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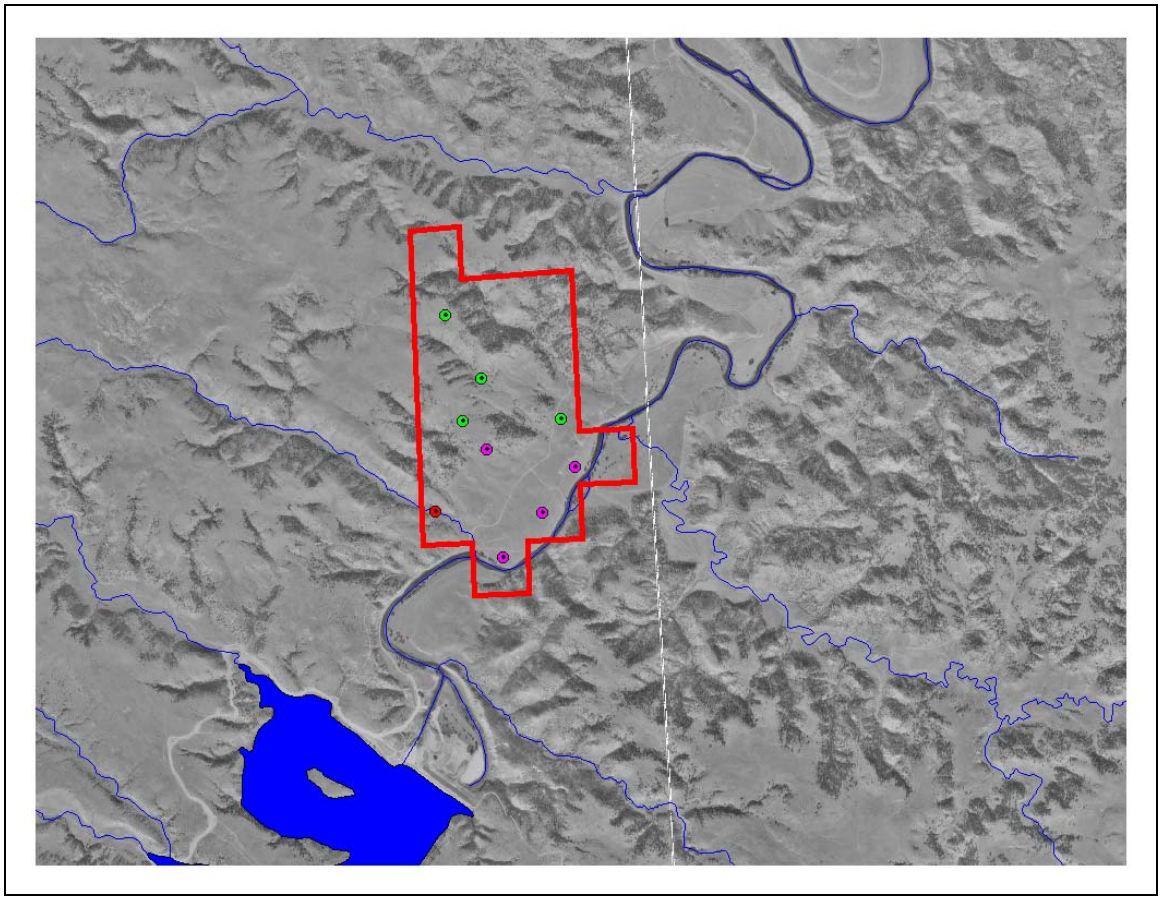
Powder River Gas LLC
Coal Creek CBNG POD

Hydrology Technical Report

July 9, 2004



Bureau of Land Management
Miles City Field Office
Miles City, MT

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INTRODUCTION/AREA DESCRIPTION:
Powder River Gas, LLC has proposed a Project Plan of Development (POD) to drill and test for coal bed natural gas (CBNG) in eight federal and eight fee wells at 8 locations (2 wells per location) in an area northeast of the Tongue River Reservoir, Big Horn County of southeastern Montana. Two existing fee wells at one site would also be tested.

It is anticipated that this testing procedure will require up to 6 weeks to complete. No production facility, compressor or other infrastructure for the production of CBNG is proposed. After testing is completed, the sites would be shut-in. These proposed wells would be finished in the Wall and Flowers-Goodale coal zones at depths varying from approximately 250 to 1,500 feet below ground surface.

A Higgins Loop type ion exchange water treatment facility will be used to manage the produced water, and the treated effluent will be discharged directly into the Tongue River. The residual brine produced by this process will be shipped off site and disposed of in a properly permitted injection well.

These well sites are located in T. 8 S., R. 41E., Sections 6 and 7. This project area is located approximately 1 mile down stream from the Tongue River Dam, and on the west side of the Tongue River. Approximately 6.5 miles of existing two-track trails, and 1.5 miles of improved road will be needed to access the POD facilities. (See Map 1)

All of these well sites are located in the Upper Tongue River 4th Order Watershed and either drain into the Tongue River via ephemeral drainages, or drain directly into the Tongue River. (See Map 1)

According to the climatic data provided by the MAPS Atlas website prepared by MSU Bozeman (http://stone.msu.montana.edu/ma6/basemap/viewer.htm) this area (MAPS cell 16976) receives an average of 12”-14” of precipitation per year, and has the potential for 43 inches of evaporation (Penman Method).

Three of the new fee well sites (11-7, 7-7, and 1-7) are located on alluvial deposits adjacent to the Tongue River. One new fee well site (3-7), one existing fee well site (5-7), and one of the new federal well sites (15-6) are located on the Tongue River Member of the Fort Union Formation. Three new federal well sites (5-6, 13-6, and 11-6) are located on the clinker deposits associated with the burned coals from the Tongue River Member of the Fort Union Formation. The Tongue River Member of the Fort Union Formation is a terrestrial deposit composed of interbedded sand, silt, clay, and coal. Large portions of this unit are covered by “clinker” deposits, which form due to coal fires baking overlying clastic materials. Clinker is resistant to erosion, fractured, and typically bright red. Many of the ridge tops are capped with clinker, and clinker also occurs on hillsides where coal seams have burned. (See Map 2)

ALTERNATIVES ANALYZED:
The following is a summary of the alternatives analyzed. Complete descriptions are found within the Powder River Gas Coal Creek POD EA (MT-020-2004-58).

No Action by Any Agency (No Action):
This alternative would have no MDEQ, MBOGC, and BLM approved actions and none of the private and federal wells in the POD would be drilled or tested, nor would any of the associated infrastructure be constructed. The entire Powder River Gas, Coal Creek POD would be denied and not take place at any level. It should be noted that under the proposed POD the BLM could not issue APDs without state action, therefore this alternative also addresses the possibility of "No State Action."

No Federal Action:
In this alternative, there would be no BLM approved actions and none of the federal wells in the POD would be drilled and tested. This alternative would include the drilling of eight private CBNG wells on four locations. The eight new wells and two existing wells would be used to test the Flowers-Goodale and Wall coal zones for CBNG potential.

All of the wells and associated infrastructure would be located on private surface. The road and pipeline routes are proposed as agreed to by the appropriate private surface owner. Where possible the roads would serve as a common corridor for the gas, electric, and water.

No earthwork would be needed to prepare the proposed drilling locations. Each well location would have a 25' by 40' reserve pit for the disposal of cuttings.

CBNG potential will be determined by pumping groundwater from the coal seams, thereby reducing hydrostatic pressure and causing the methane to become desorbed from the coal surface and flow to the wells. Produced gas will be vented approximately 10' from ground level. In areas where there is a safety concern or a possible ignition source the gas will be flared. Testing would last no longer than 6 weeks and not exceed 30,000 cubic feet per day per well. After testing, the gas will be shut off, groundwater pumping will cease, and gas pressures will be monitored.

Part of this alternative is to treat water produced from the wells using a Higgins Loop treatment facility prior to discharging it to the Tongue River. The construction of this treatment facility will require the disturbance of an area 200' by 200' (0.92 acres) of private surface. Within this facility concentrated HCl and residual Na-Cl brine will be stored. All chemical containment facilities will be surrounded by a shallow spill containment burm to prevent any accidental chemical spill from leaching into the surrounding soil profile and eliminate transmission to groundwater. A total containment impoundment will also be located within Higgins Loop treatment facility complex. This impoundment would have a total storage capacity of 0.5 acre-feet. When completed, the pit will be separated into two chambers, each measuring 125' long by 62.5' wide by 10' deep. In addition, the entire structure will be lined with a 12 mil polyethylene liner to insure that no infiltration to ground water occurs. Once produced water leaves the CBNG

wells it will be piped to the treatment complex and discharged directly into one pit chamber to allow for settling of suspended sediments that may be present due to the production process and to release any residual natural gas. Once settling has occurred, the produced effluent will then enter the Higgins Loop for the treatment process.

The primary objective in treating CBNG produced water is removal of sodium (Na^+) in order to reduce SAR levels. In addition, some situations may require the removal of barium and other heavier cations in order to meet MPDES discharge requirements. A strong acid cation exchange resin is used to scavenge the cations from the water as it is passed through the Higgins Loop. The cations are replaced by hydronium ions from resin beads. The hydronium ions are released in the treated water, which lowers the pH of the water. This will allow the bicarbonate ions in the water to react with the hydonium ions to form carbon dioxide gas. The treated water is then discharged to a neutralizing bed where excess hydronium ions and residual bicarbonate ions can react with selected calcium to achieve the desired pH. Note that neutralizing agents other than calcium may be used should the need arise. Once the pH has been stabilized the effluent will then enter the remaining pit chamber prior to discharge to the plunge pool.

Concurrent with the sodium and other cation loading that is taking place in the absorber section of the Loop, cations are stripped from the resin in the regeneration section. Dilute hydrochloric acid is injected into the loop and moves counter-current to the resin to the spent brine discharge, leaving the resin restored to the hydronium form. Concentrated brine volumes average approximately 1.0% of the total Loop feed volume, depending on the cation loading that is removed from the treated water. Excess brine that is not recycled to other beneficial uses will be transported offsite by truck for disposal injection into a Class One, deep disposal well located in Wyoming. The waste stream from the treatment process, at maximum flow, will generate approximately 60 barrels of brine or reject water per day. Note, that these disposal wells are permitted and approved by all state, local and federal regulatory agencies. Precautionary measures will be taken to ensure safe transport of brine from the facility to the disposal well. Especially when transporting adjacent to water bodies of the State. During periods of adverse weather and driving conditions, transportation efforts may be suspended until more favorable conditions exist. In the event of an accidental spill, all pertinent governing agencies will be immediately notified.

The treated water would be discharged at one outfall location to the Tongue River. The outfall structure will consist of a rock riprap plunge pool lined with an anti-erosion fabric. An energy dissipation device would be installed to decrease erosion potential. Based upon the operators POD book submission, under this alternative ten wells would discharge under this alternative at an average rate of 25 gpm per well, for a total discharge of 250 gpm (0.56 cfs) of treated water. For additional construction details please see the POD book for this project.

Reclamation of the surface would begin after construction is completed. Completion of reclamation would occur within one year (or sooner) of the construction (depending on the weather). The disturbed areas would be disked and seeded with a seed mix approved

by the Natural Resource Conservation Service and the surface owner. Powder River Gas proposes to do the reseeding in the fall of 2004.

No production facility, compressor, or other infrastructure for the production of CBNG is proposed. After testing is completed, the sites would be shut-in.

Additionally, the Operator has committed to:

- Comply with all applicable Federal, State, and local laws and regulations.

- Obtain the necessary permits for the drilling and testing the wells.

- Provide water well agreements to the owners of record for permitted water wells within the area of influence of the action.

- Provide water analysis from a designated reference well in each coal zone.

Proposed Action:
Powder River Gas proposes to drill 16 CBNG wells in the Coal Creek Project Area. Eight federal wells would be drilled at four locations, and eight private wells would be drilled on four locations. The 16 new wells and two existing wells would be used to test the Wall and Flowers-Goodale coal seams for CBNG potential.

All of the wells and associated infrastructure are proposed on private surface. The road and pipeline routes are proposed as agreed to by the appropriate private surface owner. Where possible the roads would serve as a common corridor for the gas, electric, and water.

At seven of the eight sites no earthwork would be needed to prepare the proposed drilling locations. Each drilling location would have a 25' by 40' reserve pit for the disposal of cuttings. At one of the federal drilling locations (11-6) pad construction will be needed prior to drilling.

CBNG potential will be determined by pumping groundwater from the coal seams, thereby reducing hydrostatic pressure and causing the methane to become desorbed from the coal surface and flow to the wells. Produced gas will be vented approximately 10' from ground level. In areas where there is a safety concern or a possible ignition source the gas will be flared. Testing would last no longer than 6 weeks and not exceed 30,000 cubic feet per day per well. After testing, the gas will be shut off, groundwater pumping will cease, and gas pressures will be monitored.

Part of this alternative is to treat water produced from the wells as described under the No Federal Action Alternative. Based upon the operators POD book submission, under this alternative 18 wells would discharge under this alternative at an average rate of 25 gpm per well, for a total discharge of 450 gpm (1.0 cfs) of treated water.

Reclamation of the surface would begin after construction is completed. Completion of reclamation would occur within one year (or sooner) of the construction (depending on the weather). The disturbed areas would be disked and seeded with a seed mix approved by the Natural Resource Conservation Service and the surface owner. Powder River Gas proposes to do the reseeding in the fall of 2004.

No production facility, compressor or other infrastructure for the production of CBNG is proposed. After testing is completed, the sites would be shut-in.

Additionally, the Operator has committed to:

- Comply with all applicable Federal, State and Local laws and regulations.

- Obtain the necessary permits for the drilling and testing the wells.

- Provide water well agreements to the owners of record for permitted water wells within the area of influence of the action.

- Provide water analysis from a designated reference well in each coal zone.

During field visits to each of the proposed locations (on-sites), all areas of proposed surface disturbance, and the area proposed for the outfall to the Tongue River, were inspected to ensure that potential impacts to natural resources would be minimized. As a result of these on-sites the pipeline from the Long Federal 5-6 well was moved to reduce surface disturbance.

To maintain soil productivity, provide necessary protection to prevent excessive soil erosion on steep slopes, and to avoid areas subject to slope failure, mass wasting, piping, or having excessive reclamation problems, there is a Controlled Surface Use stipulation applied to the following lands: T. 8 S., R. 41 E., Section 6: Lots 3-7, incl.; SE¼NW¼, E½SW¼, W½SE¼.

EFFECTED ENVIRONMENT:

Surface Water:

All of the proposed well sites are located in the Upper Tongue River 4th Order Watershed. This reach of the Tongue River is not listed on the MDEQ's current (2002) 303(d) list for impaired streams under the Clean Water Act (CWA), nor has it been identified on the Draft 2004 303(d) list. Further downstream, from the diversion dam just above Pumpkin Creek (12-mile diversion dam for the TY irrigation ditch) to the mouth, the Tongue River has been listed as impaired. The MDEQ has identified flow alteration as the probable cause of the impairment, and dam construction and flow regulation/modification as the probable sources of impairment along this downstream reach. The Tongue River is the only perennial river in the project area. None of the ephemeral tributaries to the Tongue River in this area have been listed as impaired. The TMDL process for the Tongue River watershed is currently underway.

The proposed action for the PRG Coal Creek project includes one discharge into the Tongue River downstream from the Tongue River Reservoir Dam. There is a USGS Gaging Station located just upstream of this discharge point and below the Tongue River Dam. This station is shown on Map 1. Data from this station should be representative of this reach of the Tongue River.

Electrical Conductivity (EC) and Sodium Adsorption Ratio (SAR) are the parameters most likely to be effected by CBNG development (MDEQ, 2003). For this reason the discussion in this document will focus on these parameters. EC is the ease with which water will transmit a current, and is proportional to salinity or total dissolved solids (TDS). SAR is a complex ratio of sodium vs. calcium plus magnesium, and is an important parameter for determining the usability of water for irrigation (See CBM-EIS; BLM, 2003, for further information). SAR is defined as:

$$SAR = \frac{Na}{\sqrt{\frac{Ca + Mg}{2}}}$$

where all constituents are in milliequivalents per liter (meq/L).

There are currently 3 existing or proposed CBNG discharge permits to the Tongue River. These discharges are summarized below. The one existing permit (MT0030457) is for untreated discharge, while the draft permit for this project (MT0030660), and the pending application (MT0030724) are both for treated discharges. The Fidelity discharges are, or are proposed to be, located upstream of the Tongue River Reservoir.

Table 1: MPDES Permits for CBNG Discharges

Permit Number	Owner/Operator	Permit Status	Volume (gpm)	Treated (Y/N)
MT0030660	Powder River Gas, LLC	Draft	1,600	Y
MT0030457	Fidelity Exploration & Production Company	Issued	1,600	N
MT0030724	Fidelity Exploration & Production Company	Application Pending	1,700	Y

The historical Pre-CBNG water quality, as measured by EC and SAR, at the Tongue River station below the dam, and at Birney Day School are shown in the table below. This historical water quality data was determined based upon historical USGS data and the analysis contained in the MDEQ's Statement of Basis for the MPDES permit (see Appendix B). This Pre-CBNG data do not accurately represent the existing conditions however, since there is an existing untreated CBNG discharge occurring upstream from the reservoir (MT0030457). For this reason the effects of this discharge are modeled as described in Appendix A of this report, to depict existing conditions. The result of this modeling is shown in Table 2 below.

Table 2: Comparison of Historical Surface Water Conditions to Modeled Existing Conditions

		Historical Conditions+			Modeled Existing Conditions*		
	Flow Conditions	Discharge (cfs)	EC (µS/cm)	SAR	Discharge (cfs)	EC (µS/cm)	SAR
Tongue River Below Dam	7Q10	70.0	809	0.97	73.6	832	1.27
	LMM	179.0	646	0.78	182.6	664	0.98
	HMM	1429.0	392	0.49	1432.6	398	0.55
Tongue River at Birney Day School	7Q10	49.0	1134	1.56	52.6	1157	1.87
	LMM	173.0	719	1.02	176.6	737	1.23
	HMM	1119.0	377	0.56	1122.6	383	0.62

+ The historical conditions for the station Below the Dam were determined from USGS data collected from 1975-1998. Birney Day School historical conditions were determined from USGS data collected from 1978-1998.

* The modeled existing conditions include historical values, plus modeled effects from the existing 3.57 cfs discharge of untreated CBNG water upstream from the Tongue River Reservoir.

The Montana Board of Environmental Quality has established surface water standards for EC and SAR. These standards have been reviewed and approved by the EPA, and therefore have Clean Water Act standing. The Northern Cheyenne Tribe has also adopted surface water quality standards for EC and SAR. The Northern Cheyenne Tribe has not been granted "Treatment as a State" status by the EPA, and therefore the EPA has not reviewed these standards. As such the Northern Cheyenne numerical standards do not have Clean Water Act standing; however they do set out the Tribe's considered determination of the water quality needed to protect irrigated agriculture on the Reservation (Northern Cheyenne Tribe, 2002). Therefore the Northern Cheyenne

standards provide reasonable criteria against which to compare the resulting water qualities. These standards were expressly developed to protect the agricultural uses of the Tongue River, which has been determined to be the most sensitive beneficial uses of the Tongue River (BLM, 2003a). As such any changes in EC and SAR that do not cause these standards to be exceeded would not be anticipated to impair the beneficial uses of the Tongue River. These various standards are summarized in Table 3.

Table 3: Surface Water EC and SAR Standards for the Tongue River

	Monthly Mean SAR	Inst. Max SAR	Monthly Mean EC (µS/cm)	Inst. Max EC (µS/cm)
MT-DEQ Irrigation Season[1] Standards	3.0	4.5	1000	1500
MT-DEQ Non-Irrigation Season[1] Standards	5.0	7.5	1500	2500
Northern Cheyenne Irrigation Season[1] Standards; Southern Boundary	---	2.0	1000	2000
Northern Cheyenne Non-Irrigation Season[1] Standards; Southern Boundary	---	2.0	---	2000

1: The Irrigation Season specified by the MT-DEQ is from March 1st to October 31st while the Irrigation Season specified by the Northern Cheyenne is from April 1st to November 15th.

For the purposes of this impact analysis the high mean monthly and low mean monthly results will be compared to the mean monthly standards, while the 7Q10 result will be compared to the instantaneous maximum standards. This is appropriate since the 7Q10 is the lowest flow that would be expected to occur for 7 consecutive days over any 10 year period.

For more general information regarding surface water, please refer to the CBM EIS Chapter 3, Affected Environment, pages 3-22 through 3-31 (BLM, 2003), the Water Resources Technical Report (ALL, 2001), and the Surface Water Quality Analysis Technical Report (SWQATR) (Greystone and ALL, 2003). Real time and historical monitoring data for the Tongue River is also available from the USGS at http://tongueriver monitoring.cr.usgs.gov/index.htm.

Groundwater:

The wells to be drilled under this proposal are to be between approximately 250' and 1500' into the Wall and Flowers-Goodale coal zones. Eight new wells would be completed in each of the coal seams, one well is currently completed in each coal seam. The Wall and the Flowers-Goodale coal zones are contained within the Tongue River Member of the Fort Union Formation. In this area, the top of the Wall coal is at approximately 3,200 feet above mean sea level (ft-amsl) and it is approximately 55 feet thick. The top of the Flowers-Goodale coal is at approximately 2,300 ft-amsl and it is approximately 20 feet thick.

Based upon water analysis from the existing CBNG wells in the POD area the SAR of the raw CBNG water is expected to be approximately 53.2, and the EC is expected to be 1,355 µS/cm. This water will be treated using the Higgins Loop ion exchange method developed by EMIT Technology such that the effluent EC will be approximately 493 µS/cm and the SAR approximately 0.03. The treated water would then be mixed with untreated water, resulting in the discharged water having an EC less than 1,000 µS/cm and SAR less than 3.0.

Due to the common clay rich layers in the Tongue River member of the Fort Union formation the vertical hydraulic conductivity in these units is very low. Based upon the results of 370 aquifer tests, Wheaton and Metesh (2002) have calculated that the horizontal hydraulic conductivity values of the coal seam aquifers in the Fort Union Formation are typically between $9.8x10^{-2}$ and $1.3x10^{1}$ feet per day, with a geometric mean of 1.1 feet per day. Mean storativity values of these coals are approximately $9x10^{-4}$ (storativity is unitless) (Wheaton and Metesh, 2002).

The Montana Bureau of Mines and Geology (MBMG) maintains the Groundwater Information Center (GWIC) database of known wells, springs, and borings in Montana. Under current Montana law drillers are required to provide well logs for all wells drilled to MBMG, or indirectly to DNRC, within 60 days of drilling the well. This database is used to determine the wells or springs which are located within the potential drawdown area. Only those wells that are finished within the coal seams being developed, and are located within the potential drawdown area, would be anticipated to be impacted by groundwater drawdown. Only those springs which emit from the developed coal seam, and are located within the potential drawdown area would be anticipated to be impacted by groundwater drawdown.

The Operator has certified that for each well "All potentially affected landowners having existing water wells within the circle of influence for the proposed well will be offered a Water Well Agreement." This is in compliance with the requirements of the Powder River Basin Controlled Groundwater Area (MT-BOGC, 1999).

For additional general information on groundwater, please refer to the CBM EIS (BLM, 2003), Chapter 3, Affected Environment pages 3-22 through 3-39 (ground water), the 2D modeling report (Wheaton and Metesh, 2001) and the 3D modeling report (Wheaton and Metesh, 2002). Groundwater monitoring information relating to CBNG (CBM) development is also available by signing in to MBMG's online GWIC database at http://mbmggwic.mtech.edu/ and using the Ground-Water Projects link.

ENVIRONMENTAL CONSEQUENCES:
The operator has submitted a comprehensive Water Management Plan (WMP) for this project. It is incorporated-by-reference pursuant to 40 CFR 1502.21. Qualified hydrologists, in consultation with the BLM, developed the water management plan. This WMP is summarized in the alternatives section of this report. Qualified hydrologists, in consultation with the BLM, developed the water management plan. Adherence with the plan should minimize project area and downstream potential impacts from proposed water management strategies. The MDEQ has assumed primacy from the United States Environmental Protection Agency for issuing waste water discharge permits in the state.

The treated water would be suitable for all of the proposed beneficial uses. Therefore no direct, indirect, or cumulative effects would be anticipated to results from these uses. For the following analysis it will be assumed that all produced water will be treated and discharged into the Tongue River since any beneficial uses in and around the Coal Creak POD area would simply decrease the magnitude of the predicted direct, indirect, and cumulative impacts, and specific beneficial uses have not been identified at this time. If specific beneficial uses are to be used in the future for water produced from the Federal mineral estate, they must be submitted to the BLM via Sundry Notice, reviewed, and approved prior to implementation. Appropriate water right permits must be in place prior to the diversion of waters for beneficial uses.

Direct and Indirect Impacts:
Direct impacts address the short term direct impacts from an alternative. Indirect impacts are those impacts which occur in the same area as the proposed action, but occur over a longer period of time than the direct impacts. As these types of impacts are closely related for this project they will be addressed together.

Surface Water – Discharge of Produced Water:
A mass balance spreadsheet type surface water model was used to provide a comparison of impacts from the alternatives. Appendix A contains a description of this model. It should be noted the approach used is not a regulatory compliance analysis, but rather an impact analysis. The standards in this analysis provide a context to gauge significance. A regulatory compliance analysis would use median water chemistry and a specific flow to determine compliance with standards. This analysis uses a different approach to more closely depict the actual impacts that would be anticipated. The results of this model are summarized below.

No Action:
Under the No Action alternative no MPDES permit would be issued by the MDEQ. No discharge to surface waters would occur. Therefore no impacts to surface water resources are anticipated to result from the discharge of produced water under the No Action alternative.

No Federal Action:
Under the No Federal Action alternative the PRG Coal Creek project would discharge 0.56 cfs of treated water. Based upon the MPDES application this discharge will have an

EC of less than 1,000 µS/cm and an SAR of less than 3. The direct effect of this discharge would increase the EC and SAR of the stream since the EC and SAR of the discharge water are higher than any of the modeled existing conditions. These results are summarized on Table 4.

Proposed Action:
Under the Proposed Action alternative the PRG Coal Creek project would discharge 1.0 cfs of treated water. The direct effect of this discharge would be to increase the EC and SAR of the stream since the EC and SAR of the discharge water are higher than any of the modeled existing conditions. These results are summarized on Table 4.

Comparison of the resultant water quality values for all alternatives to the standards shows that during HMM and LMM flows none of the mean monthly standards are exceeded. During 7Q10 flows the instantaneous maximum standards are not exceeded. These standards were expressly adopted to protect irrigated agriculture, which the MDEQ has identified as the most sensitive beneficial use of the Tongue River (BLM, 2003). As such protection of irrigated agriculture should be adequate to protect all other beneficial uses of the Tongue River, including aquatic life, drinking water, industrial uses, and recreational uses. As such, the results of this analysis indicate that neither the proposed action, nor any of the alternatives, would directly impair the beneficial uses of the Tongue River.

Table 4: Comparison of Direct Impacts to Surface Water from the Alternatives

		Modeled Existing Conditions			No Federal Action (0.56 cfs from PRG)			Proposed Action (1.0 cfs from PRG)		
	Flow Conditions	Discharge (cfs)	EC (µS/cm)	SAR	Discharge (cfs)	EC (µS/cm)	SAR	Discharge (cfs)	EC (µS/cm)	SAR
Tongue River Below Dam	7Q10	73.6	832	1.27	74.1	834	1.28	74.6	835	1.29
	LMM	182.6	664	0.98	183.1	666	0.99	183.6	667	0.99
	HMM	1432.6	398	0.55	1433.1	399	0.55	1433.6	399	0.55
Tongue River at Birney Day School	7Q10	52.6	1157	1.87	53.1	1159	1.88	53.6	1160	1.88
	LMM	176.6	737	1.23	177.1	738	1.23	177.6	740	1.23
	HMM	1122.6	383	0.62	1123.1	384	0.62	1123.6	384	0.62

Note: The Direct result of the No Action alternative would be no discharge, thus the result would be no different than existing conditions.

Surface Water – Disturbance Related Impacts:

No Action:

There would be no disturbance of the surface related to the No Action alternative, therefore no impacts to surface waters would be anticipated to occur as a result of the No Action alternative.

No Federal Action:

Well drilling, road construction, and the construction of the water treatment plant and discharge point will cause disturbance of vegetation, and cause corresponding increases in soil erosion potential. Increased soil erosion potential could cause increases in suspended sediment loads to local surface waters. The increase in suspended sediments to surface waters resulting from disturbance should be minor, based on the operator's plans and BLM applied mitigation.

All four of the proposed fee well sites can be drilled without a well pad being constructed. Only minor surface disturbance would occur with the drilling of these wells. This disturbance would only involve digging-out of rig wheel wells (for leveling drill rig on minor slopes), reserve pit construction (estimated approximate size of 25' by 40'), and compaction (from vehicles driving/parking at the drill site), for a total disturbance of 0.1 acres per well site. Estimated disturbance associated with drilling the four fee well sites would involve the disturbance of approximately 0.4 total acres. This should be a short term, minor impact with expedient, successful reclamation and site-stabilization, as proposed by the operator in their Surface Use Plan.

Other Stuff?? Water and gas pipelines, buried electric, overhead electric etc? Make sure all the stuff in the EA is addressed in here!

Approximately 0.5 miles of improved roads and 1.0 mile of two tracks will be needed to access the POD facilities. Soil productivity will be eliminated along improved roads and severely restricted along two tracks. Short term soil erosion by wind and water could affect soil health and productivity. Expedient reclamation of disturbed land along the roads and utilization of erosion control measures (e.g., waterbars) would minimize impacts to soil productivity and stability.

Due to the low intensity of the proposed disturbance, the commitment to timely reclamation, and the presence of sediment filtering vegetation between the well sites and live water, any increases in suspended sediment loads as a result of the proposed action would be unnoticeable and of short duration.

Proposed Action:

Three of the four proposed federal well sites, and all four of the proposed fee well sites, can be drilled without a well pad being constructed. Only minor surface disturbance would occur with the drilling of these sites. The disturbance would only involve digging-out of rig wheel wells (for leveling drill rig on minor slopes), reserve pit construction (estimated approximate size of 25' by 40'), and compaction (from vehicles driving/parking at the drill site), for a total disturbance of 0.1 acres per well site. One of

the wells sites (11-6) will require a well pad to be constructed, resulting in a disturbance of 0.5 acres. Estimated disturbance associated with drilling these 16 wells would involve the disturbance of approximately 1.2 total acres. This should be a short term, minor impact with expedient, successful reclamation and site-stabilization, as committed to by the operator in their Surface Use Plan and as required by BLM in the Conditions of Approval (COAs).

Other Stuff?? Water and gas pipelines, buried electric, overhead electric etc? Make sure all the stuff in the EA is addressed in here!

Approximately 1.5 miles of improved roads and 6.5 miles of two-track trails will be needed to access the POD facilities. Soil productivity will be eliminated along improved roads and severely restricted along two tracks. Short term soil erosion by wind and water could affect soil health and productivity. Expedient reclamation of disturbed land along the roads and utilization of erosion control measures (e.g., waterbars) would minimize effects to soil productivity and stability.

Due to the low intensity of the proposed disturbance, the commitment to timely reclamation, and the presence of sediment filtering vegetation between the well sites and live water, any increases in suspended sediment loads as a result of the proposed action would be unnoticeable and of short duration.

Groundwater:
Under the right conditions natural gas (CH_4; methane) is adsorbed onto coal surfaces. In order to develop or test CBNG the methane must be desorbed from the coal so that it can flow to the well. This is typically accomplished by reducing the hydrostatic pressure within the coal seam by pumping groundwater to near the top of the coal seam. Dewatering of the coal seam is not desired since this would cause the cleat to close up, and inhibit the flow of methane. This pumping of groundwater has the potential to adversely affect water wells and springs which receive their water from the coal seam being developed. These effects may be due to decreased yields resulting from lower static water levels or from the migration of methane into wells. Spring yield may also be impacted if the spring receives its flow from a regional flow system, and that system is interrupted by a CBNG field.

No Action:
Under the No Action alternative none of the wells would be drilled, tested, or produced therefore no impacts to groundwater would be anticipated.

No Federal Action:
Under the No Federal Action alternative the eight proposed fee wells, and the two existing fee wells would be drilled and tested for CBNG potential. This testing may last for up to 6 weeks. The removal of water from the Wall and Flowers-Goodale coal seams would cause a cone of depression to form around each well.

In order to analyze the potential drawdown associated with this action a Theis equation type groundwater drawdown model was prepared assuming that the coals are confined aquifers, that regional hydrologic properties apply (K= $9.8x10^{-2}$ to 13 feet/day (geometric mean =1.1 feet/day) and S=$9x10^{-4}$), and that the aquifers are isotropic and homogeneous. Based upon the drilling prospectus data contained in the POD the thickness of the Wall coal is assumed to be 55 feet, and the thickness of the Flowers-Goodale coal is assumed to be 20 feet. It is predicted in the POD that the initial production rate for these wells will be 25 gpm. A more detailed description of this drawdown analysis may be found in Appendix C of this report.

As shown in Table 5 this model indicates that with the 10 fee wells pumping (5 from each seam) the 20' drawdown contour may extend up to approximately 0.36 miles from the development area after 6 weeks of pumping.

Table 5: Summary of Direct Predicted 20 Foot Drawdown - No Federal Action

Time Pumped	Average Pumping Rate per Well (gpm)	Average Pumping Rate per Coal Seam (gpm)	Coal Seam	Hydrologic Conductivity (K)		
				$9.8x10^{-2}$ ft/day	1.1 ft/day	13 ft/day
6 weeks	25	125	Wall	0.14	0.36	0.04
			Flowers-Goodale	0.09	0.26	0.26

The groundwater modeling conducted in support of the CBM EIS anticipated that for a hypothetical CBNG field with 1,082 wells producing for 20 years, the produced coal seams will recover 70% of their hydrostatic head within 5-12 years after the end of production. It is anticipated that due to the shorter duration of pumping, and the lower number of wells, that recovery for this area will be more rapid. The exact radius of the drawdown cone, and the time required for the head to recover, will depend on the site specific aquifer properties and the precise timing of the pumping of each of the wells. For additional discussion of the anticipated drawdown related impacts please see pages 4-61 to 4-63 of the CBM EIS (BLM, 2003), and the associated groundwater modeling reports (Wheaton and Metesh 2001, Wheaton and Metesh, 2002).

Those wells and springs located within the area of drawdown, and which receive their water from the coal seam being pumped, may be affected by this drawdown. Map 3 in the Figures section of this report shows that area which may be drawn down as a direct result of the No Federal Action alternative. One well exists within this potential drawdown area. As shown in Appendix C, this is the Bill Musgrave well in T8S, R41E, Section 7. Based upon the reported well depth (146 feet), and the elevation of this site based upon topographic maps (3,700 ft-amsl), this well is finished at an elevation of approximately 3,554 ft-amsl. The top of the Wall coal in this area is at approximately 3,200 ft-amsl. As such it is not anticipated that this well will be directly affected by this project under the No Federal Action alternative.

The operator has also certified that "all land owners within the proposed CBNG well's circle of influence are being offered a Water Well Mitigation Agreement. If a water well

mitigation agreement is not reached with the landowners, the company agrees to mitigate the impacts of the CBNG wells in accordance with Montana State Water Laws" this is in compliance with the Powder River Basin Controlled Groundwater Area Order by the MT-DNRC (1999). This Order requires that operators offer water mitigation agreements to owners of water wells or natural springs within one mile of a CBNG field, or within the area that the operator reasonably believes may be impacted by CBNG production, whichever is greater and to extend this area one-half mile beyond any well adversely affected. These mitigation agreements apply to any spring or well adversely impacted by CBNG wells. As such, these agreements would apply to those wells which experience an impact to their use whether it is due to decreased yields, the production of methane, or a change in water quality. The replacement of water required by these agreements is anticipated to take the form of reconfiguring existing wells, re-drilling wells, or drilling new wells. These processes would be effective for replacing water sources since the drawdown from CBNG activity is anticipated to be confined to the coal seam aquifers and not noticeably affect other aquifers (such as sandstones) within the Tongue River Member of the Fort Union Formation. Any such lost water sources would be replaced with a permanent source before the termination of the agreement. The order also requires the monitoring of water sources by the CBNG operator. Data from monitoring would be provided to the affected water source owner. Impacts would not be expected after the cessation of CBNG development since the aquifer would then be in the recovery phase, with groundwater levels rising in the area that had been drawn down by CBNG development. Therefore, it is anticipated that these required water mitigation agreements would mitigate the potential impacts from groundwater drawdown, methane migration or changes in groundwater quality.

The potential for cross contamination of aquifers will be avoided by cementing from the top of the produced coal zone to the surface. For further details on the drilling and cementing program see the Master Surface Use Plan and Drilling Plan in the individual APDs.

Shallow groundwater is not anticipated to be impacted by this alternative since proper well completion techniques and lining of the proposed impoundment will prevent the introduction of produced CBNG water into shallow aquifers.

Proposed Action:
Under the Proposed Action alternative the impacts to groundwater will be similar to those depicted for the No Federal Action alternative except that the 8 proposed federal wells would also be tested.

As shown on Table 5 the groundwater model indicates that with 18 wells (9 from each seam) the 20 foot drawdown contour may extend approximately 0.48 miles from the POD area after 6 weeks of pumping.

Table 6: Summary of Direct Predicted 20 Foot Drawdown - Proposed Action

Time Pumped	Average Pumping Rate per Well (gpm)	Average Pumping Rate per Coal Seam (gpm)	Coal Seam	Hydrologic Conductivity (K)		
				$9.8x10^{-2}$ ft/day	1.1 ft/day	13 ft/day
6 weeks	25	225	Wall	0.14	0.41	0.21
			Flowers-Goodale	0.09	0.28	0.48

The groundwater modeling conducted in support of the CBM EIS anticipated that for a hypothetical CBNG field with 1,082 CBNG wells field, wells finished in 3 coal seams, producing for 20 years, the produced coal seams will recover 70% of their hydrostatic head within 5-12 years after the end of production. It is anticipated that due to the lower number of wells, that recovery for this area will be more rapid. The exact radius of the drawdown cone, and the time required for the head to recover, will depend on the site specific aquifer properties and the precise timing of the pumping of each of the wells. For additional discussion of the anticipated drawdown related impacts please see pages 4-61 to 4-63 of the CBM EIS (BLM, 2003), and the associated groundwater modeling reports (Wheaton and Metesh 2001, Wheaton and Metesh, 2002).

Map 3 in the Figures section of this report shows that area which may be drawn down as a direct result of the Proposed Action alternative. According to MBMG's GWIC database (http://mbmggwic.mtech.edu/), only the Musgrave well is located within this drawdown area. As discussed above it is not anticipated that this well will be directly affected by this project under the Proposed Action alternative.

As discussed under the No Federal Action alternative Water Well Mitigation Agreements will also be offered. These agreements are anticipated to mitigate groundwater drawdown related impacts.

Shallow groundwater is not anticipated to be impacted by this alternative since proper well completion techniques and lining of the proposed impoundment will prevent the introduction of produced CBNG water into shallow aquifers.

Cumulative Environmental Impacts:

Cumulative impacts address all potential impacts from past, present and reasonably foreseeable future actions that may combine with the proposed action or any of the alternatives to create environmental impacts, regardless of which agency or person undertakes such actions. Cumulative impacts address both on-site and off-site impacts.

The analysis in the effected environment section, and in the direct impacts section already include those past and present actions that may combine with the proposed action to create environmental impacts. These past actions include the discharge of untreated CBNG water upstream from of the Tongue River Reservoir, and the discharges from the

East Decker and West Decker coal mines on the east and west sides of the Tongue River Reservoir.

Other known, or reasonably foreseeable, actions which could combine with the proposed action to create environmental impacts include the proposed discharge of treated CBNG water upstream from the Tongue River Reservoir, and the development of the Powder River Gas leases associated with this Project. Other projects were considered for inclusion in this analysis, however as described in Appendix D of this report, these were the only specific projects which had the potential to overlap with the proposed action or any of the alternatives to create environmental impacts.

Cumulative Surface Water – Discharge of Produced Water:
The cumulative impacts to surface water quality were determined by including the proposed treated CBNG discharge upstream from the reservoir into the surface water model, and then adding in the PRG Coal Creek discharge under each alternative to the Tongue River downstream from the Dam.

The proposed treated discharge upstream of the reservoir is for 3.79 cfs of discharge. Based upon the MPDES permit application for this discharge point, this water would have an EC of less than 1000 µS/cm and an SAR of less than 3.

It is also reasonably foreseeable that if these wells are productive that portion of the MPDES permit relating to the wells tested fee wells would be used. The total MPDES permit application is for 2.5 cfs. For the No Federal Action alternative it is assumed that the cumulative total discharge from the PRG Coal Creek project would be 1.39 cfs of treated CBNG water. Under the Proposed Action a discharge of 2.5 cfs of treated CBNG water is assumed. The results for these different alternatives are shown on Table 6.

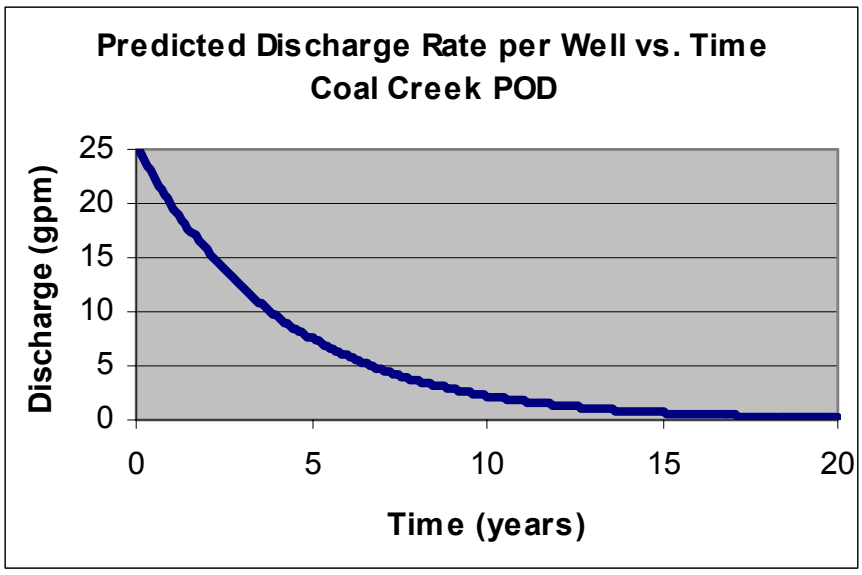
Comparison of the cumulative resultant surface water quality values for all alternatives to the appropriate standards shows that none of the appropriate standards are exceeded under any of the alternatives. These standards were adopted for the express purpose of protecting all beneficial uses of the Tongue River, including agriculture, aquatic life, drinking water, industrial uses, and recreational uses. As such, the results of this analysis indicate that the neither the proposed action, nor any of the alternatives, would be anticipated to cumulatively cause the beneficial uses of the Tongue River to be impaired.

Table 7: Comparison of Cumulative Impacts to Surface Water from the Alternatives

		Modeled Existing Conditions			No Action			No Federal Action			Proposed Action		
					(O cfs from PRG)			(1.39 cfs from PRG)			(2.5 cfs from PRG)		
	Flow Conditions	Discharge (cfs)	EC (µS/cm)	SAR	Discharge (cfs)	EC (µS/cm)	SAR	Discharge (cfs)	EC (µS/cm)	SAR	Discharge (cfs)	EC (µS/cm)	SAR
Tongue River Below Dam	7Q10	73.6	832	1.27	77.4	812	1.24	78.8	816	1.25	79.9	819	1.26
	LMM	182.6	664	0.98	186.4	656	0.97	187.8	659	0.98	188.9	662	0.99
	HMM	1432.6	398	0.55	1436.4	399	0.55	1437.8	400	0.55	1438.9	401	0.55
Tongue River at Birney Day School	7Q10	52.6	1157	1.87	56.4	1136	1.83	57.8	1140	1.85	58.9	1143	1.86
	LMM	176.6	737	1.23	180.4	729	1.21	181.8	732	1.22	182.9	735	1.23
	HMM	1122.6	383	0.62	1126.4	384	0.62	1127.8	385	0.62	1128.9	386	0.62

Cumulative Surface Water – Disturbance Related Impacts:
No other projects are known which would combine with the proposed action to create environmental impacts to surface water resources as a result of disturbance. It should be noted that disturbance within the Tongue River watershed is occurring associated with other CBNG development, however much of this impact is upstream of the Tongue River Reservoir, and therefore the sediment is not anticipated to reach below the dam. The full development of the leases which would be tested under this proposal would cause additional disturbance, and if the testing shows these areas to have economic quantities of CBNG it is reasonability foreseeable that these leases would be developed. The development of any of these leases would include implementation of BMPs to prevent erosion, surface use agreements, surface use plans, and proper reclamation. For this reason it is not anticipated that cumulative disturbance related impacts would be noticeable.

Cumulative Groundwater Impacts:
If the wells associated with this project are productive it is reasonably foreseeable that they would be produced at some point. This would require pumping the groundwater for up to 20 years at ever lessening rates (BLM, 2003). Additionally it would require the installation of additional wells. 26 wells total (16 more than the current No Federal Action alternative) would be installed under the No Federal Action alternative (13 per coal seam), and 46 wells total (28 more than the current Proposed Action alternative) would be installed under the Proposed Action alternative. In order to address these potential cumulative impacts it is assumed that the rate of groundwater discharge would be reduced by 20% per year. This results in an exponential decay curve of water production, as shown in the chart below. Using this information the extent of the 20 foot contour was calculated for the No Federal Action and the Proposed Action alternatives. The No Action alternative would not result in any drawdown. The results of this analysis for 1 year, 5 years, 10 years and 20 years are shown in Tables 7 and 8. More detailed discussion of the model used to determine these results is provided in Appendix C of this report.



No Federal Action:
The results of the drawdown analysis indicate that for the No Federal Action alternative with 13 wells pumping from each coal seam, cumulative drawdown may extend up to 3.6 miles from the project area after 20 years.

Table 8: Summary of Predicted 20 Foot Drawdown from the PRG - Coal Creek CBNG Project - Alternative B - No Federal Action

Time Pumped	Average Pumping Rate per Well (gpm)	Number of Wells per Seam	Average Pumping Rate per Coal Seam (gpm)	Coal Seam	Hydrologic Conductivity (K)		
					$9.8x10^{-2}$ ft/day	1.1 ft/day	13 ft/day
1 Year	22.4	13	291	Wall	0.43	1.27	1.00
				Flowers-Goodale	0.26	0.83	1.68
5 Years	14.6		190	Wall	0.95	2.63	0.95
				Flowers-Goodale	0.58	1.81	2.74
10 Years	9.5		123	Wall	1.33	3.33	0.35
				Flowers-Goodale	0.82	2.46	2.38
20 Years	5.1		67	Wall	1.84	3.59	0.02
				Flowers-Goodale	1.15	3.16	1.05

The groundwater modeling conducted in support of the CBM EIS anticipated that for a hypothetical CBNG field with 1,082 wells producing for 20 years, the produced coal seams will recover 70% of their hydrostatic head within 5-12 years after the end of production. It is anticipated that due to the lower number of wells, that recovery for this area will be more rapid. The exact radius of the drawdown cone, and the time required for the head to recover, will depend on the site specific aquifer properties and the precise timing of the pumping of each of the wells. For additional discussion of the anticipated drawdown related impacts please see pages 4-61 to 4-63 of the CBM EIS (BLM, 2003), and the associated groundwater modeling reports (Wheaton and Metesh 2001, Wheaton and Metesh, 2002).

Map 3 in the Figures section of this report shows that area which may be drawn down as a cumulative result of the No Federal Action alternative. According to MBMG's GWIC database (http://mbmggwic.mtech.edu/), 32 wells, and 13 springs, in additional to those from the Direct Proposed Action alternative, exist within this potential drawdown area. These wells and spring are listed on Table 4. These wells would only be impacted if they are finished in the same coal seams being developed for CBNG. Based upon the reported well depths (10 to 620 feet), and the elevations of these sites based upon topographic maps, these wells are finished at elevations between approximately 2,950 and 3,792 ft-amsl. The top of the Wall coal in this area is at approximately 3,200 ft-amsl, and it is approximately 55' think. The top of the Flowers-Goodale coal is at approximately 2,300 ft-amsl and it is approximately 20' thick. Assuming a potential 25 foot error in these calculations for the elevation at which the well is finished, and the elevation of the coal bed, two wells fall into the elevation range where they have the potential to be finished in

the coal seams being developed. These are the Kinnison and Legge wells. According to the well logs in the GWIC database the Legge well is finished in a sand. Lithology information is not available from the GWIC database for the Kinnison well. As such the Kinnison well may be finished in the Wall coal seam, and may be cumulatively affected by this project under the No Federal Action alternative. Since the nearest known outcrop of the Wall Coal seam is approximately 11 miles away, it is not anticipated that these springs emit from the coal seams being tested and so they would not be anticipated to be affected by this project under the No Federal Action alternative.

As discussed under the No Federal Action alternative Water Well Mitigation Agreements would be offered as required by the MT-DNRC (1999). These agreements are anticipated to mitigate groundwater drawdown related impacts.

Proposed Action:
The results of the drawdown analysis indicate that for the Proposed Action, with 23 wells pumping from each coal seam, cumulative drawdown may extend up to 4.7 miles from the project area after 20 years.

Table 9: Summary of Predicted 20 Foot Drawdown from the Coal Creek CBNG Project - Alternative C - Proposed Action

Time Pumped	Average Pumping Rate per Well (gpm)	Number of Wells per seam	Average Pumping Rate per Coal Seam (gpm)	Coal Seam	Hydrologic Conductivity (K)		
					9.8×10^{-2} ft/day	1.1 ft/day	13 ft/day
1 Year	22.4	23	516	Wall	0.43	1.34	2.01
				Flowers-Goodale	0.26	0.85	2.16
5 Years	14.6		336	Wall	0.96	2.88	2.77
				Flowers-Goodale	0.57	1.88	4.05
10 Years	9.5		218	Wall	1.35	3.83	1.83
				Flowers-Goodale	0.80	2.59	4.35
20 Years	5.1		118	Wall	1.88	4.64	0.43
				Flowers-Goodale	1.11	3.47	3.19

The groundwater modeling conducted in support of the CBM EIS anticipated that for a hypothetical CBNG field with 1,082 wells producing for 20 years, the produced coal seams will recover 70% of their hydrostatic head within 5-12 years after the end of production. It is anticipated that due to the lower number of wells, that recovery for this area will be more rapid. The exact radius of the drawdown cone, and the time required for the head to recover, will depend on the site specific aquifer properties and the precise timing of the pumping of each of the wells. For additional discussion of the anticipated drawdown related impacts please see pages 4-61 to 4-63 of the CBM EIS (BLM, 2003), and the associated groundwater modeling reports (Wheaton and Metesh 2001, Wheaton and Metesh, 2002).

Map 3 in the Figures section of this report shows that area which may be drawn down as a cumulative result of the Proposed Action alternative. There are 58 wells and 19 springs located within the cumulative drawdown area that results under this alternative with 20 years of pumping. These wells and springs are listed in the PRG-Coal Creek–Hydrology Technical Report. These wells are finished at elevations between approximately 2,897 and 3,904 ft-amsl. The top of the Wall coal in this area is at approximately 3,200 ft-amsl, and it is approximately 55' think. The top of the Flowers-Goodale coal is at approximately 2,300 ft-amsl and it is approximately 20' thick. Assuming a potential 25 foot error in these calculations for the elevation at which the well is finished, and the elevation of the coal bed, a total of 5 wells have the potential to be finished in the coal seams being developed. These include the Legge and Kinnison domestic wells discussed under the cumulative impacts section of the No Federal Action alternative, the Petre Preston domestic well (3,212 ft-amsl), the Preston Pete * 10 MI SW Birney Montana domestic well (3,216 ft-amsl), and the Decker Coal Co. monitoring well (3,249 ft-amsl). Based upon the well logs in the GWIC database the Legge well is completed in a "Brown Sandstone (Aquifer)". There is no lithology information for the Kinnison well, and so it may be finished in the Wall coal, and could be affected by CBNG development as a cumulative result of the Proposed Action alternative. Both Preston domestic wells are listed in the GWIC database as being finished in the alluvial aquifer adjacent to the Tongue River. Thus these domestic wells would not be anticipated to experience drawdown since they are not finished in the aquifer being drawndown. The Decker monitoring well is completed in a coal seam. Therefore the monitoring well has the potential to be drawndown under the cumulative Proposed Action Alternative. Since the nearest known outcrop of the Wall Coal seam is approximately 11 miles away, it is not anticipated that any of the springs emit from the coal seams being tested, and they are not anticipated to be impacted by groundwater drawdown.

As discussed under the No Federal Action alternative Water Well Mitigation Agreements would be offered as required by the MT-DNRC (1999). These agreements are anticipated to mitigate groundwater drawdown related impacts.

<u>Relation of the Alternatives to Cumulative Impacts Predicted in the CBM-EIS:</u>
The cumulative impacts from CBNG development have also been addressed in general in the CBM EIS (BLM, 2003). The Hydrology sections of the Statewide FEIS identified the following potential cumulative impacts:

- Surface water quality will be slightly altered, however downstream uses will not be diminished.
- Surface water flows will be moderately increased.
- Groundwater drawdown will extend 4 to 5 miles from the edge of production.
- Shallow groundwater quality may be slightly altered.

No Action:
No Action would not cause any discharge to surface waters to occur, and pumping of coal seams would not occur, therefore this alternative would not contribute to the impacts predicted in the CBM-EIS (BLM, 2003).

No Federal Action:
In table 4-46 of the CBM-EIS (BLM, 2003; page 4-85) impacts to surface waters are depicted numerically for the USGS station on the Tongue River at Birney Day School during minimum mean monthly flows (LMM). Table 4-46 in the CBM-EIS depicts an increase in EC of 49 µS/cm. This alternative would directly cause the EC during LMM flow to increase by 1.5 µS/cm plus the untreated discharge upstream from the Tongue River Reservoir accounts for an EC increase of 18 µS/cm. Together these discharges account for an increase of 40% of that projected in the CBM-EIS. Table 4-46 also depicts an increase in SAR during LMM flows at the Birney Day School Station of 1.43 units. This proposal would directly account for an SAR increase of 0.005 units. When combined with the untreated discharge a total SAR increase of 0.215 units, or 15.0% of that projected in the CBM-EIS, results.

Table 4-46 of the Statewide FEIS also shows that stream flow at the Birney Day School Station during LMM flows would increase by 7 cfs. This alternative would directly account for a flow increase of 0.56 cfs and cumulatively by 1.39 cfs, while the existing untreated CBNG discharge upstream from the Tongue River Reservoir increases the flow by 3.57 cfs for a combined total of 4.96 cfs, or 71% of that projected in the CBM-EIS (BLM, 2003).

Groundwater drawdown directly resulting from this alternative may cause 20' drawdown contour in the coal seam aquifer to extend up to 0.36 miles from the POD Area. The cumulative drawdown resulting from pumping of these wells for 20 years would cause the 20' drawdown contour to extend approximately 3.6 miles from the POD area. These results are less than predicted in the CBM EIS due to the size of the field being much smaller than analyzed in the CBM-EIS (10 wells vs. 1,082 wells).

Shallow groundwater is not anticipated to be effected by this alternative.

Proposed Action:
This alternative would directly cause the EC during LMM flow to increase by 2.6 µS/cm plus the existing untreated discharge upstream from the Tongue River Reservoir accounts for an EC increase of 18 µS/cm. Together these discharges account for an increase of 42% of that projected in the CBM-EIS (BLM, 2003). This proposal would directly account for an SAR increase of 0.009 units. When combined with the existing untreated discharge a total SAR increase of 0.219 units, or 15.3% of that projected in the CBM-EIS results.

Table 4-46 of the CBM-EIS (BLM, 2003) also shows that stream flow at the Birney Day School Station during LMM flows would increase by 7 cfs. This alternative would directly cause the flow to increase of 1.0 cfs and cumulatively by 1.39 cfs. The existing untreated CBNG discharge upstream from the Tongue River Reservoir increases the flow by 3.57 cfs. This results in a combined cumulative total of 6.07 cfs, or 87% of that projected in the CBM-EIS.

Groundwater drawdown directly resulting from this alternative may cause 20' drawdown contour in the coal seam aquifer to extend up to 0.48 miles from the POD Area. The cumulative drawdown resulting from pumping of these wells for 20 years would cause the 20' drawdown contour to extend approximately 4.7 miles from the POD area. These results are comparable to those predicted in the CBM EIS.

Shallow groundwater is not anticipated to be effected by this alternative.

SUMMARY:

Impacts to hydrological resources would be greatest under the Proposed Action alternative, less under the No Federal Action alternative, and would not occur under the No Action alternative. The discharge of treated CBNG water would increase the SAR and EC of the Tongue River, however the surface water standards would not be exceeded under any of the alternatives. Therefore, it is not anticipated that the beneficial uses of the Tongue River would be impacted by any of the alternatives. Disturbance related impacts may cause suspended sediment loads to be slightly higher, however not noticeably so. Groundwater may be drawn down up approximately 0.36 mile from the producing field as a direct result of No Federal Action alternative, or 0.48 miles as a direct result of Proposed Action. Cumulative drawdown would be anticipated to extend approximately 3.6 miles and 4.7 miles from the field under the No Federal Action and Proposed Action alternatives, respectively. Wells and springs which draw their water from the produced coal seam and are located within this potential drawdown area would have the potential to be affected by this drawdown. Based upon the information contained in the GWIC data base no wells would have potential to be directly impacted by either of the action alternatives. One domestic well (the Kinnison well) would have the potential to be cumulatively impacted under both action alternatives. It is not anticipated that any of the springs in the area would be impacted by groundwater drawdown since they do not emit water from the coal seams being developed. Water mitigation agreements, as required by the Powder River Basin Controlled Groundwater Area designation, will be put in place to mitigate potential impacts from groundwater drawdown. After production is completed, 70% groundwater recovery would be expected in 5-12 years.

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