Appendix H

Roan Plateau Planning Area
Oil and Gas Reasonable Foreseeable Development
Prepared by
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Summary

The Roan Plateau Planning Area (RPPA) can be divided into two areas: upper plateau and lower plateau (See Figure 1b). The Oil and Gas Reasonable Foreseeable Development (RFD) for the RPPA is that 3,176 Mesaverde and Wasatch federal mineral estate wells are forecasted to be drilled within the RPPA over the 20 year life of the plan. From these federal mineral estate wells, 3,632 BCF[1] of gas and 8,066BO will be recovered over the next 20 years - predominantly from the Mesaverde. Of the 3,176 wells projected to be drilled, 480 wells are projected for the upper plateau and 2,696 wells are projected for the lower plateau within the RPPA. While Coal Bed Methane exists in the Cameo Coal zone of the Mesaverde in the RPPA, it is found at much deeper depths and does not have the well-developed natural fracture permeability exhibited elsewhere in the rocky mountain region. As such, the Cameo Coal zone in the RPPA produces little associated water (<4 BWPD) and is not expected to have the water disposal problems associated in other areas of the Rocky Mountains. The estimated technically recoverable gas resource within the RPPA is calculated as 15,416 BCF[2], with federal lands comprising 8,933 BCF[3] of this amount. For federal lands, the upper and lower plateau comprise 4,219 BCF and 4,713 BCF respectively[4]. Per Table 3c of the January 2003 "Scientific Inventory of Onshore Federal Lands' Oil and Gas Resources and Reserves and the Extent and Nature of Restrictions or Impediments to their Development", the Uinta/Piceance Basin contains 28,843 BCF of technically recoverable resources and proved reserves. The estimated technically recoverable gas resource within the RPPA represents 53% of this amount. According to Dwights energy data, only 14 wells were dry and abandoned out of 802 wells drilled within the RPPA. This represents a 98% success ratio. A historical area summary as well as RFD projections on private minerals as well as federal minerals are summarized in Tables 1 and 2. Road, pipeline and well pad disturbance projections will be discussed in the RPPA Environmental Impact Statement and are therefore not part of this RFD.

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[1] 1M = 1,000; 1B = 1MMM = 1,000,000,000; 1T = 1MB = 1,000,000,000,000;
W-Water; O-Oil; G - Gas; D – Day; B – Barrels; CF – Cubic Feet;

[2] 15,416 BCF = 127,009 RPPA acres * (1.17 BCF/10 acre Mesaverde well + 0.7 BCF/160 acre Wasatch well); See Table 2

[3] 8,933 BCF = 15,416 BCF * 73,597 Federal acres/127,009 RPPA acres; See Table 2

[4] 4,219 BCF = 15,416 BCF * (34,758 upper acres/127,009 RPPA acres)
4,713 BCF = 15,416 BCF * (38,833 lower acres/127,009 RPPA acres); See Table 2

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Introduction

The RPPA consist of 127,009 acres. Of which 73,597 acres contain federal minerals available for oil and gas development. Of the 73,597 federal acres, about 18,744 acres are presently leased. Contained entirely within the RPPA are NOSRs 1 and 3 which were transferred to the BLM from the Department of Energy (DOE) under the Defense Authorization Act of 1997 (DAA). About 36,363 and 18,993 acres comprise NOSRs 1 and 3, respectively. 53,800 acres comprise the upper plateau which contains most of NOSR1. The upper plateau contains approximately 65% federal and 35% private land. BLM leased 8,379 acres of the NOSRs 1and 3 effective May 1, 1999, to Barrett Resources (now Williams). Table 1 provides an area summary of the RPPA.

The RPPA contain parts of three active gas fields including the Grand Valley, Parachute and Rulison (See Figure 1a). The major productive horizons include the Mesaverde group and the Wasatch Formation. The deeper Mesaverde group is the principal development objective and includes the Williams Fork Formation, the Corcoran, the Cameo Coal Zone and the Rollins Sandstone. Development started in the 1940s. According to Dwights Energy June 28, 2005, data as of May 1, 2005, and as summarized in Table 1, 958 wells have been spud (787 drilled and completed) within the RPPA. Of those drilled, 14 have been drilled and abandoned (D&A). 674 wells (608 Mesaverde, 64 Wasatch and 2 other) remain as productive wells as of May 1, 2005, in the RPPA. Of the 958 wells, 219 were spud (197 drilled and completed) on federal oil and gas minerals. Drilling started on federal land on the NOSR in 1980, by the DOE. Figures 1a and 1d depict mineral ownership, petroleum field boundaries, and existing leases and agreements. Figure 1b depicts the wells in the area. Production is mainly gas with a little associated condensate mainly from the Mesaverde.

Oil and Gas Resource Potential

Previous Work

The DOE prepared two reports which discussed reserves, development potential and geology for the NOSRs 1 and 3. The first is entitled, "Naval Oil Shale Reserves 1 and 3 Oil and Gas Reserves Evaluation" and the second is entitled, "Naval Oil Shale Reserve No. 3 Commercial Development Study". Both were prepared in July, 1998. Geologic studies were also conducted in 1988 and 1990 as part of the Department of Energy's Multi Well Experiment (MWX), which characterized the Mesaverde low permeability reservoirs and developed technology for their production. In addition, Ron Gunnufson, BLM Colorado State Office Geologist, prepared a report on the geologic potential of the area on October 14, 1999 and Brian Macke (Director of the Colorado Oil and Gas Conservation Commission) prepared a related report on August 26, 2005. The USGS prepared an oil and gas assessment report in 2003 for the Piceance Basin. The following discussion incorporates information from those reports, except where otherwise noted. See Figure 7 for stratigraphic column.

Geology

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Williams Fork Formation

The principal drilling objective in the RPPA is the gas-bearing fluvial sand section present in the Williams Fork Formation of the Mesaverde Group. This includes the Cameo Member found directly above the prominent Rollins Sandstone at the base of the Williams Fork. The Williams Fork is approximately 3,600 feet thick (Rulison Field), of which the lower 2,400 feet is gas saturated in the Rulison Field, and lower 1,500 feet in the Grand Valley Field. In the lower plateau, depth to the base of the Williams Fork (Rollins Sandstone) is about 7,000-8,000 feet. On the upper plateau, depths are about 3,000 feet greater.

The fluvial section in the Williams Fork Formation consists almost totally of lenticular channel sandstones and fine grained flood plain deposits which were deposited on a coastal plain behind the retreating Late Cretaceous coastline. Lorenz (1985) best described this section as consisting of meander belt river-channel sandstones inter-bedded with muddy flood plain, levee and swamp deposits. Lorenz stated that the average meander-belt width for the fluvial section of the Williams Fork Formation is 1,500 feet but within that meander-belt width are numerous point bar deposits, with each sandstone body generally not exceeding 700-800 feet in width. The point bar sand bodies are stacked vertically throughout the thickness of the formation. Studies show that the point-bar reservoirs are layered, do not communicate vertically, are naturally isolated from each other, have an asymmetric drainage pattern based on natural fracture distribution, and that drainage from a well is limited to the aerial extent of the point bar sand bodies. This explains why wells that penetrate the fluvial section encounter 10 to 25 + different, individual sandstone reservoirs that are tight and lenticular with very limited extent. These discontinuous and compartmentalized sand bodies have a very limited aerial extent which requires that wells be drilled closer together in order to adequately recover the gas and associated hydrocarbons and prevent resource waste.

The lenticular nature of the fluvial sandstone reservoirs form the major trapping mechanism at Rulison, Parachute and Grand Valley Fields with regional extension fractures enhancing this production. The source rocks for the fluvial section are the Cameo Coals and associated carbonaceous shales.

Production rates from the sands are highly variable and are a function of depth, porosity and permeability, continuity of individual sands, degree of natural fracturing, number of sands penetrated and other geologic factors which vary from well to well. The Williams Fork gas wells produce some associated condensate but little water. Initial well production for Williams Fork wells averages 1,360 MCF/D. During an April 2001, spacing hearing before the Colorado Oil and Gas Conservation Commission, Williams estimated Mesaverde reserves to be 1.25 -1.86 BCF /Well.

Geologically, there is little risk in extending the existing Grand Valley, Parachute and Rulison Fields into NOSR 1. It is expected that the Williams Fork gas saturated zone will probably underlie most of the plateau. Very few dry holes have been drilled in the Grand Valley, Parachute and Rulison Fields due to the nature of the play. Risks are minimized because the wells are drilled into

a pre-dominantly gas saturated section encompassing an enormous area. Gas sand reservoirs may lack continuity and may not be correlative between closely spaced wells, but each well will penetrate numerous productive reservoirs, unique to that well. There are smaller risks related to the geologic and engineering heterogeneities (such as permeability, porosity, faults, fracture systems, structural irregularities, etc.) that are unique to each well, which is evidenced by the large range in production rates.

Wasatch Formation

The DOE report considered the Wasatch reserves as second only to Mesaverde potential. The Wasatch Formation is Eocene to Paleocene in age and consists of multiple, lenticular sandstone lenses interbedded with bentonitic varicolored shales and siltstones. The sands of the Wasatch were deposited as channels cut into the shales and siltstones. The sands which usually contain high clay content are considered "tight" with low permeability.

Most of the Wasatch production in the RPPA is expected to be derived from the G Sand of the Molina Member. Production has been established in the G Sand in the Rulison, Parachute and Grand Valley Fields. Due to the heterogeneous make-up of this formation trapping mechanisms are normally stratigraphic in nature. Economic gas production rates and recoveries are highly dependent on natural and induced fracture systems within the reservoirs. Below the rim, the Wasatch Formation is found from the surface down to a depth of about 3500 feet. Most production from this formation has been derived from depths between 2,000-3,000 feet. Wasatch reserves are estimated to be about 0.7 BCF/Well and initial well production averages 270 MCF/D.

One factor affecting potential Wasatch development could be the relatively deep drilling depths required to reach the "G Sand" and the other reservoirs of the Wasatch on top of the plateau since the top is about 3,000 feet higher than the majority of the producing wells situated to the south. In December of 1990 Barrett Resources Corporation completed a Wasatch G Sand well only 1179 feet from the southern boundary of NOSR-1. The Allen Point #1-8-95 was completed between the depths of 5887-5933 feet and had an initial well production of 230 MCFGPD with no oil and no water. The ground surface elevation of this well was 8,516 feet. If the Wasatch G Sand approaches a depth of nearly 6,000 feet near the southern boundary of NOSR-1 (and structurally the regional dip underlying much of this area is to the northeast) then depths to the G Sand could be in excess of 7,000 feet. Traditionally in many areas of northwestern Colorado the Wasatch has been developed at depths between 2,000-3,000 feet with typical initial well productions of 200-300 MCFGPD.

Coal Bed Natural Gas (CBNG)

The Cameo Coal Zone is the basal member of the Williams Fork Formation, and the coal beds represent a potential reservoir component within the Mesaverde Group. This section reflects a paludal (swamp) depositional environment landward of the prograding Rollins paleoshoreline. In the Grand Valley Field, the Cameo coal zone is about 470 feet thick and contains 50 to 70 feet of

net coal with the thicker coals occurring near the base of the zone. The zone thickens regionally from the Grand Valley Field to the Parachute Field.

While CBNG exists in the Cameo coals, they lack the well-developed natural fracture permeability associated with prolific water and gas flows exhibited in some areas of the northern San Juan Basin and on the Divide Creek anticline in the eastern Piceance Basin. Well test data from the Parachute Field indicate that in situ coal permeability ranges from 0.02 to 0.2 md. In the Grand Valley Field the absence of well developed cleat systems and the lack of abundant open fractures is probably related to the depth of rock overlying the coals and to the lack of faulting in the area. With the exception of any structurally impacted areas on top of the plateau, coal beds could be subjected to even less fracturing, with greater thicknesses of overburden, resulting in less developed cleat and fracture systems which would equate to less gas production.

The CBNG potential was also evaluated in several studies which concluded that permeability in coals is significantly reduced with depth. At a depth of about 7,000 the permeability would be so low that coalbed methane could not flow in economic quantities (SPE 26196, 1993). The USGS geologic assessment of oil and gas (2003) delineated a coalbed natural gas area in the Grand Valley and Parachute fields to a depth of 7,000 based on Barrett Resources completing 51 wells in the coal beds to near that depth between 1989 and 1992. However, USGS noted that most of the wells were dual coal bed and sandstone completions, and that the coal beds were contributing only small amounts of gas to the overall production. The DOE's Coalbed Methane Primer (2004) noted that due to the depth of Piceance Basin coals, permeability is reduced, thereby hindering extraction.

It should be noted that the Cameo coals in the White River Dome area in the northeastern part of the Piceance Basin are productive at deeper depths. CBNG production has occurred down to a depth of 8,140' (Olson, 2003). The coals have low permeability, but higher than the sandstones. Coal permeability is derived from the cleats and natural fractures.

Although there are current problems associated with commercial development of CBNG within the RPPA, the future potential is unknown.

Iles Formation

The Iles Formation underlies the Williams Fork Formation and comprises the lowest part of the Mesaverde Group. The Rollins, Cozzette, and Corcoran Sandstone Members reflect distributary channel, and beach (shoreline and offshore bar sands) depositional environments. Significant gas production from the Cozzette and Corcoran Sandstones occurs in other fields to the south and west, but is very minimal within the RPPA. Therefore, the future potential of this resource is unknown.

Mancos Shale, Dakota Sandstone

The DOE report states that hydrocarbons could exist in the Upper Cretaceous Mancos Shale in fractured reservoirs, in the Lower Cretaceous Dakota Sandstone and Cedar Mountain-Burro Canyon

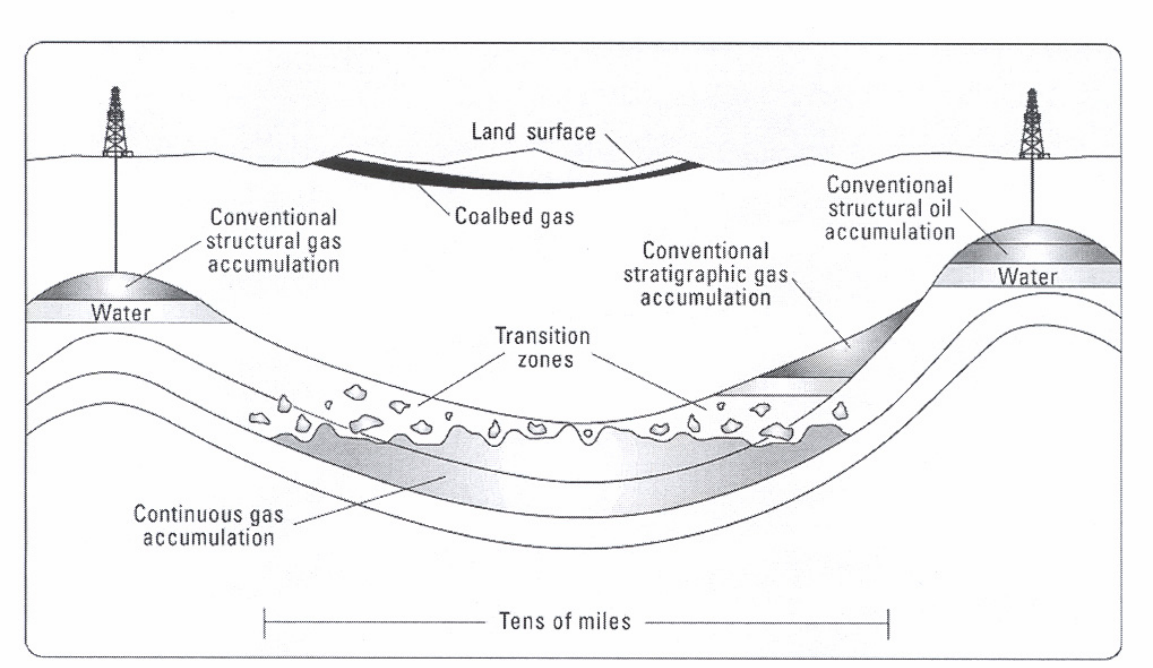
Formations, Jurassic Morrison Formation and in Paleozoic strata. With the possible exception of the Mancos Shale all of the above formations would probably occur at depths in excess of 15,000 feet which significantly reduces their importance as viable objectives in this area. In addition the Cedar Mountain-Burro Canyon Formations are actually stratigraphic lateral equivalents, and the Cedar Mountain component present in portions of northwestern Colorado may actually be absent in the NOSR-1 area.

USGS Oil and Gas Assessment Units

The USGS oil and gas assessment project (2003) for the Piceance and Uinta Basins developed geologically based hypotheses regarding the potential for oil and gas reserves. The focus was to determine the distribution, quantity, and availability of oil and gas resources, with an emphasis on undiscovered resources underlying federal lands. The approach was to establish the framework geology, define the major total petroleum systems (TPS), define assessment units within the TPS, and assess the potential for additions to reserves.

Each TPS is a mapable accumulation of gas which was generated by a pod of mature source rock. In addition, USGS mapped the reservoirs, traps, and seals necessary for gas accumulations to exist. Within each TPS, assessment units were developed, which encompass conventional or continuous accumulations sharing similar geologic traits. The two Piceance Basin TPS designations are the Mancos and Mesaverde. An assessment unit may contain multiple plays.

Hydrocarbons generated from coals and carbonaceous shales in the Williams Fork Formation define the limits of the Mesaverde TPS. That portion of the area underlain by the lowest coal zone in the Williams Fork is included in the Mesaverde TPS. Gas migrated into low permeability, lenticular sandstone beds, resulting in basin-centered accumulations, such as found in the Rulison and Mamm Creek Fields. The TPS includes the lowest major coal zone (Cameo zone), potential reservoirs in overlying fluvial sands of the Williams Fork fluvial sands, and sands within the Wasatch Formation. There are 4 assessment units within the Mesaverde TPS which overlap the RPPA – continuous gas, transitional gas, coal bed gas, and conventional gas.



Schematic diagram of the types of oil and gas resources in USGS assessment

Continuous gas units include and overlie Mesaverde source rocks where thermal maturity values are highest, and include basin-centered gas accumulations characterized by gas-saturated sandstone reservoirs. The primary reservoirs are the lenticular, fluvial channel sandstones in the Williams Fork and overlying Wasatch Formation. In a continuous-type accumulation, the deep basin gas-saturation zone cuts across formation boundaries and basically gas production that is water free can be established wherever permeability is sufficient to yield economic flows. Traps such as structural closures and updip stratigraphic pinch-outs are not necessary for trapping gas in this type of gas accumulation. Artificial fracture treatments are normally required because sandstone reservoirs in deep basin continuous accumulations are "tight" and generally characterized by low porosities (<8%) and very low permeabilities (usually less than 0.1 md). Near the basin margins and closer to outcrops (Roan Cliffs) sandstone reservoirs could be saturated with fresh water.

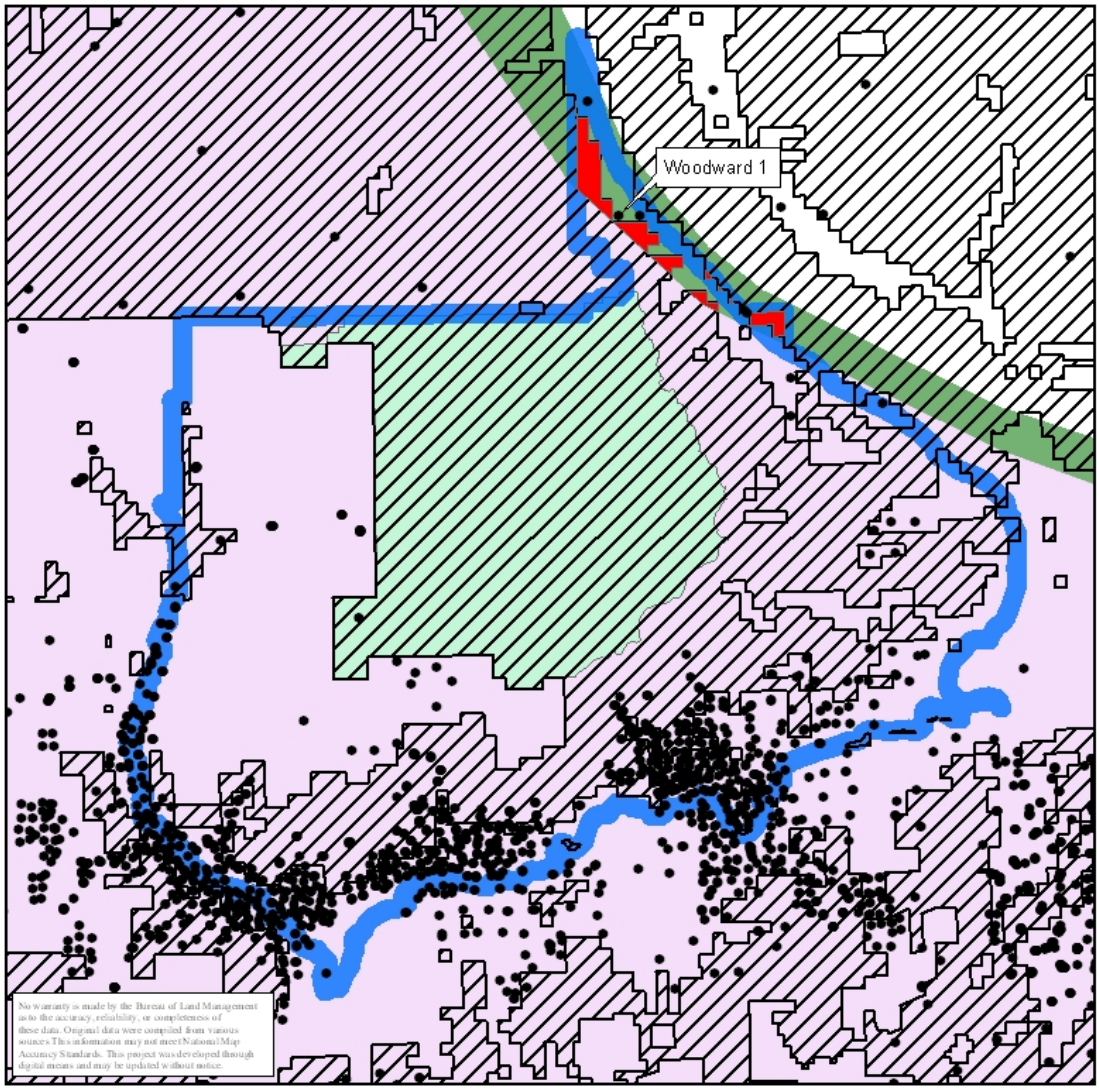
Updip from the continuously gas-saturated zone a transitional zone may exist with reservoirs containing a mixture of gas and water in more traditional stratigraphic traps with downdip gas-water contacts. Transitional units represent the transition zone surrounding the basin-centered accumulation and are characterized by a combination of gas-saturated and water-wet reservoirs, having source rocks with lower thermal maturity values.

The transitional unit has incomplete gas saturation as compared to the continuous unit, with increased chance of penetrating water-wet reservoirs (Johnson and Roberts, 2002).

Conventional gas units include reservoirs with conventional-type structural and stratigraphic traps and discrete gas-water contacts. According to USGS, there is a small potential for conventional reservoirs in the Wasatch Formation and fluvial channel sands of the Williams Fork along the basin

margins.

The oil and gas resource potential map shows that nearly the entire planning area is underlain by the Mesaverde continuous gas unit, and therefore is considered to have a similarly high gas resource potential. However, the extreme north end falls within the transitional gas unit along the steeply dipping Grand Hogback and is projected to have a lower gas resource potential. The Woodward 1 well, drilled by Williams Production in 2002, is located in section 22, T 4 S, R 94 W. in the north end of the plan area within the Mesaverde transitional gas unit. The total depth was 12,850' in the Sego Sandstone (upper Mancos). It was completed in the Mesaverde, but average production for the entire 500-day production period has only been 89 MCF/day, and the well is currently shut-in. By comparison, typical production from the Rulison Field (nearest field) averaged 821 MCF/day based on the initial 500-day production period for 15 representative wells. (Note: The above data on the Woodward 1 well and production data was obtained and compiled from the COGCC public website.) About 1100 acres of federal mineral estate and 1700 acres of fee lands within the planning area lie within the transitional gas unit (2800 acres total). Because the federal acreage having lower resource potential is a tiny fraction of the planning area total, any changes to the overall RFD well projections would be minimal.



Oil and Gas Resource Potential within the Roan Plateau Planning Area

- Gas Wells (producing, shut in, plugged/dry and abandoned, proposed locations)
- Federal minerals within the Roan Plateau Planning Area within the Mesaverde Transitional Gas Unit. 1100 acres
- Mesaverde Transitional Gas Unit
- Mesaverde Continuous Gas Unit
- Federal Minerals
- Roan Plateau Planning Area Boundary
- Upper Plateau

Map based on USGS Petroleum Systems and Geologic Assessment of Oil and Gas in the Uinta-Piceance Province, Utah and Colorado, 2003.

N

0 2 4 6 8 10 Miles

This map was produced by the BLM Grand Junction field Office, June 2005 t:\gisuser\bfowler\cg\roan_USGS.mxd

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Oil and Gas Activity

Past Development

In the early 1980's, private companies began to develop natural gas reserves in the Rulison, Parachute and Grand Valley Fields, just outside of NOSR3. In, 1985, to protect federal gas resources from drainage, DOE initiated its own drilling program. DOE drilled 24 wholly-owned wells and entered into joint ownership or Communitization Agreements (CAs) with private developers for some 25-30 additional wells. The wells in which the U.S. holds and interest are located along the southern boundary of the reserve. This area is referred to in the DAA as the "developed tract of Oil Shale Reserve Numbered 3".

Drilling on federal mineral estate from 1980 to 1991 was sporadic, averaging less than three wells per year. Since 1991, activity had increased, averaging about seven wells per year, a total of 184 wells by May 1, 2005. In the last 7 years, drilling has been increasing at a rate of about 27 wells per year on private and federal. The average number of wells drilled per year for the last seven years is about 115 wells per year with an expected 250 wells drilled in 2005. As of May 1, 1999, there were 141 Mesaverde and 45 Wasatch wells. As of May 1, 2005, there were 608 Mesaverde and 64 Wasatch wells. In the NOSR, there were 27 wells as of May 1, 1999, and 123 wells as of May 1, 2005. The number of wells drilled annually on federal and private mineral estate is depicted on Figures 2 and 2a

Present Development

During January, 1999, a Supplemental Environmental Impact Statement (SEIS) covering impacts from oil and gas development in the Glenwood Springs Resource Area, including the developed portion of the NOSR was completed. The undeveloped portion of the NOSR3 and NOSR 1 were not included in the analysis. The production area of the NOSR covers 12,029 acres. During March, 1999, 8,379 acres of this area was divided into four parcels and leased. The effective date of the leases is May 1, 1999. As of May 1, 2005, Dwights Energy Data reveals that there are 124 spudded and completed wells in the NOSR. These completions are located on the 4 NOSR leases. As of May 1, 2005, there are 123 wells producing.

Directional drilling in the RPPA has increased substantially in recent years. Prior to January 1, 2001, a total of 17 wells were completed as directional wells in the RPPA. During 2001, 2002, 2003 and 2004, 18, 48, 50 and 132 wells respectively were completed directionally. As of May 1, 2005, a total 328 wells were completed as directional wells. While directional drilling is generally more expensive in this area, directional drilling allows for wells to be drilled on a common pad resulting in less surface disturbance.

The operator of the NOSR leases (Williams) proposed 160 federal wells for this area drilled from 39 new locations and 21 existing locations. The environmental assessment for this proposal is the Wheeler to Webster Geographic Area Proposal (WWGAP) and is dated July 2002. In this proposal,

there were two to three wells per location with as many as seven wells on a single location. In 2004, the WWGAP was amended to add an additional 55 wells. All wells proposed in this action were to be drilled from existing gas well locations. Then in 2005, Williams proposed to drill up to 213 additional natural gas wells within the Wheeler to Webster project area during a two-to-three year program. The plan proposed to drill these 213 new wells from up to 12 previously analyzed new surface locations plus 47 existing well pads for a total of 59 well pads. The wells will all be directionally drilled. All of the 59 well pads would have multiple well bores. Of the 213 proposed wells, 19 would be based on 40-acre bottom hole spacing, 38 would be based on 20-acre bottom hole spacing, and 156 would be based on 10-acre bottom hole spacing patterns. All of the 213 proposed wells would be drilled on existing Williams's leases. Combinations of the following development scenarios are proposed:

- Forty-seven existing well pads to obtain 180 bottom hole locations;
- Twelve new well pads to obtain 33 bottom hole locations; and
- Multi-well locations where up to ten additional wells would be drilled from a single well pad.

If fully developed, this proposal would result in an additional 213 new bottom hole locations. Williams expects to drill up to 30 of the proposed wells in 2005 and an equal or greater number per year in subsequent years. As one can see, future plans from the operator call for a stronger emphasis on directional drilling multiple wells from common pads.

The COGCC requires that all applications for increased oil and gas well density are supported by evidence and testimony that shows that the additional wells are necessary to recover the resource. Prior to 1994, much of the area was approved by the COGCC for one Mesaverde group well per 640, 320 or 160 acre drilling spacing unit. Beginning in 1994, it was determined that the existing wells were not adequately recovering the natural gas resources from the Williams Fork Formation primarily because of the geological characteristics of the Williams Fork Formation. Increased downhole well density to 80 acres for the Williams Fork was approved by the COGCC in 1994. Forty-acre down-hole spacing was approved in 1995. 20-acre down-hole spacing was approved in 1996 in a limited area as a pilot. Then, in 1998, 20 acre well density for the Grand Valley, Rulison and Parachute fields was approved with most of the lands limited to 40 acre surface well density and a small portion approved for 20 acre surface well density. The COGCC then approved a limited 10 acre subsurface well density pilot in 2001. During a COGCC administrative hearing held prior to an April 21, 2003, hearing, and further supported by July 2, 2003, industry testimony before the COGCC and a Williams May 20, 2003, report, it was determined that 20 acre well spacing would recover only about 40% of the gas in place. Wells drilled on 10 acre spacing would recover approximately 80% of the gas in place. Industry further testified that based on measurements of the Williams Fork Formation of the Mesaverde group where it outcrops near Cameo, Colorado, that the average lateral extent of the point-bar sand bodies that make up the Williams Fork Formation is 682 feet and is consistent with 10-acre spacing of 660 feet. Also, log cross sections were presented that further supported discontinuous sand bodies that are probably not connected. Additional data support laterally stacked meander belt complexes and point bar sandstone deposits of the Williams Fork Formation. The meander belts have an average thickness of 1500 feet with the average sand body width being approximately 750 feet. It was also shown that

little or no production interference was exhibited between wells drilled at 10 acre spacing. Ten acre down-hole well spacing for the Williams Fork was approved by the COGCC on April 21, 2003, for fee lands and August 18, 2003, for federal lands. As of August 2005, the COGCC has approved 127,094 acres of lands for 10 acre subsurface well density Williams Fork Formation natural gas and associated hydrocarbon development with most of the lands in and adjacent to the Roan Planning Area. As of August 2005, Williams has approximately 39,429 acres of land approved by the COGCC for 10-acre down-hole Williams Fork spacing on private and federal land in the area. Approximately 21,000 acres of these 10-acre lands are in the planning area. Over 90% of the existing federal leases and communitization agreements (CAs) in the planning area are currently approved for 10-acre down-hole spacing for the Mesaverde (See figure 1c).

While it is anticipated that the reservoir characteristics of the upper plateau are similar to the lower plateau, drilling will not be similar. On the upper plateau, an additional 2,000 to 3,000 feet of Uintah and Green River formations must be penetrated as compared to the lower plateau. The mineral make-up of these two formations results in drilling problems including water flows, lost circulation and swelling and sloughing clays. Also, the operator reports that lost circulation was encountered in the Wasatch due to the additional 2,000 to 3,000 feet of overburden present in the upper plateau. These hole problems result in drilling difficulties including differential drill pipe sticking and lost circulation which have not been overcome as of yet. A directional well has yet to be drilled on the upper plateau. A review of four Allen Point Wasatch wells located on the upper plateau reveal that drilling times were seven times the drilling times of an average lower plateau Wasatch well. Additionally, the upper plateau is limited to a single suitable access road, weather allows for drilling only six months of the year as reported by industry and an average Mesaverde well drilling and completion would be extended to 30 days.

RPPA Production

Between May 1, 1999, and May 1, 2005, Cumulative gas and oil production from the RPPA has increased from 126 BCF and 195 MBO to 390 BCF and 553 MBO. Monthly gas production from the RPPA between the same periods increased from 1,531 MMCF to 6,367 MMCF. Monthly oil production increased from 2,678 BO to 11,994 BO. Between the same periods, federal oil and gas minerals cumulative production has increased from 26 BCF and 50 MBO to 89 BCF and 161 MBO. Monthly federal gas and oil has increased from 270 MMCF and 782 BO to 2,320 MMCF and 6,282 BO. These figures support a gas production rate increase of about 316% on federal and private land and 190% on just federal land between the periods. As of May 1, 2005, cumulative federal gas production from the Mesaverde is 78 BCF and 11 BCF from the Wasatch. From these figures, one can conclude that Mesaverde is about 88% of the total production. Cumulative total and federal water production is 4,052 BW and 1,207 BW, respectively as of May 1, 2005. Between May 1, 1999, and May 1, 2005, cumulative gas and oil production from the NOSR has increased from 14 BCF and 19 MBO to 50 BCF and 61 MBO respectively. Monthly gas production increased from 95 MMCF and 183 BO to 1,472 MMCF and 3,840 BO respectively. Production figures are from the June 28, 2005, Dwights Energy Data load and are summarized in Table 1.

Over the period from 1994 to 2004, production from the Piceance Basin has inclined at about 10%

per year (Figure 3) and production from the Grand Valley, Rulison and Parachute fields has inclined at about 20% per year (Figure 4). From this data, one can conclude that production incline in the area of the Roan Plateau exceeds the production incline in the Piceance Basin as a whole.

Reasonable Foreseeable Development

The Reasonable Foreseeable Development (RFD) is the level of oil and gas development activity, constrained only by technical and legal constraints, that an objective reviewer might reasonably expect to occur over a specified range of time. The actual amount of future oil and gas development activity is dependent on many factors, such as actual field life, commodity prices, changes in technology, availability of infrastructure to transport the product, inflation, availability of capital, legislation, and taxes.

RFDs for this area in the past have been based upon historical development rates and have been consistently low in estimating development activity - Appendix B of the 1991 Final Colorado Oil and Gas Leasing and Development EIS (FEIS) forecast 54 wells to be drilled on BLM lands for the period of 1989, throughout 2010, with 36 expected within high oil and gas potential areas, known as Region 4. The projections were subsequently increased to 90 wells total and 72 in Region 4. By 1997, or six years after implementation of the FEIS, 72 wells had been authorized in Region 4.

Section 4.20 of the 1999 FSEIS forecast 300 BLM wells to be drilled from 1999 to 2018 in Region 4 with 65 or 70 wells projected for the four Naval Oil Shale Reserve (NOSR) leases. Three years after the FSEIS implementation, 12 wells were drilled on the NOSR with an application for 160 additional wells as covered in a July 2002 Environmental Analysis. As such, emphasis is being placed on recent oil and gas activity, operator plans and the geology of the productive horizons.

The geology and reservoir characteristics require that the Williams Fork Formation be developed on 10 acre subsurface well density to adequately recover the natural gas and associated hydrocarbon resources within the Roan Planning Area. Lesser development interest will exist for the Wasatch and it will be developed at 160 acre spacing.

Exploration activity on the upper plateau will be limited due to one suitable access road, a weather drilling window of six months, 3000 feet of additional unconsolidated Wasatch zone which all combine to result in less favorable well economics and fewer wells as compared to the lower plateau area. It is assumed that anticipated directional drilling difficulties due to the extra 3000 feet of overburden would make directional drilling improbable at this time but it is anticipated that drilling technology will improve so that by year four, directional drilling will be utilized. Also, wells drilled on the upper plateau - federal minerals would be limited to drilling 6 months with 1 rig running for the first 3 years, 3 rigs running for the next 4 years , then 5 rigs running for the next 13 years. Wells drilled on the upper plateau – private minerals would follow a similar schedule but have more rigs running because of better access, existing surface use agreements and less government involvement on private land. Two rigs will be running during the first 3 years, then 5 rigs running for the next 4 years and 5 rigs running for the remaining 13 years. An average upper

plateau well would take 30 days average time to drill. Using this staged development, a total of 1,026 wells will be drilled over 20 years on the upper plateau as presented on line 10 of Table 2. This is about 15% of the number of wells (6,725 wells, as seen on line 6' of Table 2) that will eventually be drilled on the upper plateau. Currently, 90% of the wells are Mesaverde and 10% of the wells are Wasatch. In the future, it is assumed that Wasatch will be developed at 160 acre downhole spacing and Mesaverde at 10 acre downhole spacing (i.e., 1 Wasatch well for every 16 Mesaverde wells). After subtracting existing wells, the 1,026 wells will result in 967 Mesaverde and 59 Wasatch wells forecasted to be drilled as presented on lines 11 and 12 of Table 2.

To determine the number of well pads for the upper plateau, it is assumed that wells will be vertically drilled through year three. In year 4, drilling technology will be developed that will facilitate wells being directionally drilled. As such, vertical wells will be drilled one per pad for the first 3 years. Starting in year 4, three additional wells, drilled directionally, will be drilled on each existing pad for a total of 4 Mesaverde wells per pad. As an example, using the upper plateau-private minerals drilling scenario from above, the first 3 years will yield 36 wells, the next 4 years (years 4 through 7) will yield 120 wells and the next 13 years will yield 390 wells for a total of 546 wells, or 515 Mesaverde wells and 31 Wasatch wells. In the first 3 years, 36 single-well pads will result. In years 4 through 7, 36 wells times 3 wells per existing pad leaves 108 wells that will be placed on the existing 36 single-well pads leaving 120-108, or 12 wells to be drilled at 4 wells per pad or 3 pads for a total of 3 + 36 or 39 pads through year 7. In year 8, all but 31 Wasatch of the remaining 390 wells, or 359 wells will be drilled 4 to a pad or an additional 90 pads for a total of 3 + 36 + 90 or 129 pads as presented on line 17 of Table 2. The 31 Wasatch wells will be drilled at 160 acre spacing and will be the 5^{th} well on every 4^{th} pad, collocated with the Mesaverde wells.

For the lower plateau, it is assumed that areas within the Rulison, Grand Valley and Parachute fields will be developed fully at 10 acre spacing within 5 years. After these fields are fully developed, then the areas outside the fields will be developed with the area closest to the existing fields being developed first and then progress away from the existing fields. It is estimated that the area outside the existing fields will be developed at a rate similar to the development that occurred from 1999 to the present in the RPPA (Figure 2a). Figure 2a is a graph of the number of spuds in the PRRA versus years. Using least squares and the spud data from 1999 on the graph, a trend line, Y=26.936X can be obtained where "Y" is the number of wells and "X" is years. Integration of this linear equation for 15 years starting in 1999 will yield the total number of wells that will be developed over 15 years. Integration provides Y=26.93X**2/2. Using this equation, 3,029 wells would be spud in 15 years which represents the number of spuds from year 6 to the end of the plan (year 20). Subtracting the existing 50 wells leaves 2,979 wells as represented in line 8 of Table 2. Adding the wells for the area inside the field boundaries of 1,875 wells provides 4,854 total wells for the lower plateau. This number is then checked against development of the lower plateau based upon rig availability and drilling times. For example, at 20 days/well, over 20 years with 20 rigs running, 20 years * 365 days/year/ 20 days/well * 20 rigs running, or 7,300 wells per year can be drilled as seen on line 9 of Table 2. However, only 4,854 wells can be developed based on spacing and a development schedule as seen on line 8 of Table 2. As such, the RFD wells are the lesser of 7,300 wells and 4,854 wells, or 4,854 wells as presented in line 10 of Table 2. For the area outside the existing fields on the lower plateau, 2,979 wells will be developed over 48,692 acres, or an

average of 16 acres per well. Since full development is at 10 acre spacing, a little over half of the area outside the existing fields will be developed during the planning period.

For the purpose of determining the number of well pads, it is assumed that all Mesaverde wells would be drilled on 40 acre surface locations. For the Wasatch, wells would be co-located with Mesaverde wells every 160 acres on the lower plateau and located on every 4th pad and be the 5th well on a pad. For example, line 10 of Table 2 reveals that there are 2,546 lower plateau federal Mesaverde wells. At 4 wells per pad, the number of pads on federal lower plateau would be 2,546 wells/4 wells per pad or 636 pads as revealed in line 17 of Table 2. These pads would have 4 MV wells each and every fifth pad would have 4 MV and 1 Wasatch wells.

RFD Assumptions

Based on the above information, the following assumptions are made in determining the RFD. The results are presented in Table 2:

1. All potentially productive areas are open under standard lease terms and conditions (i.e., lease form without stipulations).

2. The surface covered by lands in excess of 50% slopes will be precluded from use. However, directional drilling of 2,500' * offsets will be utilized to obtain reserves otherwise precluded by steep slopes. GIS reveals that there are no steep slopes that will likely preclude the development of the minerals after directional drilling with 2,500’ offsets.

3. Wasatch reserves will be .7BCF/Well and development will occur at the rate of 1 Wasatch well for every 16 MV wells (160 acre downhole spacing) and will be collocated on pads constructed for Mesaverde wells throughout the lower plateau.

4. Based upon a 4/10/03 Colorado Oil and Gas Conservation Commission (COGCC) 10 acre spacing hearing data that Williams submitted, Mesaverde reserves will be 1.17 BCF/well and will occur on 10 acre downhole spacing.

5. On the lower plateau, the Mesaverde will be fully developed at 10 acre spacing inside the existing Rulison, Grand Valley and Parachute field boundaries. It is estimated that this area will be developed in approximately 5 years based upon 20 rigs running, 20 days/well and drilling 365 days per year. The development tendency in this area is to develop the known areas prior to exploring less-known areas. As such, it is assumed that the area outside the existing field boundary will be developed after the area inside the field boundary is developed (5 years) and continue for an additional 15 years of development for a total of 20 years of development. Based on the historical development trend of this area since 1999 (Figure 2a), it was calculated that 3,029 wells could be drilled in 15 years. Based on 10 acre MV spacing and 160 acre Wasatch spacing, there will be 16 MV wells for every Wasatch well. It is believed that development will progress from the field boundary outward at 10 acre spacing.

6. The upper plateau will be drilled concurrently with the lower plateau but at a different schedule rate because of access, weather, infrastructure and directional drilling limitations. The development rate will increase over time as the development and production infrastructure (roads, pipelines, compressors, etc) are improved. It is assumed that on federal land for the first 3 years, 1 rig will be running. For the next 4 years, 3 rigs will be running and for the last 13 years, 5 rigs will be running. Because of existing private surface agreements, easier access and less government involvement, private acreage will be more preferable to develop. On private acreage, it is assumed that for the first 3 years 2 rig will be running. For the remaining 17 years, 5 rigs will be running. Drilling will occur 6 months out of a given year and a typical well will take 30 days to complete.

7. The wells for the upper plateau will generally be drilled vertically for the first 3 years. For the final 17 years, the wells will be drilled directionally on existing pads up to 4 MV wells per pad and an additional Wasatch well every 4th pad with the remaining wells drilled on new pads at 4 MV wells per pad and an additional Wasatch well every 4th pad.

8. Generally, for upper and lower plateaus when directional drilling is employed, pads will be at 40 acre surface locations with Mesaverde wells at 10 acre downhole locations – one drilled vertically and the other three drilled directionally and Wasatch wells at 160 acre downhole locations – all drilled vertically from an existing Mesaverde pad.

9. Development of the Wasatch will occur after much of the Mesaverde development because of the greater reserve and initial production potential and the fact that not much recent emphasis has been placed on the Wasatch (last Wasatch well was drilled in 1994).

* Typical directional wells drilled in this area have horizontal displacements of about 800 feet to 900 feet. COGCC however provided comments that a 2500 foot reach is technically feasible. As such, we also believe that directional drilling will improve and that a 2500 foot reach is reasonable now for the lower plateau and at a later time for the upper plateau. To provide for the most flexibility in pad placement, to lessen surface impacts, and still provide for well displacements that will not leave resources un-recovered, surface locations will probably be limited to 40 acre locations. Pads placed at distances greater than 40 acres could require well displacements greater than 2,500 feet resulting in un-recovered resources. If directional drilling improves and further reaches are obtained, surface locations might expand to 80 or 160 acre locations.