

Alternative Access Route Feasibility Review

West Tavaputs Plateau
Carbon County, Utah



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k p f f Consulting Engineers



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Introduction and Purpose

The Bill Barrett Corporation and other oil and gas operators have developed a plan to drill for natural gas resources on the West Tavaputs Plateau (WTP) located in Carbon County, Utah. A Draft Environmental Impact Statement (DEIS) for the WTP Natural Gas Full Field Development Plan was issued by the United States Department of the Interior, Bureau of Land Management (BLM) in February 2008. The preferred route to and from the WTP Project Area is Nine Mile Canyon Road.

The purpose of this document is to:

- Review relevant sections of the DEIS, including the reasons the BLM provided for dismissing alternative access routes.
- Conduct an assessment of possible alternative access routes that would eliminate, or substantially reduce, the need to use Nine Mile Canyon Road to access the WTP Project Area.

A site visit was conducted on August 19 and 20, 2008, to assess field conditions. GPS waypoints were acquired to aid in the field and to assist in understanding route location.

It is our opinion that an alternative access route solution exists which would allow industrial traffic from the proposed project to avoid use of Nine Mile Canyon as a primary route. A new connecting route would allow industrial traffic to access all three mesas in the WTP Project Area (Prickly Pear, Flat Iron, and Peter's Point) and would connect with a transecting route located in the Left Fork of Trail Canyon, that crosses Nine Mile Canyon Road at the intersection of Nine Mile and Harmon Canyons. Further, any concerns associated with using the connecting routes during winter are comparable to those associated with the use of roads proposed by the BLM in the DEIS.

Review of WTP DEIS

KPFF reviewed the WTP DEIS as part of this feasibility review. In the DEIS, the BLM identified and briefly discussed three alternative access routes to the WTP Project Area:

- New transecting routes from Uinta Basin that cross Nine Mile Canyon Road, including a new road in Trail Canyon;
- the Bruin Point Route; and
- A route around the mouth of Nine Mile Canyon.

(DEIS, pages 2-149 through 2-150.)



In the DEIS, the BLM dismissed these routes from further detailed analysis and without outlining technical findings for various reasons, including the following:

- A new road in Trail Canyon could potentially take traffic to the bottom of Harmon Canyon; however this route would only provide access to the Prickly Pear Mesa and not the other two mesas in the WTP Project Area (Flat Iron Mesa and the Peter's Point Unit)
- The elevation at Bruin Point exceeds 10,000 feet and the road would be difficult to safely maintain in the winter months; and
- The alternative access routes do not meet standards, and would require extensive engineering.

(DEIS, page 2-150.)

Alternative Access Routes

A new BLM collector or primary road connecting Harmon Canyon Road and the Gate Canyon Road via the left fork of Trail Canyon and the existing Rye Patch road system would allow industrial traffic access to the Prickly Pear Unit. A new connecting route from the Prickly Pear Unit across to the Peter's Point Unit is also required to connect the three mesas within the WTP Project Area. It should be noted that this study did not consider potential impacts to sensitive resources that may be associated with alternative access routes.

The following route selections were determined to be the most feasible solutions for providing an alternative access route to and within the WTP Project Area (See Figures 1 and 2 for illustrative maps showing alternative access routes evaluated in this study).

- **Transecting Route - Trail Canyon:** The Gate Canyon Road connects to the Rye Patch Road in Duchesne County. A new route would connect to the Rye Patch Road above the top of Trail Canyon and continue into the left fork of Trail Canyon before connecting into Harmon Canyon Road at the intersection of Nine Mile Canyon Road.
- **Connecting Route A - Mount Bartles Road to Bishop Ridge Road via a Ridge-Top Route:** A new and existing ridge-top route which would connect the Prickly Pear Unit, Flat Iron Mesa, and Peter's Point Unit from the Mount Bartles Road to the Cottonwood and Bishop Ridge Roads. Existing roads such as Water Tank Road, Dry Canyon Road, and Range Valley Mountain Road, would need to be improved to meet current BLM road standards.
- **Connecting Route B - Mount Bartles Road to Bishop Ridge Road via a Canyon Route:** A new and existing canyon route which would connect the Prickly Pear Unit, Flat Iron Mesa, and the Peter's Point Unit. The route would connect from Mount Bartles Road to Dry Canyon Road through the canyon area just north of Horse Ridge. The route would continue from Dry Canyon Road through Cold Springs Draw canyon to Cold Springs Draw Road. This route would continue on Range Valley Mountain Road to the Cottonwood and Bishop Ridge Roads.

The alternative access routes described above would add another 17 to 26 miles of new road construction and improvement (see Table 1: Summary of Alternative Access Route Findings). The DEIS is currently proposing 178 miles of new access roads to serve the WTP Project (DEIS at Appendix F-14).



Both of the connecting routes discussed above would take industrial traffic past Bruin Point to the Range Valley Mountain Road and tie in with the Cottonwood and Bishop Ridge Roads. The DEIS discussed concerns with the elevation at Bruin Point and difficulty maintaining safe winter-time operations. Winter-time considerations for WTP Project Area roads along the different mesa tops and canyon routes, especially those north-facing, would be similar to those of the alternative access routes evaluated in this study. Elevations at the summit of the connecting routes range from 9,500 to 10,000 feet and would gradually decline along the mesa tops served. DEIS project roads near the southern limits of the WTP Project Area have maximum elevations that range from 7,900 to 8,400 feet. A significant variation in snow hydrology is unlikely and the ability to provide snow removal should be considered in greater detail by the DEIS proponent.

Table 1: Summary of Alternative Access Route Findings

Route	Roadway Length (mi)	Average Profile Grade (%)	Maximum Profile Grade (%)	Side Slopes (H:V)
Transecting Route - Trail Canyon	4.4	8	8	1.5:1 and 1:1
<i>Connecting Route A</i> Mount Bartles Road to Bishop Ridge Road via a Ridge-top Route	12.1	8	12	1.5:1 and 1:1
<i>Connecting Route B</i> Mount Bartles Road to Bishop Ridge Road via a Canyon Route	21.1	5.3 and 9.5*	12	1.5:1 and 1:1

*Average profile for canyon north of Horse Ridge is 5.3 percent and Cold Spring Draw is 9.5 percent.

Methodology

BLM road standards were obtained and reviewed to understand minimum design requirements for BLM roads. Criteria found in the BLM/US Forest Service *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – The Gold Book (Fourth Edition – Revised 2007)* and the *BLM Manual 9113 – Roads* were applied in our evaluation of the selected alternative access routes. Information also contained in the WTP DEIS Appendix F, Transportation Plan, was examined to understand design considerations specific to existing and proposed roads within the WTP Project Area that might be applicable to the alternative access routes studied under this review.

Geographical Information Systems (GIS) data containing topographic and surface feature information was obtained through the State of Utah’s GIS Portal made available on-line. The GIS data was imported into Autodesk’s AutoCAD Civil 3D modeling software, which allowed KPFF to build a digital terrain model representative of the existing topographic surface. Roadway corridors were built and processed in the Civil 3D program using conceptual-level alignments, profiles, and roadway cross-section data to check the feasibility of each of the alternative access routes identified.



The alternative access routes were designated as collector or primary roads in mountainous terrain with a design speed of 30 miles-per-hour (mph) and a minimum curve radius of 460-feet. In some instances, the radius was lowered to 50-feet to negotiate sharp bends in topography or for the installation of a switch back. This reduction in the radius correlates to a design speed of 10 mph and was applied in only minor instances.

In conjunction with the horizontal alignment criteria discussed above, the following roadway geometrics were applied to conduct our feasibility review of alternative access routes to the WTP Project Area:

- Maximum grade preferred: 8 percent
- Maximum grade allowed: 12 percent
- 22-foot travel width
- 2-foot deep by 6-foot wide drainage ditch for cut side
- 1.5:1 typical side slope / 1:1 maximum side slope

It is likely that the alternative access routes identified in this study will require variances from the BLM road standards similar to those proposed for WTP Project Area roads in the DEIS. Any variances from BLM road standards should be consistent with those discussed in detail and outlined in the DEIS *Transportation Plan*, which aim to reduce environmental and resource damage. A technical analysis outlining findings and deviations to BLM road standards should be confirmed by the project proponent similar to the others being requested for Project Area roads.

Cost Estimating

A planning level cost estimate was prepared using the BLM's costing methods to identify construction costs for each of the routes evaluated. Quantity assumptions were based on the BLM's *Current Replacement Value Computations – Road Design Guideline, July 2005, Revised December 2007* spreadsheet (see Appendix A). Unit prices for each of the major construction cost items were acquired from the Utah Department of Transportation Concept Level Cost Estimating spreadsheet available online. A 10 percent mobilization and 30 percent contingency was added into the construction cost estimate. Engineering and administration costs were not included. Our estimating analysis indicates that the alternative access routes will range from \$600,000 to \$800,000 per mile. A breakdown of our cost estimating analysis can be found in Appendix B.

KPFF estimated construction costs (in millions) to be the following:

- Transecting Route - Trail Canyon: \$2.6 – 3.5
- Connecting Route A -
Mount Bartles Road to Bishop Ridge Road via a Ridge-Top Route: \$7.3 – 9.7
- Connecting Route B -
Mount Bartles Road to Bishop Ridge Road via a Canyon Route: \$12.7 – 16.9



Findings and Conclusion

KPFF has made three principal findings during this study. First, the routes evaluated as part of this feasibility review can allow industrial traffic to access each of the three mesas in the WTP Project Area. Second, concerns with elevation and safe winter-time operations are common to both WTP Project Area roads and the alternative access routes reviewed under this study. Third, alternative access routes evaluated in this review can meet BLM criteria for roadway design but may need select variances similar to those being applied to WTP Project Area roads. Thus, KPFF concludes that feasible alternative access routes exist that can eliminate or substantially reduce the need to use Nine Mile Canyon Road to access the WTP Project Area.

The DEIS should also consider Argyle Canyon as a possible alternative route. Argyle Canyon was not carried forward in the feasibility review, since it is over 23 miles from a connection with Harmon Canyon and the WTP Project Area to Highway 191. This route would eliminate the need to use Trail Canyon, Rye Patch Road, and Gate Canyon Road for access although it may be more costly to improve and maintain.

While the Bruin Point route may require extensive engineering to access the WTP Project Area for haul trucks and other heavy vehicles, the DEIS proponent should also consider utilizing this route from Sunnyside, Utah to allow access to the mesa areas for light-duty or service trucks. Grades along the Water Canyon Road leading up to Bruin Point from the southwest are near the maximum limit allowed under the BLM road standards, but it is our opinion that this route may allow some opportunity for service trucks to access the WTP Project Area and avoid using Nine Mile Canyon Road.



Appendix A

BLM CRV - Road Design Guideline

CURRENT REPLACEMENT VALUE COMPUTATIONS – ROAD DESIGN GUIDELINES

July 2005, Revised December 2007

Surface Type	Terrain	Surfacing Width	Road Bed Width	Ditch – One side of roadway only		Cut Slopes		Fill Slopes	No. of Culverts	No. of Cattle Guards	No. of Signs	Guardrail
				Type	Depth	FS	BS					
Natural Surface Roads	Flat	10'	12'	V	2'	2:1	2:1	2:1	0.2 per mi.	0.2 per mi.	1 per 10 mi.	none
	Rolling	10'	12'	V	2'	2:1	2:1	2:1	0.4 per mi.	0.2 per mi.	1 per 10 mi.	none
	Mountain	10'	12'	V	2'	2:1	1:1	1.5:1	0.4 per mi.	0.1 per mi.	1 per 10 mi.	none
Aggregate Surface Roads	Flat	10'	12'	V	2'	2:1	2:1	2:1	0.7 per mi.	0.2 per mi.	1 per 10 mi.	none
	Rolling	10'	12'	V	2'	2:1	2:1	2:1	1.6 per mi.	0.3 per mi.	1 per 10 mi.	none
	Mountain	10'	12'	V	2'	2:1	1:1	1.5:1	2.2 per mi.	0.3 per mi.	1 per 10 mi.	none
Asphalt Surface Roads	Flat	10'	12'	V	2'	2:1	2:1	2:1	0.2 per mi.	0.1 per mi.	1 per 10 mi.	none
	Rolling	10'	12'	V	2'	2:1	2:1	2:1	1.0 per mi.	0.3 per mi.	1 per 10 mi.	none
	Mountain	10'	12'	V	2'	2:1	1:1	1.5:1	3.8 per mi.	0.3 per mi.	1 per 10 mi.	none
Western Oregon Natural	Mountain	10'	12'	V	2'	2:1	1:1	1.5:1	4.0 per mi.	0 per mi.	1 per 10 mi.	none
Western Oregon Aggregate	Mountain	10'	12'	V	2'	2:1	1:1	1.5:1	8.0 per mi.	0 per mi.	1 per 10 mi.	none
Western Oregon Asphalt	Mountain	10'	12'	V	2'	2:1	1:1	1.5:1	8.0 per mi.	0.2 per mi.	1 per 10 mi.	none

NOTES:

1. Terrain type guide (pre-construction): Flat = 0-15% sideslopes; Rolling = 16-30% sideslopes; Mountain = >30% sideslopes.
2. Values shown on table are for development of consistent Current Replacement Values only and are not design standards.
3. Road typical section is assumed for a one-lane roadway.
4. CRV unit cost for a two-lane roadway will be computed as the unit cost for a one-lane roadway x 2.
5. Frequency of signs is estimated based on State Engineer input gathered during the May 2005 Roads Team Meeting.
6. Frequency of culverts and cattle guards is based on field information gathered during Road Assessment Phases 1 through 5.
7. Roads on rolling terrain are assumed to have excavation quantities of 10,000 cy/mi. for estimating purposes.
8. Mountain roads, excluding western Oregon, are assumed to have excavation quantities of 15,000 cy/mi. for estimating purposes.
9. For western Oregon mountain roads, it is assumed to have excavation quantities of 20,000 cy/mi. for estimating purposes.
10. All asphalt roads are assumed to have 900 tons (600 binder 2" thick and 300 wear coarse 1" thick) for estimating purposes.



Appendix B

KPFF Cost Estimate



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West Tavaputs Plateau
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Planning Level Cost Estimate for BLM Primary Road

ITEM	QUANTITY	UNIT	UNIT PRICE	EXTENSION	NOTES
Clearing & Grubbing	7.6	AC	\$2,400	\$18,240	
Roadway Excavation & Embankment	31,180	CY	\$8	\$245,698	assumes only 1 V ditch along cut side of roadway
Prepare Aggregate Sub-Base	14,080	SY	\$1	\$10,560	
Fine Grading for Roadway Base	14,080	SY	\$1	\$7,040	
Untreated Base Course	5,940	TN	\$31	\$184,318	9" section depth
Surfacing Course	1,991	TN	\$30	\$59,730	3" section depth
18" Reinforced Concrete Pipe	110	LF	\$63	\$6,937	length based on 50' per culvert and 2.2 culverts/mile
Cattle Guard	0.3	EA	\$25,000	\$7,500	based on 0.3 ea/mile
<i>Subtotal:</i>				\$540,023	
Design Contingency (30%)				\$162,007	
Mobilization (10%)				\$54,002	
Construction Cost Total:				\$756,000 /mile	

Notes:

- Quantity assumptions taken from BLM Current Replacement Value Computations - Road Design Guidelines, July 2005, Rev. December 2007 spreadsheet for aggregate surface roads in Mountainous Terrain.
- Quantities are based on two-lane road for 1 mile of roadway & assumes 20' surfacing width and 24' road bed width for 22' average travel width.
- Unit prices taken from UDOT cost data available on-line.
- 30% Design Contingency used at planning level stage.
- 10% Mobilization added from subtotal.