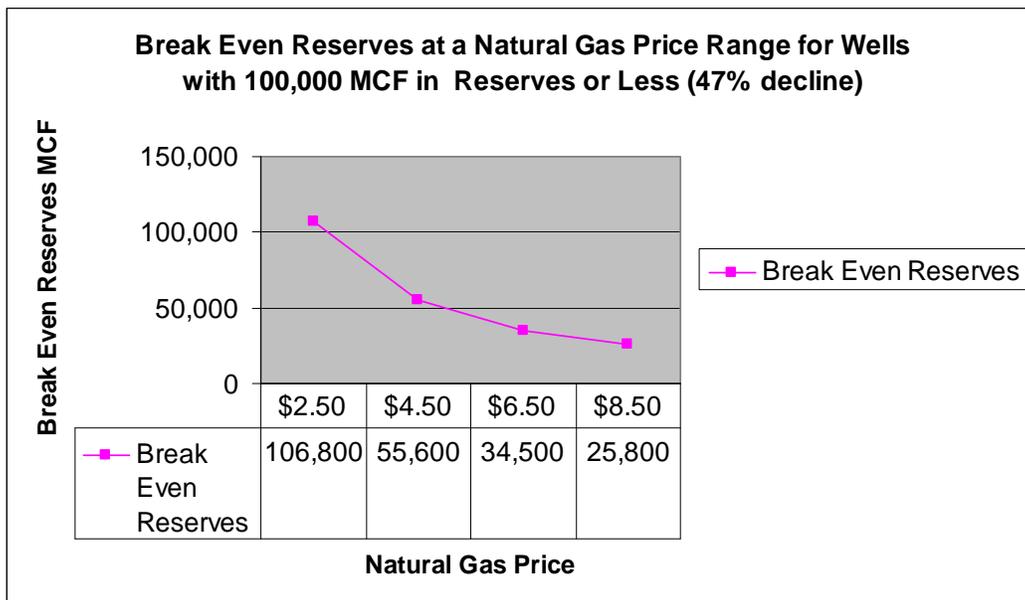


Figure 4.8-2

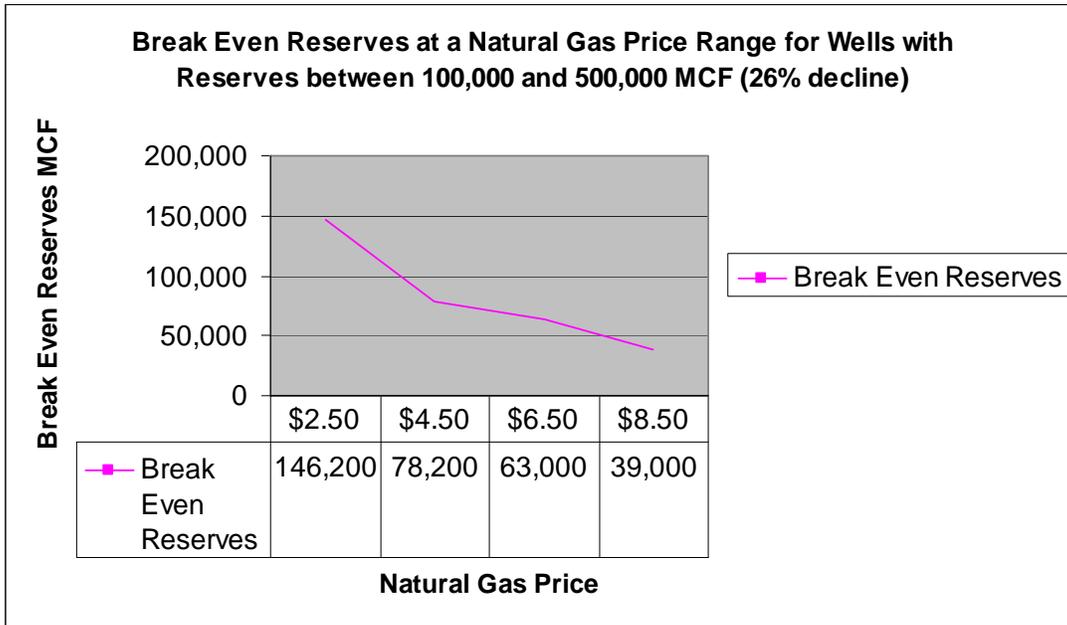
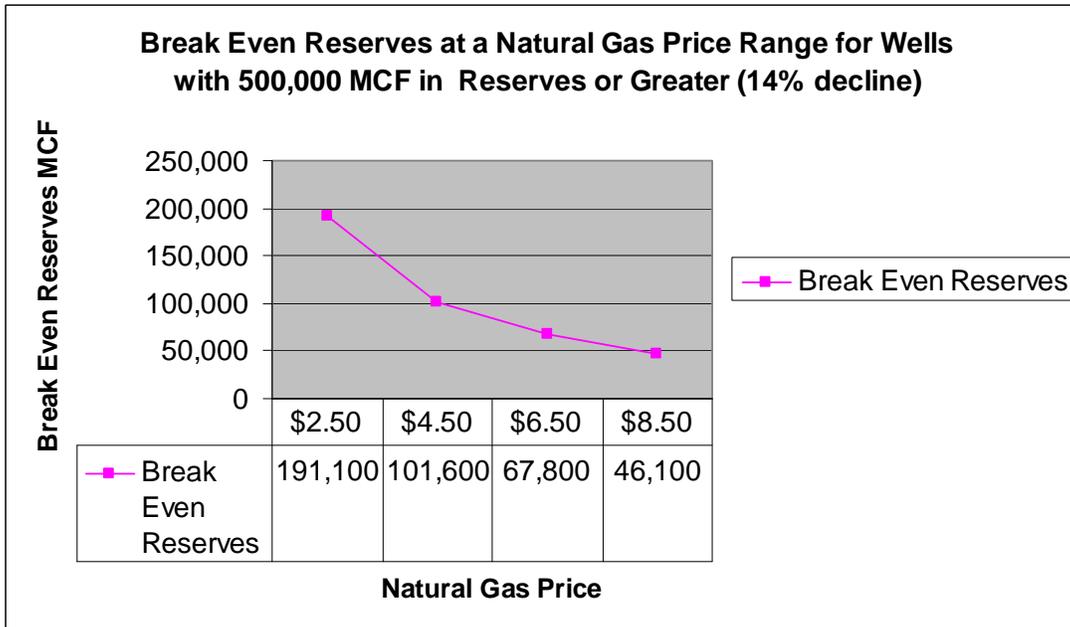


Figure 4.8-3



Based on the information presented in Figures 4.8-1 through 4.8-3, it is evident that the diagrams are for the purpose of evaluating wells with small reservoir potential (i.e., 100 MMCF or less). Using the information in Figure 4.8-1, a well with 34.5 MMCF would be considered a break even well, if the price of gas remained at \$6.50/MCF. If the price fell below the \$6.50/MCF a well with 34.5 MMCF would become subeconomic. For wells with reserves of 100 MMCF and greater the necessary price of natural gas to break even is significantly below current gas prices (\$2.60/MCF, \$4.00/MCF and \$4.60/MCF) for each respective case.

4.9 Reasonable and Foreseeable Oil and Gas Operations

4.9.1 Geophysical Exploration Methods

Oil and gas can be discovered by either direct or indirect exploration methods, such as geologic surface mapping, seeps, well data, and remote sensing data. In many cases, indirect methods, such as seismic, gravity, and magnetic surveys, are required to delineate subsurface features that may contain oil and gas. Geophysical exploration provides information that increases the chances of drilling a discovery well, as well as information that may discourage drilling and the associated surface disturbance. A more sophisticated geophysical technique, such as a three-dimensional (3-D) seismic survey, is an intensive data acquisition and computer synthesis system used to analyze and three-dimensionally depict subsurface geologic structures/stratigraphy. This technique is capable of locating and displaying unknown subsurface pools or pockets that potentially could contain producible hydrocarbons. Data obtained through 3-D geophysical data acquisition should enable wells to be drilled with a much greater probability of locating producible hydrocarbons than is attainable via previous methods, such as two-dimensional (2-D) seismic data and wildcat wells. This should result in fewer “dry holes” in the future, minimizing the need for drilling and associated environmental disturbance.

Gravity Surveys

Gravitational prospecting detects micro-variations in gravitational attraction caused by the differences in the density of various types of rock. Gravity data are used to generate anomaly maps from which faults and general structural trends can be interpreted. These surveys generally are not considered definitive because of the many corrections required (e.g., terrain, elevation, latitude, etc.) and the poor resolution of complex subsurface structures. The instrument used for gravity surveys is a small portable device called a gravimeter. Generally, measurements are taken at many points along a linear transect. The gravimeter is transported either by backpack, helicopter, or off-road vehicle. The only surface disturbance associated with gravity prospecting is that which is caused by a vehicle, if used.

Magnetic Surveys

Magnetic prospecting most commonly is used for locating metallic ore bodies. It is used to a limited extent in oil and gas exploration. Magnetic surveys use an instrument called a magnetometer to detect small magnetic anomalies caused by mineral and lithologic variations in the Earth’s crust. These surveys can detect trends in basement rock and the approximate depth to basement rocks but, in general, they provide little specific data to aid in petroleum exploration. Many corrections are required to obtain reliable information. The generated maps lack high resolution and provide rudimentary views of subsurface geology. Magnetometers vary greatly in size and complexity and, in general, most magnetic surveys are conducted from the air by suspending a magnetometer under an airplane. Magnetic surveys conducted on the ground are nearly identical to gravity surveys; surface disturbance is minimal to nonexistent.

Seismic Reflection Surveys

Seismic prospecting is the best and most popular indirect method used for locating subsurface structures and stratigraphy that may contain hydrocarbons. Seismic energy (shock waves) is induced into the earth using one of several methods, typically shot holes or vibrators. As these waves travel downward and outward, they encounter various rock strata, each having a different seismic velocity characteristic. As the wave energy encounters the interface between rock layers where the lower layer is of lower seismic velocity, some of the seismic energy is reflected upward. Sensing devices, commonly called geophones, are placed on the surface to detect these reflections. The geophones are connected to a recording truck that stores the data. The time required for the shock waves to travel from the shot point down to a given reflector and back to the geophone is related to depth. This value is mapped to give an underground picture of the geologic structure.

Many methods exist today that an explorationist can use to induce the initial seismic energy into the earth. All methods require preliminary surveying and laying of geophones. The thumper and vibrator methods pound or vibrate the earth to create a shock wave. Usually, large trucks are used, each equipped with vibrator pads (about 4-feet square). The pads are lowered to the ground, and vibrators on all trucks are triggered electronically from the recording truck. Information is recorded, and then the trucks move forward a short distance and the process is repeated. Less than 50

square feet of surface area is required to operate the equipment at each test site. The trucks are equipped with large flotation-type tires, designed to further spread the weight of the truck on the surface, which reduces the impact of driving over undisturbed terrain.

The drilling method uses truck-mounted and buggy-mounted drills that drill small-diameter holes to depths of 5 to 20 feet. Four to 12 holes are drilled per mile of line. Usually, a 30-pound charge of explosives is placed in the hole, covered, and then detonated. The detonated explosive sends a shock wave below the earth's surface that subsequently is reflected back to the surface from various subsurface rock layers. In rugged topography, a buggy-mounted drill is used or a portable drill is carried in by helicopter or by foot. Charges are placed in the hole as is done in a truck-mounted operation. In remote areas where there is little known subsurface data, a series of short seismic lines may be required to determine the subsurface geology. Subsequently, more extensive seismic lines are arranged to obtain the greatest amount of geologic information. Seismic information can be obtained in 2-D or 3-D configurations. To obtain 3-D seismic information, the seismic sensors and energy source are located along lines in a grid pattern. This type of survey differs from the more common 2-D surveys because of the large volume of data and the intensive computerization of the data. The results are expensive to obtain but give a more detailed and informative subsurface picture. The orientation and arrangement of the components in 3-D seismic surveys are less tolerant of adjustments to the physical locations of the lines and geophones, but they are also more compact in the area they cover. Although alignment can be fairly critical, spacing of the lines often can be changed to increase the information collected. The depth of the desired geologic information will dictate the spacing of the grid lines, with smaller spacing detailing shallower formations. The 3-D surveys are very expensive and usually conducted after 2-D surveys or drilling has delineated a geologic prospect that will justify the extra cost. Extensive computer processing of the raw data is required to produce a useable seismic section from which geophysicists can interpret structural relationships to depths of 30,000 feet or more. The effective depth of investigation and resolution are determined to some degree according to the method used.

A typical drilling seismic operation can use 10 to 15 men operating five to seven trucks. Under normal conditions, three to five miles of line can be surveyed each day using the explosive method. The vehicles used for a drilling program include several heavy truck-mounted drill rigs, water trucks, a computer recording truck, and several lightweight pickup trucks for the surveyors, shot-hole crew, geophone crew permit person, and party chief. Helicopters are used to lay out and pick up recording equipment.

Public roads, existing private roads, and vehicle routes can be used. Off-road travel may be necessary to carry out tasks. Motor graders and/or dozers may be required to provide access to remote areas. Concern about unnecessary surface disturbance has prompted government and industry personnel to plan surveys more carefully. As a result, earth-moving equipment is now rarely used in seismic exploration work. Several trips a day are made along a seismograph line. The repeated movement back and forth along the line (particularly by the lightweight pickup trucks) usually establishes a well-defined two-track vehicle route. Spreading vehicles out so that vehicle routes are not straight and vehicles do not retrace the same route has, in some cases, prevented the establishment of new vehicle routes, thus reducing impacts. Drilling water, when needed, usually is obtained from private landowners.

Each of the foregoing exploration methods has inherent strengths and weaknesses, and explorationists must decide which method will produce the most useful information, while being practical in regard to surface constraints (such as topography). Economics and past information also play a role in determining which method should be used. Reconnaissance-type gravity and geomagnetic surveys can be conducted in areas where little information is available with the attendant lower costs and fewer impacts. More expensive and higher impact seismic surveys are conducted when more detailed information is required.

4.9.2 Geophysical Management (Permitting Process)

Geophysical exploration on BLM public lands is covered under the regulations at 43 CFR 3150 – Onshore Oil and Gas Geophysical Exploration. Geophysical operations can be done prior to the issuance of a lease. More specifically, regarding potential geophysical work to be done in the Monument, it would likely be done in or near (within ½ mile of) an existing lease whether that lease be private, state or federal and follow the conditions of approval as stated in the Monument RMP/EIS. Because the Monument Proclamation withdrew future leasing from lands in the Monument, this removed a major part of the reason for conducting future pre-oil and gas lease geophysical work on the unleased federal lands in the Monument. Off-lease seismic operations or seismic operations on BLM land with unleased federal

minerals may be permitted for the purpose of defining the limits of the federal lessee's interests or for the purpose of exploring state and private oil and gas minerals. Seismic operations planned off of existing roads must demonstrate that proposed transportation and exploration methods will minimize the potential for creating new roads or trails.

Twelve of the leases in the Monument were leased under the West HiLine RMP and are being reviewed under Alternative E where no surface-disturbing or disruptive activities would be allowed and Alternative E (No Lease) where the leases would not have been allowed. Under Alternative E, it is likely that no on-lease geophysical operations would take place because under this alternative, no wells are allowed to be drilled. Since the alternative removes the incentive to conduct seismic in the first place, the seismic would likely not occur. Also under this alternative, seismic operations could be permitted on federal lands for the purpose of exploring state and private oil and gas minerals; however, it is also believed under this alternative that oil and gas companies would forego this opportunity too because by removing the majority of the potential resource from the table, they would be less likely to conduct geophysical surveys for a smaller piece of the pie. Under Alternative E (No Lease), there would be very little difference from Alternative E, since again all of the incentives are removed to do geophysical work. Alternative E (No Lease) applies only to the 12 West HiLine leases.

The responsibilities of the geophysical operator and the BLM are as follows:

Geophysical Operator – An operator is required to file with the appropriate BLM office a “Notice of Intent to Conduct Oil and Gas Geophysical Exploration Operations” (Notice of Intent). The Notice of Intent shall include a map showing the location of the line(s), all access routes, and ancillary facilities. The party filing the Notice of Intent shall be bonded. A copy of the bond or other evidence of satisfactory bonding must accompany the Notice of Intent. For geophysical operation methods involving surface disturbance, a cultural resources survey also is required. A pre-work field conference may be conducted. Earth-moving equipment shall not be used without prior approval. Upon completion of operations, including required reclamation, the operator is required to file a “Notice of Completion of Oil and Gas Geophysical Exploration Operations”. If an operator/lessee planned on completing seismic activity as part of a lease activity, a Sundry Notice would be required to be filed along with a Notice of Intent and appropriate National Environmental Policy Act (NEPA) documentation would be need to completed prior to approval.

BLM – The BLM must contact the operator after the Notice of Intent is filed and apprise the operator of the practices and procedures to be followed prior to commencing operations on BLM-administered lands. After the operations are completed, as specified by the Notice of Completion, the BLM shall complete a final inspection and notify the operator if the terms and conditions of the Notice of Intent have been met or that additional action is required. Consent to release the bond or termination of liability shall not be granted until the terms and conditions have been met.

4.9.3 State Standards

In Montana, the operator is required to register with the Montana Department of Natural Resources and Conservation (MT-DNRC). MT-DNRC standards for plugging shot holes, personnel safety, and so on, would be followed as specified in the State Permit.

4.9.4 Mitigation

Seasonal restrictions are imposed to reduce conflicts with wildlife, watershed damage, and hunting activity.

The most critical management practice is compliance monitoring during and after seismic activity. Compliance inspections during the operation ensure that stipulations are being followed. Compliance inspections upon completion of work ensure that the seismic lines are free of trash and the drill holes are plugged properly.

4.9.5 Drilling Permit Process

The federal lessee or operating company selects a drill site based on spacing requirements, subsurface and surface geology, geophysics, topography, and economic considerations. Statewide spacing regulations are established by the Montana State Board of Oil and Gas Conservation and are generally as follows:

Gas Wells: One well per 640 acres unless covered by one of the existing gas fields or Board orders. Exceptions to spacing requirements involving federal lands may be granted after a BLM review.

Notice of Staking (NOS)

Once the company makes the decision to drill, they must decide whether to submit a Notice of Staking (NOS) or apply directly for a permit to drill. The NOS is an outline of what the company intends to do, including a location map and sketched site plan. The NOS is used to review any conflicts with Monument resources. The BLM utilizes information contained in the NOS and obtained from the onsite inspection to develop stipulations to be incorporated into the APD. Under the Federal Onshore Oil and Gas Leasing Reform Act of 1987 (Reform Act of 1987), upon receipt of an NOS the operator/company name, well name/number, well location and a map showing the drill site must be posted in a public place for a minimum of 30 days prior to approving the APD.

Application for Permit to Drill (APD)

The operator may or may not choose to submit an NOS; in either case, an APD must be submitted. An APD consists of two main parts: the 13-point surface plan that describes any surface disturbances and is reviewed by resource specialists, and the eight-point plan that details the drilling program and is reviewed by the petroleum engineer and geologist. For the APD option the onsite inspection is used to assess possible impacts and develop conditions of approval to minimize these impacts. During the onsite inspection and selection of the potential drill site, it is feasible to see four to six vehicles present. The people at the onsite function will typically include representatives of the company and the BLM, along with the private land owner (if applicable), dirt contractor, drilling contractor representative, and contract archaeologist. If the NOS option is not utilized the 30-day posting period, as required by the Reform Act of 1987, will commence upon receipt of the APD by the BLM. Regardless of whether the NOS option or APD option is followed, an onsite inspection is conducted for every federal well proposed.

For oil and gas activity involving surface-disturbing operations, an archaeological clearance is required. However, there may be exceptions to this policy on a case-by-case basis. Additionally, the BLM must prepare any site-specific environmental documentation required by NEPA and develop mitigation measures necessary to protect Monument resources. The BLM approves all wells drilled on federal minerals regardless of surface ownership, which would include private lands intermingled with the Monument that have federal mineral ownership. For privately owned surfaces it is the responsibility of the operator to obtain a surface owner agreement.

Drilling Phase

Once the APD is approved, the operator may begin construction activities. When a site is chosen that necessitates the construction of an access road, it is usually planned over the shortest feasible route and would attempt to avoid steep slopes. Best Management Practices (BMPs) will be followed. In some cases BMPs or a landowner's wishes may dictate a longer route.

During this first phase the operator moves construction equipment over existing roads to the point where the access road begins. Depending upon the type of terrain, equipment may include dozers (track-mounted and rubber-tired), scrapers and graders. Existing roads and trails often require improvement in places and occasionally culverts and cattle guards are installed. Because of the topography and the shallow depth of wells (1,500 to 2,200 feet) they can be drilled using a truck-mounted rig, which oftentimes means very little or no access road work is necessary and this phase of construction requires very little time.

The second phase is the construction of the drilling pad or platform. Much of the study area has steep slopes and some dirt work will be necessary to prepare a safe drill pad (usually it takes less than a day to construct the road and the well pad). In some cases no disturbance is required other than a mud (reserve) pit and cellar. If surface disturbance is necessary, soil material suitable for plant growth is removed and stockpiled in a designated area, to be used later for reclamation. Drilling sites on ridge tops and hillsides are constructed by cutting and filling portions of the location after the topsoil has been removed. The excess cut material is stockpiled in an area that would allow recovery for reclamation.

The amount of level surface required for safely assembling and operating a drilling rig varies with the type of rig, but is usually 200 feet by 250 feet for typical wells of 1,500 to 2,200 foot depths. Deeper wells may require larger pads because of the rig size and associated equipment. When construction of a drilling location requires cut and fill, the foundation of the drilling derrick is usually placed on a cut surface ensuring that it rests on solid ground, thereby preventing it from leaning or toppling due to settling of uncompacted soil.

In addition to the drill pad, a reserve pit may be constructed to contain drilling fluids and drill hole cuttings. It is usually square or oblong, but is sometimes constructed in other shapes to accommodate topography. Generally, the reserve pit is 6 to 12 feet deep by 15 to 20 feet wide by 40 to 50 feet in length. For air drilling, smaller reserve pits are used, usually less than 10 feet by 10 feet and approximately 6 to 10 feet in depth. In some instances steel tanks are utilized which eliminate the need for a pit.

Depending on how the drill site is located relative to a natural drainage, it may be necessary to construct water bars or diversions to control surface runoff and erosion. The area disturbed for construction and the potential for successful revegetation depends largely on topography, soil type, climate and the degree of disturbance.

Typical equipment used for drilling well in the Monument includes the following:

Drill Pad Construction:

- Cat-type dozer and backhoe. Two semi-loaded trailers used to transport these pieces of equipment.
- Two 3/4-ton pickup trucks can also be used as support vehicles.

Drilling Operations Equipment:

- Drill rig (including a 55-86 foot freestanding mast) either truck-mounted or trailer-mounted and elevated anywhere from five to nine feet above ground level, powered by a diesel engine with a power rating from 280 to 420 horsepower.
- Mud pump, powered by a diesel engine with a power rating from 350 to 600 horsepower.
- Diesel electric generator for lights and other electrical equipment with a power rating from 150 to 400 horsepower.
- Other support equipment such as a mud and chemical trailer, dog house, drill pipe racks, water tanks, mud tanks, fuel tanks, two to three camp trailers, and a portable latrine.

Eight to ten semi-loads are required to move in and rig up an operation with up to six additional 3/4-ton pickup trucks for support.

During casing and cementing operations a semi-type cement bulk truck, cement pump truck and 3/4-ton truck could come on to location twice during the operation: once for running and cementing the surface casing, and another time for running and cementing the production casing operations if a successful well is drilled.

Some drilling operations may require that the well safety equipment (blowout preventer equipment, or BOPE) be tested by a third party rather than the equipment at the drill rig. This would require the need for a one-ton type truck at the location for a minimum of four hours.

A 4-ton truck is required to perform a petrophysical survey (formation evaluation) of the well bore. This is normally conducted after the well reaches total depth.

Once the well is cased with pipe and cemented back to the surface, the drill rig and support equipment rig down and move on to the next location, usually within a half day after the decision to move. If the well is determined to not be a commercial well, it will be plugged while the drill rig is on location (see Plugging and Abandonment of Wells).

Drilling Operations

Water for drilling is hauled or piped to the rig storage tanks or reserve pit from rivers, wells, reservoirs or private sources. The volumes of water required for drilling wells in the Monument is 200 to 300 barrels (BBLs). Occasionally, water supply wells are drilled on or close to the drill site. Bentonite, a type of clay, is mixed with the water to form the main constituent of the drilling mud. A wide variety of other materials and chemicals may be added to enhance the mud properties. Drilling mud performs several important functions; it cools the bit, reduces the drag of the drill pipe on the sides of the bore hole and seals off any porous zones, aids in preventing an uncontrolled release of formation fluids, and carries the cuttings to the surface.

High pressure air is sometimes used in place of mud. The use of mud or air is largely dependent upon the target formation, drilling depth and type of completion desired. The drilling mud or air is circulated through the drill pipe to the bottom of the hole, through the bit and up the well bore. At the surface the mud and rock cuttings are returned to the reserve pit where gravity separates the two or they are mechanically separated through a screen. The mud is recycled and returned to the system for further use. When drilling with air, the cuttings are blown into another pit called the blooie pit, where compressed air and cuttings leave the drill system. By regulation, this pit or discharge point is to be located no closer than 100 feet to the well bore. Drilling muds are not allowed to contain any hazardous or toxic substances.

The actual commencement of the drilling is referred to as spudding in. Initially, the drilling usually proceeds rapidly due to the unconsolidated nature of shallow formations.

Drilling is accomplished by rotating special bits bearing a controlled portion of the drill string weight. The rig structure and associated hoisting equipment bear the remainder of the drill string's weight. The weight on the bit is controlled to maintain as vertical a hole as possible or deviate from vertical when desired, and to prevent rapid wearing of the drill bit.

The combination of rotary motion, hydraulic jet action of mud through the bit and weight on the bit causes rock to be chipped away at the bottom of the hole. As mentioned earlier, these chips are then transported to the surface via the mud or compressed air where they are disposed of in the reserve pit or blooie pit.

The rotary motion is created either by a square or hexagonal rod, called a kelly, which fits through a square or hexagonal hole in a large turntable, called a rotary table or a top drive hydraulic unit that turns the drill pipe. The rotary table sits on the drilling rig floor and as the hole is deepened the kelly descends. When the kelly has gone as deep as it can, it is raised and a piece of drill pipe about 30 feet in length is attached to the drill pipe in the hole. The drill pipe is then lowered, the kelly is raised and attached to the top of it, and drilling recommences. By adding more and more drill pipe the hole is steadily deepened.

Eventually, the bit becomes worn and must be replaced. To change bits, the entire string of drill pipe must be pulled from the hole. Once the bit is replaced the drill string is reassembled, lowered into the hole and drilling is started again.

Drilling operations are continuous, 24 hours a day, seven days a week. The crews usually work three 8-hour shifts or two 12-hour shifts a day. Typical wells in the area require three to four days to reach total depth. At periodic intervals BLM personnel, usually petroleum engineering technicians, will conduct inspections of the drilling rig and operations to ensure compliance with the approved plans in the APD and regulations.

Completion Operations

Upon completion of drilling, the well is tested to determine its capability to produce oil and gas. If oil or gas is found in commercial quantities the well is completed as a producer. Completion operations can begin as early as one week after the drill rig moves off location, but they normally occur within two to three weeks.

The typical equipment used for completing a well in the Monument includes the following:

- Wire line truck and mast trailer (~30 tons combined) used to determine the depth of the zone of interest and perforate the well (to expose the formation with natural gas in it to the well bore)
- 3/4-ton support truck
- Workover unit (semi-mounted mast) used to hoist tubing in and out of the well
- Stand-alone air compressor unit
- Supply trailer
- Tubing trailer
- Two 3/4-ton trucks

Or, in place of the workover unit, a semi-mounted coiled tubing unit which includes the following:

- Air compressor
- Coil tubing
- Reel and injector head
- Catch tank trailer to catch any formation water or make up water that is blown off the well
- Two 3/4-ton support trucks

It normally takes about a day to perforate the well and run tubing. Depending on the well, the operator will flow test the well up to three days and then perform a pressure build up test that will last up to five days. This information is invaluable in determining the extent of the reservoir.

Depending on the geological issues, some of the wells in the Monument (mainly in the northern part – Sawtooth Mountain Gas Field) may need to be stimulated with an artificially induced fracture (well frac). In those cases the following pieces of equipment would be required to perform this work:

- Blender truck (a semi-type truck)
- Chemical van (lab and chemicals) (semi type truck)
- Data van (computer monitoring equipment) (similar sized truck to a wire line truck)
- Liquid pump truck (semi type truck)
- One to two nitrogen pump trucks (semi type trucks)
- Iron truck (semi-type truck carrying surface pipe supplies)
- Sand storage unit (semi-type truck)
- One 400 BBL water holding tank on location (transported via semi-type truck)
- One 250 BBL flowback tank (semi-type truck)
- Up to four 3/4-ton trucks for support

The frac operation typically takes less than a half day and on average the frac operation/post operation (flowback and well clean-up) lasts up to four days. The well is then put on line if the pipeline has been constructed.

Production Operations

Installation of production facilities generally requires little additional surface disturbance beyond that necessary for drilling and completion; however, additional disturbance could result from pipeline and gathering line installations if they are installed across undisturbed areas. If pipelines follow existing access roads, no appreciable additional surface disturbance is necessary to hook the well up to production. The typical equipment used for installing production equipment to a well includes the following:

- Pipe trailer transported via semi-type truck or poly pipe that is spooled off a coiled tubing reel trailer pulled by a 3/4-ton truck
- Excavator or a trenching piece of equipment brought into the site via a semi-type tractor trailer or a large goose neck trailer pulled by a 3/4-ton truck

Equipment that would stay with the well during its life include the following:

- Well head, a gas meter house which is usually a 10-by-10-by-8 feet skid-mounted steel shed

- Pumpjacks which are sometimes used if water is produced with the gas, and the gas reservoir pressure declines to a level that is not adequate to overcome the hydrostatic pressure created by a column of water in the well. Pumpjacks are usually 8 to 10 feet in height, require a slightly larger surface area than a gas shack, and may or may not be skid-mounted. They are powered by either electric motors or natural gas/propane internal combustion engines.

The gas meter house and/or pumpjack are usually situated over the well head on the same area where the drill rig was set up. The installation of the pipeline and the meter house can last up to two days.

If liquid hydrocarbons (condensates) are produced with the gas, a separator and storage facility are necessary. Gas wells which produce water require a disposal pit for evaporation or to catch the water and later be hauled away by truck. A barrel of glycol is necessary to treat the water in the gas stream which prevents freeze-ups and removes water. The pit generally fits within the boundaries of the drilling pad and the final disturbed area necessary for production operations. After the production facilities are fully installed, the remaining drilling disturbances are reclaimed back to an area 100-by-100 feet. Liquid hydrocarbon storage at each well site is typically not required for the wells in the study area because the gas in this region normally does not yield liquid hydrocarbon.

Typically, the wells in the Monument are “sweet gas” wells, that is, they contain no hydrogen sulfide gas (H₂S); therefore, no H₂S facilities would be necessary for producing gas in the Monument. As the wells produce in an area, pressures eventually become depleted and they require an artificial method to lower the pressure of the gathering system to allow production to continue. Once this occurs, the operator will design and install a compressor station that further enables the production of natural gas from the wells. Currently, no compressor stations reside in the Monument and the closest compressor station to the Monument is located approximately four miles to the northwest. One compressor has been proposed and approved to be located within a half mile of the Monument on a private well (the compressor has not been installed as of this document).

During the production phase, BLM monitors and approves field activities needed for well and field operations. Many operations, such as plugging, completion in a different zone, deepening, etc., require prior approval. Others, such as acidizing and fracturing, do not require prior approval but a subsequent report of operations describing the operation in detail must be filed.

4.9.6 Plugging and Abandonment of Wells

The purpose of plugging and abandoning a well is to prevent fluid migration between zones, protect minerals from damage, and restore the surface area. Each well must be handled individually due to a combination of factors, including geology, subsurface well design, and specific rehabilitation concerns. Therefore, only minimum requirements can be established, and these must be modified for individual wells.

The first step in the plugging process is filing a Notice of Intent to Abandon with the BLM. The notice must be filed and approved prior to plugging a past producing well. Verbal plugging instructions can be given for plugging current drilling operations, but a notice must be filed after the work is completed. If usable fresh water was encountered while the well was being drilled, the BLM may, if interested, assume future responsibility for the well and the operator will be reimbursed for the attendant costs. This assumption of responsibility becomes effective after the deeper zones are plugged back to the usable water zone. Usually, the operator is more than satisfied to remove the surface reclamation liability and will not charge for the remaining well equipment.

The operator’s plan for securing the hole is reviewed. The minimum requirements as stated in Onshore Order No. 2, are as follows: In open hole situations, cement plugs must extend at least 50 feet above and below zones that have fluid with the potential to migrate, zones of lost circulation (this type of zone may require an alternate method to isolate it), and zones of potentially valuable minerals. Thick zones may be isolated using cement plugs across the top and bottom of the zone. In the absence of productive zones and minerals, long sections of open hole may be plugged with cement plugs placed every 3,000 feet. In cased holes, cement plugs must be placed opposite perforations and extending 50 feet above and below except where limited by plug back depth. The length of the plug is 100 feet plus 10 percent per 1,000 feet (i.e., at 10,000 feet the plug will be 200 feet long). Typical wells in the Monument range between 1,500 and 2,200 feet in depth.

Cement plugs could be replaced with a cement retainer, if the retainer is set 50 feet above the open perforations and the perforations are squeezed with cement. A bridge plug may also be used to isolate a producing zone and must be capped, if placed through tubing, with a minimum of 50 feet of cement. If the cap is placed using a dump bailer, a minimum of 35 feet of cement is required. A dump bailer is an apparatus run on wire line to convey the cement to the bottom of the hole. In the event that the casing has been cut and recovered, a plug is placed 50 feet within the casing stub, and the 100 feet plus 10 percent per 1,000 feet rule is used for the space above the cutoff point. In all cases, a plug is set at the bottom of the surface casing that has a volume of cement using the 100 feet plus 10 percent per 1,000 feet rule. This may require perforating the casing and circulating or squeezing cement behind the production casing if that casing is not removed. Annular space at the surface will be plugged with 50 feet of cement using small-diameter tubing or by perforating and circulating cement.

If the integrity of a plug is questionable or the position is extremely vital, it can be tested with pressure or by tagging the plug with the tubing or drill string. Tagging the plug involves running pipe into the hole until the plug is encountered and placing a specified amount of weight on the plug to verify its placement and competency. The surface plug within the casing must be a minimum of 50 feet. The interval between plugs must be filled with mud that will balance the subsurface pressures. If this balance point is unknown, a minimum of nine pounds per gallon is specified. After the casing has been cut off below the ground level, any void at the top of the casing must be filled with cement. A metal plate is welded over the top of the casing with a weep hole in the plate and the well identity and location permanently inscribed.

Typical equipment associated with plugging operations include a well workover/pulling unit, cement bulk truck, cement pump truck, water hauling truck (all semi-type trucks) and two to three, 1/2 to 3/4-ton pickup trucks. Depending on the depth of the well, the plugging operation can last up to three days. Typical plugging operations in the Monument last for one to two days.

Disturbance from plugging operations is usually contained within the existing disturbed area used to drill or produce the well, whichever the case may be. If the well to be plugged is a depleted producer, it is customary that the operator will dig a small catch pit (10 feet long by 10 feet wide by 8 feet deep) to contain any fluids pumped in and out of the well. Typical fluids that may come out of the well and put into the catch pit are formation water, drilling mud and cement. These fluid materials are removed from the pit within 48 hours of the well being plugged. Within a week of plugging the well, initial reclamation (dirt work) begins depending on the time of year the well is plugged.

The BLM is responsible for establishing and approving methods for surface reclamation and determining when this reclamation has been satisfactorily accomplished. When that determination is made a Subsequent Report of Abandonment is approved and the well bond is released.

4.10 Existing Oil and Gas Infrastructure

With the exception of county roads in the Monument (e.g., Cow Island Road) an estimated 13.0 miles of access roads (6.1 miles of right-of-way access) service the existing 14 gas wells (federal, state and private) within the Monument and an estimated 9.8 miles of access roads (4.2 miles of right-of-way (ROW) access) service 19 gas wells (federal, state and private) within 1/2 mile of the Monument. Many of the access roads are resource roads (two-track type roads) that allow well service vehicles and company personnel to visit the wells and facilities on a scheduled basis. The resource roads are not all-weather type surfaces so operators would use their best judgment to determine when the roads are passable. Many of the roads that access gas wells are also currently open for public use.

Of the 14 wells in the Monument, pipelines service 10 federal and one state well (three wells do not have pipeline service). The estimated length of pipelines in the Monument supporting the 11 wells is 31.1 miles (25.8 miles are covered by ROWs). Pipelines also service the 18 peripheral wells within 1/2 mile of the Monument (one well does not have pipeline service). The estimated length of pipe supporting the 18 peripheral wells is 21.1 miles (13.1 miles are covered by ROWs). An estimated 1/4 of the total pipeline length follows access roads; the remaining 3/4 does not. The total length of pipelines discussed above is 52.2 miles of pipeline and is best described by separating the pipelines into 10 separate sections. Table 4.10-1 describes the pipelines in the study area.

The infrastructure related to natural gas surface operations, other than the access roads and pipelines, includes the following:

- Meter shed (8 feet long x 8 feet tall x 5 feet wide)
- Well head (can be enclosed within the meter shed depending on the operation)
- Gas meter run (enclosed within the meter shed)
- Glycol barrel (can be enclosed within the meter shed)
- Small water separator (normally enclosed within the meter shed depending on the well and the operation)
- Water pit sized depending on the operation, but can range from 20 feet x 20 feet x 8 feet to 40 feet x 40 feet x 10 feet)
- Gas compressor (Compressors typically do not accompany each well. Depending on the operation and the size of the compressor, one gas compressor could service 8-12 wells). Currently, no gas compressors are located within the study area; however, a skid-mounted 42 HP compressor has been approved by the State of Montana on the David Kincaid No. 1 private well (the compressor has not been installed as of this document).

**Table 4.10-1
Pipelines in the Study Area**

<i>Pipeline Section</i>	<i>Well(s) PL Services</i>	<i>Legal Location</i>	<i>Pipeline Length</i>	<i>Remarks</i>
Butch Camp	Fed No. 1-7*	Sec 7, T25N R21E to Sec 3, T25N R20E	4.8 miles (4.6 miles of ROW)	4" poly pipe
Robinson/N. Bullwhacker	Fed No 1-12* Fed No 15-1 David Kincaid No 1 Fed No 31-3* State No 1 Fed No 34-1	Sec 12, T24N R21E, Sec 15, T24N R20E, Sec 3, T25N R20E, Sec 3, T25N R20E, Sec 16, T25N R20E Sec 34, T26N R20E, Leaving the Monument in Sec 4, T25N R20E	12.9 miles (9.1 miles of ROW)	2" steel and 4" poly pipe
W. Bullwhacker ¹			5.1 miles (4.5 miles of ROW)	
W. Coal Ridge	Fed No 35-24-18A* Fed No. 35-24	Sec 35, T24N R18E, Sec 35, T24N R18E, leaving the Monument in Sec 35, T24N R18E	1.3 mile (0.3 miles of ROW)	
Sherard "E" PA	US 4-27* ² US 6-28* US 28-1*	Sec 27, T25N R19E, Sec 28, T25N R19E, Sec 28, T25N R19E, leaving the Monument in Secs 27 & 28, T25N R19E	2.5 miles (1.6 miles of ROW)	
Southeast Leroy ³	Fed No P21-23-19N Fed No N27-23-19B Fed No A28-23-19N Fed No 31-23-19 Osburnsen 29-23-19	Sec 21, T23N R19E, Sec 27, T23N R19E, Sec 28, T23N R19E, Sec 31, T23N R19E, Sec 29, T23N R19E, Sec 22, T23N R19E, leaving the Monument in Sec 14, T23N R18E	12.5 miles (8.4 miles of ROW)	Pipeline crosses the Missouri River
Johnson/Ervin	Fed 29-15*	Sec 29, T24N R20E,	8.5 miles (8.0	Pipeline mainly

<i>Pipeline Section</i>	<i>Well(s) PL Services</i>	<i>Legal Location</i>	<i>Pipeline Length</i>	<i>Remarks</i>
Ridge		leaving the Monument in Sec 15, T24N R19E	miles of ROW)	buried in the access road
Sherard/Northwest Leroy	Fed 11-25-19 US 29-10 34-15 State 36-26-19	Sec 11, T25N R19E, Sec 29, T25N R19E, Sec 34, T26N R19E, Sec 36, T25N R19E, Leaving the study area in Sec 11, T25N R19E, Sec 29, T25N R19E and Sec 34, T26N R19E	3.5 miles (2.1 miles of ROW)	
North Leroy	Fed 23-26-20 Fed 21X-26	Sec 23, T26N R20E, Sec 26, T26N R20E, leaving the study area in Secs 23 & 26, T26N R20E	0.4 miles (0.0 miles of ROW)	
Sawtooth	Fed 1-2 US 9-9 Fed 15-9	Sec 2, T26N R20E, Sec 9, T26N R20E, Sec 9, T26N R20E, Leaving the study area in Secs 2 & 4, T26N R20E	0.7 miles (0.0 miles of ROW)	
Total	27 wells		52.2 miles (38.8 miles of ROW)	

* Monument well (8 wells). Another 19 wells are outside the Monument but are serviced by the overall natural gas pipeline system in the area.

- ¹ Fed No 31-25-20 was plugged and abandoned on October 26, 2005. The referenced pipeline was allowed to remain in place because the BLM has an APD to be drilled in the vicinity of this pipeline/well that was plugged and abandoned.
- ² A notice of intent to plug and abandon the US 4-27 well has been approved and the well likely will be plugged during the 2007 field season (spring or summer).
- ³ Fed L22-23-19N was plugged and abandoned on June 14, 2006.

5.0 Reasonable Foreseeable Development Baseline Scenario Assumptions and Discussion

The study area is being addressed because of the potential for future exploration and development on lands with existing federal leases. All federal lands in the study area are considered to have moderate and high potential for oil and gas occurrence. Occurrence is based on structural geology and historic activity of the area. It is further confirmed using well information to identify the extents of reservoirs. The areas considered to have high potential are those lands in the 18 exploration/production areas where commercial volumes and moderate shows of natural gas were evident at the time of well completion (see Figures 4.2-1 and 4.2-2). All other federal lands in the study area are considered to have moderate potential for oil and gas occurrence.

In conjunction with these proposed actions, a review was conducted to evaluate the geologic potential of the study area and determine the Reasonable Foreseeable Development (RFD) that could be expected. A total of 11 exploration/production areas were identified with RFD well projections, as shown in Table 5.0-1.

**Table 5.0-1
RFD Well Projections**

Exploration/Production Area	Wells within ½ Mile of the Monument	Monument Wells	Total Wells
North Leroy	4	1	5
Central Leroy	0	6	6
Central Leroy East	0	3	3
Leroy Bullwacker East	0	6	6
Sherard Northwest Leroy	7	8	15
West Leroy	1	0	1
South Sawtooth	13	4	17
Sherard Unit Area East	2	8	10
Southeast Leroy	1	1	2
Chase Hill	0	2	2
Sherard Unit	1	5	6
Total Wells in the 11 Areas	29	44	73

Specific well locations are not identified because many wells are considered proprietary information.

In addition to the 15.9 miles of existing roads supporting natural gas operations, the RFD locations would require 34.1 miles of new roads both in the Monument and within ½ mile of the Monument.

In addition to the 52.2 miles of existing pipeline, assuming a 35% success rate and because pipelines will be mostly buried in the access road corridor, the length of road to each new well was used. The new miles of pipelines are estimated at 11.9 miles. As a result, the number of well site visits can be limited to only those necessary for routine maintenance as determined via remote well monitoring with radio telemetry.

5.1 Proposed Actions

The BLM has received APDs from three federal lease holders in the study area in Blaine County, Montana. One APD has been received from Klabzuba Oil and Gas, Inc., one from Macum Energy, Inc., and one from Devon Energy. All three are pending approval based on the outcome of the Monument RMP/EIS. The three wells would be drilled from the following locations:

Klabzuba Federal 31-25-20B	SE¼NW¼ of Section 31, T. 25 N., R. 20 E.
Macum Federal 23-10	NE¼SW¼ of Section 10, T. 25 N., R. 20 E.
Devon Federal 9-7	SW¼NE¼ of Section 9, T. 26 N., R. 20 E.

The wells would develop known gas resources in three producing gas fields in the study area. The wells would not require the construction of any new roads. If the wells are productive, they would require the installation of 3.7 miles of new pipeline in the study area to connect into existing pipelines.

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