HYDROLOGY APPENDIX

Summary of Water Resources Technical Report

Introduction

During the second half of the 1990s, coal bed methane (CBNG) production increased dramatically nationwide to represent a significant new source of natural gas to meet ever-growing energy demands. In Montana, oil & gas development has been growing since the first oil wells were drilled in the early 20th century. There are currently more than 200 commercially producing CBNG wells in the state of Montana, all of which are located in the Powder River Basin near the town of Decker, Montana. CBNG development in the Montana portion of the Powder River Basin (PRB) is in part a result of successful development in the Wyoming portion of the basin where CBNG activity started as early as 1993 (Flores et al. 2001).

A primary intent of the Montana CBNG Environmental Impact Statement (EIS) is to provide an overall projection of impacts associated with CBNG development for the planning areas and to address issues raised as part of the public scoping process. Of primary consideration for the EIS are water resources. Due to the extraction methods required for CBNG production, impacts to surface water and groundwater can potentially result from CBNG development. The purpose of the Water Resources Technical Report (WRTR) (ALL 2001b) is to serve as one of many supporting documents for the subject EIS. Following is a short summary of the WRTR.

Study Area

The planning area for the EIS is defined as the area where oil and gas decisions will be made by the BLM and the State of Montana. The BLM's planning area is the oil and gas estate administered by the BLM in the Powder River and Billings Resource Management Planning (RMP) areas. The State of Montana's planning area is statewide, with emphasis on the state-administered oil and gas within the BLM planning area and in Blaine, Park and Gallatin counties. The planning area excludes those lands administered by other agencies (for example, Forest Service and Tribal Councils). For ease of reference, the Billings and Powder River RMP areas, and Blaine, Park, and Gallatin counties, are referred to in the document as the BLM and State "CBNG emphasis area." This is the 16-county area within the BLM and state planning area where CBNG development interest has been identified.

CBNG Production Operations

During CBNG production, water is pumped up a tubing string to be put into a water flow-line for handling or discharge. At the only producing CBNG field in the Montana portion of the PRB, the water is either used in drilling new wells, pumped into ponds for use by the land owner, or discharged to the Tongue River through a MDEQ discharge permit. Assessment of management alternatives requires an accurate estimate of the amount of produced water to be produced from each well. CBNG wells must pump water from the reservoir to lower pressure within the coal, to augment the formation of cleat, and to allow the natural gas to break out as a discrete phase. The amount of water that must be pumped off appears to vary not only from reservoir to reservoir, but also during the history of each individual producing well according to the specific coal bed reservoir it is producing from, and its proximity to other producing wells. The WRTR compiles average water production rates for approximately 200 wells in the CX field normalized to the age of each well (MBOGC oil and gas database). This data was prepared by averaging the water production rates from active CBNG wells during each month dating from the date of first production. The exponential trend line is extrapolated from this data is: $Q = 14.661e^{-0.0242t}$ When Q is discharge per well in gallons per minute (gpm), and t is time in months. This indicates that initial discharges are approximately 15 gpm per well, and the 20-year average discharge would be 2.5 gpm. It should be noted that although the average initial discharge is approximately 15 gpm, some wells have discharges as high as 20-25 gpm.

Regional Geology

The planning area of the EIS centers on the Powder River RMP area and the Billings RMP area. The planning area contains three major basinal features – Powder River, Big Horn, and Bull Mountains – and surrounding uplifted areas. The asymmetric basins are the result of sedimentary deposition and structural subsidence with most of the fill consisting of the Fort Union Formation. The Fort Union Formation also contains most of the coals occurring in these three basins.

Fort Union Formation

The Fort Union Formation encloses the various coal seams within the Montana portion of the PRB; these coals function as the source and reservoir for the CBNG, as well as aquifers carrying groundwater of varying quantity and quality. Depth to coal seams in the Montana portion of the PRB range from exposure at ground surface to 1,000 feet or more below land surface. Coal thickness varies from thin stringers to over 50 feet and can form aggregate thicknesses that exceed 100 feet. Coal seams in the Fort Union do not have significant matrix porosity and permeability; they can act as aquifers because fluids such as water and methane are contained within the coal's fracture system, known as cleat. The fractures accumulate the fluids and allow the fluids to move horizontally and vertically.

Quaternary Alluvium

Quaternary age sediments are those that are Pleistocene (the latest glacial episode) and Recent (post-glacial episode) in age; the sequence is dominated by events and effects associated with continental glaciation, including glacial till and exaggerated peri-glacial valley fill. Quaternary sediments in the PRB and most of the state are present as variable fill in stream and river valleys. Quaternary Alluvium consists of unconsolidated sand, silt, and gravel that make up the floodplains and stream terraces of creek valleys in the PRB. Alluvium aquifers are largely unconfined and connected to active river flow. Because alluvial aquifers can deliver large quantities of water-to-water supply wells, they are important stratigraphic features. Alluvial aquifers can be impacted by surface activity and can act as a conduit to carry those impacts to valuable surface water resources.

Hydrology

Hydrology identifies aquifers (porous units containing water) and aquitards (non-porous strata that serve to confine and separate aquifers) in a geographic and vertical sense. Aquifers can contain drinkable water, brackish water of limited usability, or salt water. In the EIS planning area, several formations contain drinking water but show variable reservoir quality and water quality. The Montana portion of the PRB includes many aquifers that represent different hydrologic flow regimes. The basin includes unconfined aquifers as well as confined, bedrock aquifers. Aquifers range from the unconfined Quaternary alluvium in the streambeds of rivers and creeks to the Mississippian Age Madison Formation in excess of 10,000 feet below the surface. The water quality within these aquifers ranges from less than 300 mg/L TDS to more than 30,000 mg/L TDS. The aquifers also vary in depth from the basin center to the margin. Coal aquifers are widespread, supply large numbers of water wells, and will be impacted most by CBNG production. Alluvial aquifers are commonly unconfined and in direct contact with surface water and can, therefore, be impacted by surface discharge of CBNG water.

Watersheds

Watersheds are important to predicting the impacts from CBNG development in Montana. Water resource factors such as water quality, water use, and potential impacts are discussed throughout the report in terms of watersheds. Each watershed is drained by a single stream or river and each is bounded by a no-flow topographic boundary. Streams and rivers are profoundly influenced by their watersheds; in particular water volume and water quality vary from base flow conditions to high-flow conditions under the control of runoff from land surfaces and recharge to rivers by aquifers. The WRTR highlights the watersheds in the PRB along with potential CBNG areas.

Groundwater Quality

Quality of groundwater resources are detailed in the WRTR. The report lists quality statistics for the major aquifers from various parts of the CBNG emphasis area with emphasis on the coal seam aquifers.

Water Resources Impact Issues

Groundwater Drawdown from CBNG Development

Groundwater drawdown from CBNG production has been documented inside and adjacent to existing production in Montana. CBNG production in the PRB requires drawdown of coal aquifers within the producing field in order to liberate methane. Water wells and springs to but outside of a producing CBNG field may also be impacted. Drawdown can be documented by way of dedicated monitoring wells or by gauging private water wells. In Montana's CX Ranch CBNG field, the MBMG has installed monitoring wells designed to track drawdown due to the coal mines in the area as well as CBNG development.

Surface Water Impact from Discharge

Impacts to surface water from discharge of CBNG water can be severe depending upon the quality of the CBNG water. Some watersheds may be able to absorb the discharged water while others are sensitive to large amounts of low-quality CBNG water. Surface water quality in the watersheds is tabulated in the WRTR. Water quality data is from stream gauging points maintained by the USGS; these multi-year collections of water quality data illustrate changes within the stream from times of high run-off (typically June for the PRB) when the river is the highest and water is mostly the result of precipitation from spring rains and melting snow. During periods of high flow the streams and rivers contain higher quality water. The USGS data also contains data on base-flow conditions (typically winter in the PRB) when streams are at their lowest flow and water quality is the lowest since much of the water is recharge from alluvial and bedrock aquifers where groundwater is often of low quality. Discharge scenarios are described and resultant water quality is computed on a watershed basis.

Mitigation

CBNG production in the Montana PRB will certainly impact groundwater. Impacts to groundwater resources may however be mitigated through the use of water well agreements, limits placed on discharge and monitoring programs. Furthermore, a predictive model may be helpful as an approximation of future impacts. Groundwater rights will be protected through the use of spring/water well mitigation agreements and an approved monitoring plan to aid in the identification of potentially significant drawdown impacts. Surface water resources can be protected by limiting discharge through alternative management techniques.

Conclusions and Attachments

The WRTR concludes with a list of key water resource factors that are important to the subject of impacts. The appendices contain several pertinent documents as well as groundwater drawdown data from monitoring wells in the vicinity of the CX Ranch field, decline analysis from the CX Ranch field, and groundwater quality data from coal seam aquifers.

TMDL Schedule for CBNG Emphasis Area of Montana

Section 303 (d) of the Federal Clean Water Act and Sections 75-5-701 MCA, et. seq. of the Montana Water Quality Act requires Montana to develop "Total Maximum Daily Loads" (TMDLs) for lakes, rivers, and streams that are not meeting water quality standards. A TMDL is the amount of a pollutant that a waterbody can assimilate from point, non-point and natural sources and still meet water quality standards. In short, TMDLs guide the development of discharge targets for contributing sources that once implemented will restore or protect water quality.

All waters in Montana have been assigned to one of nine classifications based upon their presumed ability to support certain beneficial uses (i.e. drinking water, recreation, fisheries and aquatic life, agriculture, and industrial uses). Each classification has specific water quality standards including numerical and narrative limits. Waters that fail to meet the numerical or narrative standards are considered impaired. Montana must develop one or more TMDLs for each impaired waterbody.

In accordance with Section 303(d) of the Federal Clean Water Act, the Montana Department of Environmental Quality (MDEQ) has prepared a list of impaired and threatened waters every two years since 1992. This so called "303(d) list" identifies lakes, rivers and streams that are not meeting water quality standards and establishes priorities for TMDL development. However, Montana like the rest of the nation was slow to develop TMDLs.

On June 21, 2000, the United States District Court of Montana ordered EPA to work with the State of Montana to develop and adopt a schedule that would result in developing all necessary TMDLs for waters on Montana's 1996 Section 303(d) list (EIS Table 3-6) by May 5, 2007. On November 1, 2000, MDEQ and EPA published a schedule that was based upon a watershed or planning area approach. MDEQ divided the state into 91 TMDL Planning Areas each with a deadline for completing all necessary TMDLs. Since that time, an agreement has been reached to extend these timelines such that all TMDLs will be completed prior to May 5, 2012 (Yashan, pers. com., 12/8/05). This revised schedule is shown graphically on Figure HYD-1. The surface waters most likely to be affected by CBNG development are located in the Tongue Powder and Rosebud TMDL Planning Areas. The TMDL analyses for these areas are currently underway.

Independent of the court order, but as required by the Federal Clean Water Act and the Montana Water Quality Act, MDEQ prepared a 303(d) list in 2004. The 2004 list was finalized with EPA approval on November 24, 2004. It is superior to earlier lists for several reasons. First, significantly more data was available for making listing decisions. Second, the public review process was substantially expanded including a lengthy comment period and public meetings around the state. Third, MDEQ significantly improved the methods for making listing decisions. Fourth, MDEQ dramatically improved the supporting documentation for all listing decisions and made the information easily accessible by the public.

Although the court order mandates the 1996 list (EIS Table 3-6) as the starting point, both the 1996 and the 2004 lists should be consulted when making TMDL decisions. Figures HYD-2 to HYD-4 provides a summary of the waters in the Tongue, and Rosebud Creek basins that are on the 2004 list. No segments of the Powder River are on the 2004 list. The accompanying tables (Tables HYD-1 to HYD-3) identify the pollutants of concern and summarize the reasons for the listings.

The MDEQ or EPA is required to develop *all necessary* TMDLs for each waterbody and pollutant identified as impaired or threatened on the 1996 list. A TMDL may not be necessary for a waterbody listed on the 1996 list for a couple of reasons. First, a TMDL is unnecessary if further assessment, such as was done for the 2004 list, determines that the waterbody is meeting water quality standards for the particular pollutant. During the development of the 2000, 2002, and 2004 lists, MDEQ determined that several waters in the Tongue, Powder, and Little Powder river basins that were listed as impaired on the 1996 list, were actually meeting water quality standards (i.e., Mizpah Creek was found to be fully supporting for nutrients, dissolved oxygen, inorganics and suspended solids). Second, EPA has determined that TMDLs are not necessary for "pollution" that is not associated with a specific pollutant (i.e., flow or habitat alteration). EPA described their position on this issue to MDEQ in a July 23, 2001 letter concerning a flow alteration TMDL for Big Creek, a tributary of the Upper Yellowstone River. It should be noted however, that further assessment frequently shows that flow or habitat alterations cause high levels of pollutants (i.e., flow and habitat alteration can cause violations of temperature standards).

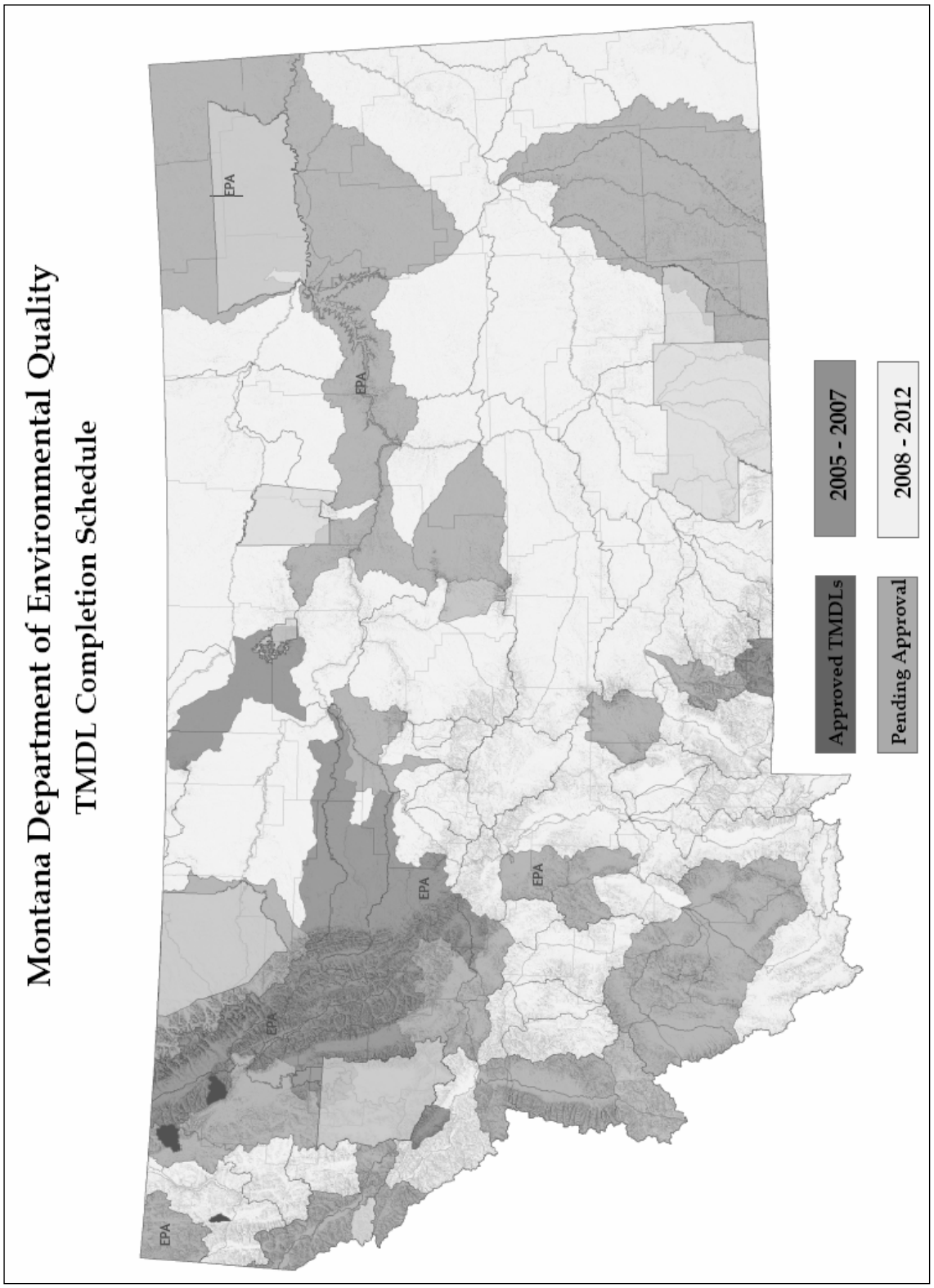

Figure HYD-1:
A graphical display of MDEQ's TMDL Planning Schedule (obtained from P. Schade (MDEQ) on 12/9/05).

Figure HYD-2: Impaired Waterbodies in the Upper Tongue Watershed

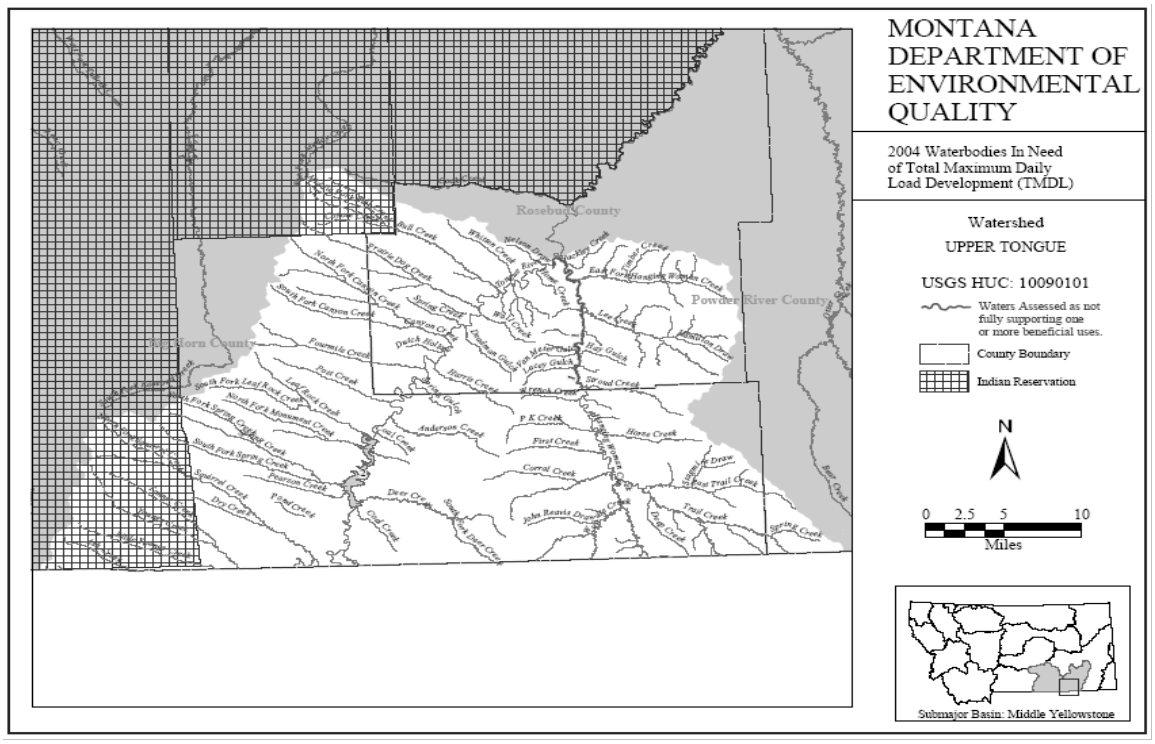

Figure HYD-3: Impaired Waterbodies in the Lower Tongue River Watershed

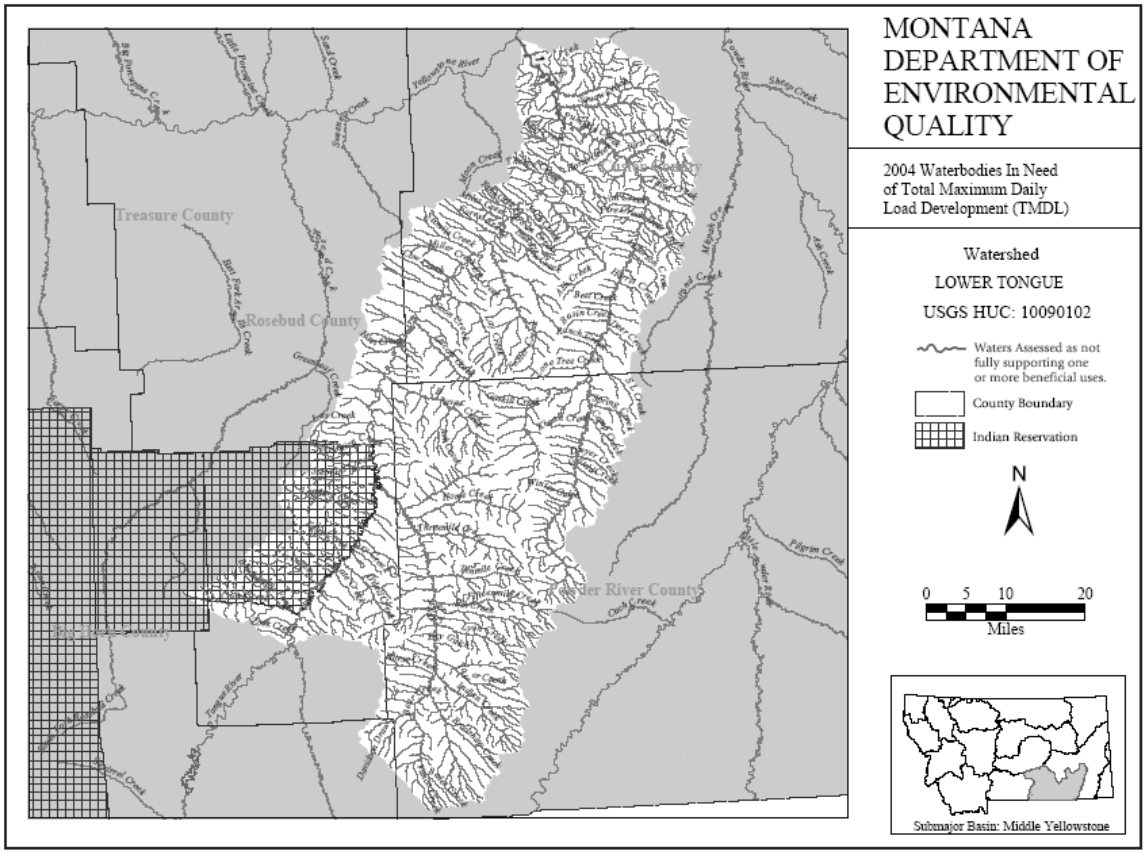

Figure HYD-4: Impaired Waterbodies in the Rosebud Creek Watershed

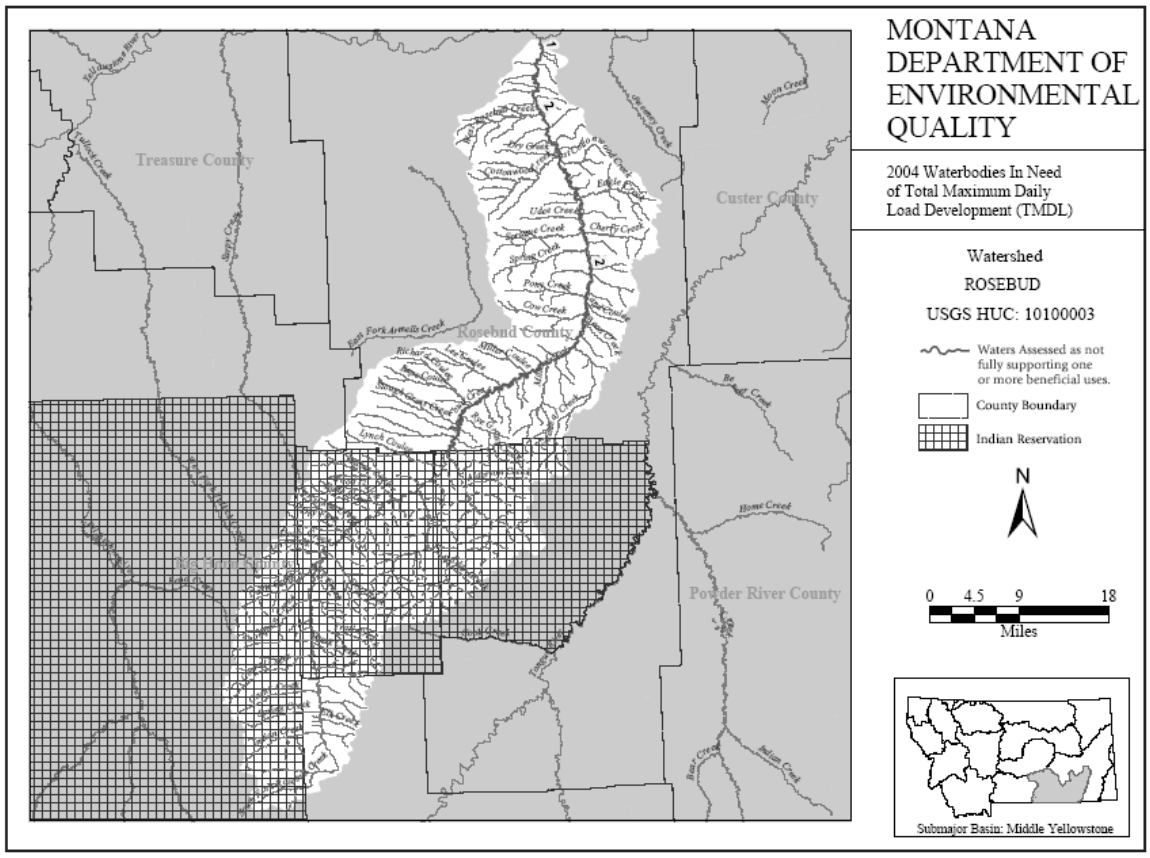

Table HYD-1: List of Impaired Waterbodies in the Upper Tongue River Watershed

Hydrologic Unit Code 10090101						**Watershed** UPPER TONGUE								
ID	Segment ID	Waterbody Segment	List Category	Size	Use Class	Use Support							Probable Causes of Impairment	Probable Sources of Impairment
						Aqua	Cold Fish	Warm	Drink	Swim	Agr	Ind		
1	MT42B002_031	Hanging Women Creek from Stroud Cr. To the mouth (Tongue R.)	5	18.5 M	C-3	P		P		X			Siltation	Grazing related sources Agriculture
2	MT42B003_010	Tongue River Reservoir	5	3500 A	B-2	P	X		X	P	F	F	Algal Growth/Chlorophyll a	Domestic wastewater lagoon Agriculture

Table HYD-2: List of Impaired Waterbodies in the Lower Tongue River Watershed

Hydrologic Unit Code 10090102						Watershed LOWER TONGUE								
ID	Segment ID	Waterbody Segment	List Category	Size	Use Class	Use Support							Probable Causes of Impairment	Probable Sources of Impairment
						Aqua	Cold Fish	Warm	Drink	Swim	Agr	Ind		
1	MT42C001_011	TONGUE RIVER from diversion dam just above Pumpkin Cr. To the mouth (Yellowstone R.)	4C	20.4 M	B-3	P		P	X	P	F	F	Flow alteration	Dam Construction Flow Regulation/ Modification Hydromodificatio

Table HYD-3: List of Impaired Waterbodies in the Rosebud Creek Watershed

Hydrologic Unit Code 10100003						Watershed ROSEBUD								
ID	Segment ID	Waterbody Segment	List Category	Size	Use Class	Use Support							Probable Causes of Impairment	Probable Sources of Impairment
						Aqua	Cold Fish	Warm	Drink	Swim	Agr	Ind		
1	MT42A001_011	ROSEBUD CREEK, From the mouth 3.8 mi upstream to an irrigation dam	4C	3.8 M	C-3	P		P		X			Bank erosion Other habitat alterations	Removal of Riparian Vegetation Habitat Modification (other than
2	MT42A001_012	ROSEBUD CREEK, Northern Cheyenne Res. Boundary to an irrigation dam 3.8 mi above the mouth	5	105.8 M	C-3	X		P		X			Other Nutrients	Dam Construction Hydromodificatio n

Although, during the preparation of the 2000, 2002, and 2004 lists the MDEQ determined that several waterbodies on the 1996 list were meeting the water quality standards for some of the listed pollutants, it was far more common for MDEQ to determine that there was insufficient credible data to make a listing decision. MDEQ determined that many segments of the Tongue and Powder rivers and some tributaries lacked sufficient credible data to determine whether the waters are impaired, threatened, or fully supporting the numerical and narrative water quality standards. These waters require additional assessment prior to developing TMDLs for the associated TMDL Planning Areas. The reassessment work has been conducted, and MDEQ is in the process of evaluating that data. It is possible that MDEQ will determine that additional waterbodies are meeting the standards for listed pollutants. If so, a TMDL will not be necessary, even though the waterbody and the pollutant were listed on the 1996 list. Conversely, additional TMDLs may be necessary if the assessment demonstrates that a waterbody is impaired for other pollutants that were not originally identified on the 1996 list.

The 1996 list identified many waters within the Tongue and Powder TMDL planning areas as impaired by salinity, total dissolved solids, chlorides, metals, inorganics, suspended solids, siltation, nutrients, low dissolved oxygen, pathogens, flow alteration, thermal modification, and habitat alteration. Of these pollutants, salinity, total dissolved solids, metals, and nutrients are frequently associated with produced water from CBNG development. Additionally, it should be noted that pollutants including salinity, total dissolved solids, and nutrients are also frequently associated with agricultural operations. CBNG development may also cause flow alterations and associated pollutants to exceed standards (i.e., total suspended solids).

As mentioned earlier, the court order prohibits MDEQ from issuing any new MPDES permits or renewals that would increase permitted discharges until all necessary TMDLs are established for a particular impaired waterbody. This provision of the court order has a direct bearing on CBNG development. Unless producers choose a no discharge option, such as reinjection, MPDES permits will be required for CBNG development. MDEQ and EPA are applying the court order on a pollutant-specific basis. For example, if the water is listed for nutrients and the new source will not discharge nutrients, a permit can be issued. Likewise, a permit can be renewed, if an existing source intends to increase its discharge but the effluent limit for nutrients will remain the same. Under some circumstances a permit can be issued even when the new discharge contains the pollutant of concern. By regulation, such permits must contain water quality based effluent limits that insure that the water quality standards will be met downstream of the discharge. For example, if the water quality standard is expressed as an in-stream concentration and the concentration in the discharge is less than the standard, the new source may actually improve water quality.

MDEQ is prohibited from issuing permits for discharges that would cause exceedances of a state water quality standard (i.e., where there is no assimilative capacity). This will be the case for many impaired waterbodies. Therefore, MDEQ will frequently not be able to issue a permit until a TMDL is developed for the entire watershed. A watershed TMDL will identify the major point and non-point sources contributing to the impairment and establish discharge targets for the pollutant of concern. In combination, the limits for all the sources must insure that water quality will improve to the point where the standards are met. The Montana Water Quality Act requires MDEQ to work with local landowners to implement voluntary measures (reasonable land soil and water conservation practices) to reduce pollutant loads from non-point sources. The Act also requires targets for point sources to be incorporated into MPDES permits in the form of effluent limits. The changes would normally be made during the next scheduled permit renewal and could include permits issued between now and the final development of the watershed TMDL. A watershed TMDL may include an allocation for growth to allow for new or increased discharges in the future and facilitate permitting. To provide for growth existing point and non-point sources would need to reduce their discharges even further.

Developing a TMDL takes time and involves completing the ongoing assessments; coordinating with landowners and CBNG producers in Montana, on tribal lands, and perhaps in Wyoming; assigning allocations for point and non-point sources; drafting the TMDL and a technical support document; conducting public meetings; and obtaining EPA approval.

Specific Electrical Conductivity (EC as uS/cm) and Sodium Adsorption Ratio (SAR) Limits for the Tongue, Powder, and Little Powder River Basins and Rosebud Creek

MONTANA DEQ NUMERIC STANDARDS FOR ELECTRICAL CONDUCTIVITY (EC) AND SODIUM ADSORPTION RATIO (SAR). ARM 17.30.670 (2003 Version)

(1) No person may violate the numeric water quality standards or the criteria for determining nonsignificant changes in water quality identified in (2) through (6). Compliance with the standards and criteria contained in (2) through (6) will be determined according to the procedures specified in (7).

(2) The numeric standards for electrical conductivity (EC) and sodium adsorption ratio (SAR) for the mainstems of Rosebud Creek, the Tongue, Powder, and Little Powder rivers from November 1 through March 1 are as follows:

(a) for Rosebud Creek and the Tongue River, the monthly average numeric water quality standard for EC is 1500 µS/cm and no sample may exceed an EC value of 2500 µS/cm. The monthly average numeric water quality standard for SAR is 5.0 and no sample may exceed an SAR value of 7.5; and

(b) for the Powder River and the Little Powder River, the monthly average numeric water quality standard for EC is 2500 µS/cm and no sample may exceed an EC value of 2500 µS/cm. The monthly average numeric water quality standard for SAR is 6.5 and no sample may exceed an SAR value of 9.75.

(3) The numeric standards for EC and SAR for the mainstems

of Rosebud Creek, the Tongue, Powder, and Little Powder rivers from March 2 through October 31 are as follows:

(a) for Rosebud Creek and the Tongue River, the monthly average numeric water quality standard for EC is 1000 µS/cm and no sample may exceed an EC value of 1500 µS/cm. The monthly average numeric water quality standard for SAR is 3.0 and no sample may exceed an SAR value of 4.5; and

(b) for the Powder River and Little Powder River, the

monthly average numeric water quality standard for EC is 2000 µS/cm and no sample may exceed an EC value of 2500 µS/cm. The monthly average numeric water quality standard for SAR is 5.0 and no sample may exceed an SAR value of 7.5.

(4) For all tributaries and other surface waters in the Rosebud Creek, Tongue, Powder, and Little Powder River watersheds, the monthly average numeric water quality standard for EC is 500 µS/cm and no sample may exceed an EC value of 500 µS/cm. The monthly average numeric water quality standard for SAR from March 2 through October 31 is 3.0 and no sample may exceed an SAR value of 4.5. The monthly average numeric water quality standard for SAR from November 1 through March 1 is 5.0 and no sample may exceed an SAR value of 7.5.

(5) For the Tongue River Reservoir, the monthly average numeric water quality standard for EC is 1000 µS/cm and no sample may exceed an EC value of 1500 µS/cm. The monthly average numeric water quality standard for SAR is 3.0 and no sample may exceed an SAR value of 4.5.

(6) Changes in existing surface or ground water quality with respect to EC and SAR are nonsignificant according to the criteria in 75-5-301(5)(c), MCA, provided that the change will not have a measurable

effect on any existing or anticipated use or cause measurable changes in aquatic life or ecological integrity.

(7) For purposes of determining compliance with the water quality standards and nonsignificance criteria for all parameters of concern in any new or increased discharge of unaltered ground water from coal bed methane development, the department shall determine effluent or compliance limits (e.g., evaluate the design of disposal systems) by using a flow-based analysis that considers a range of flows or monthly flow probability. With respect to EC and SAR, the department shall also use the median chemistry for the specified flow range or monthly flow.

(8) If any of the provisions of (6) or (7), or both of them, are declared to be invalid, then the numeric water quality standards and requirements specified in (1) through (7) shall be void. (History: 75-5-301, 75-5-303, MCA; IMP, 75-5-301, 75-5-303, MCA; NEW, 2003 MAR p. 779, Eff. 4/25/03.)

17.30.670 NUMERIC STANDARDS FOR ELECTRICAL CONDUCTIVITY (EC) AND SODIUM ADSORPTION RATIO (SAR) (2006 Version)

(1) No person may violate the numeric water quality standards or the criteria for determining nonsignificant changes in water quality identified in (2) through (6).

(2) The numeric standards for electrical conductivity (EC) and sodium adsorption ratio (SAR) for the mainstems of Rosebud Creek, the Tongue, Powder, and Little Powder rivers from November 1 through March 1 are as follows:

(a) for Rosebud Creek and the Tongue River, the monthly average numeric water quality standard for EC is 1500 µS/cm and no sample may exceed an EC value of 2500 µS/cm. The monthly average numeric water quality standard for SAR is 5.0 and no sample may exceed an SAR value of 7.5; and

(b) for the Powder River and the Little Powder River, the monthly average numeric water quality standard for EC is 2500 µS/cm and no sample may exceed an EC value of 2500 µS/cm. The monthly average numeric water quality standard for SAR is 6.5 and no sample may exceed an SAR value of 9.75.

(3) The numeric standards for EC and SAR for the mainstems of Rosebud Creek, the Tongue, Powder, and Little Powder rivers from March 2 through October 31 are as follows:

(a) for Rosebud Creek and the Tongue River, the monthly average numeric water quality standard for EC is 1000 µS/cm and no sample may exceed an EC value of 1500 µS/cm. The monthly average numeric water quality standard for SAR is 3.0 and no sample may exceed an SAR value of 4.5; and

(b) for the Powder River and Little Powder River, the monthly average numeric water quality standard for EC is 2000 µS/cm and no sample may exceed an EC value of 2500 µS/cm. The monthly average numeric water quality standard for SAR is 5.0 and no sample may exceed an SAR value of 7.5.

(4) For all tributaries and other surface waters in the Rosebud Creek, Tongue, Powder, and Little Powder river watersheds, the monthly average numeric water quality standard for EC is 500 µS/cm and no sample may exceed an EC value of 500 µS/cm. The monthly average numeric water quality standard for SAR from March 2 through October 31 is 3.0 and no sample may exceed an SAR value of 4.5. The monthly average numeric water quality standard for SAR from November 1 through March 1 is 5.0 and no sample may exceed an SAR value of 7.5.

(5) For the Tongue River Reservoir, the monthly average numeric water quality standard for EC is 1000 µS/cm and no sample may exceed an EC value of 1500 µS/cm. The monthly average numeric water quality standard for SAR is 3.0 and no sample may exceed an SAR value of 4.5.

(6) EC and SAR are harmful parameters for the purposes of the Montana Water Quality Act, Title 75, chapter 5, MCA. (History: 75-5-301, 75-5-303, MCA; IMP, 75-5-301, 75-5-303, MCA; NEW, 2003 MAR p. 779, Eff. 4/25/03; AMD, 2006 MAR p. 1733, Eff. 5/19/06.)

Montana Board of Environmental Review
March 23, 2006 Decisions Concerning New CBNG Water Quality Rules

Adopted

The Montana Board of Environmental Review (BER) adopted new rules for EC and SAR to be changed to harmful parameters. This designation triggers the non-degradation criteria under the Montana Pollutant Discharge Elimination System (MPDES) permitting process. It is consistent with Montana's management of other parameters with numerical water quality standards. The essence of the non-degradation criteria is to protect high quality state waters and limit discharges so changes to water quality would always result in levels of "harmful parameters" (in this case EC and SAR) between existing water quality levels and 40% of the existing water quality standards (there is also a 10% change limit for any discharge). For example, if the water quality standard is 1000 uS/cm a discharge permit would need to result in an instream water quality (after the mixing zone) not greater than 400 uS/cm. Whenever ambient conditions exceed 40% of the existing standards, no assimilative capacity is available, and any discharges resulting in a measurable increase would not be permitted (can not cause an increase, but could keep it the same or make it less). It should be noted that the three CBNG permits into the Tongue River already use up most of the assimilative capacity there.

This rule would apply statewide, however it is only effective at this point on water bodies with numeric water quality standards for EC and SAR (i.e., Tongue, Powder, Little Powder, and Rosebud watersheds).

Companies would have to treat water in the Tongue River to SAR and EC levels comparable to ambient water quality, which is below the existing standards if they wanted to discharge to waters of the state. Discharges into the Powder River and Little Powder River would also be limited because the ambient conditions in these water bodies often exceed 40% of existing standards. Plans for treating water by companies operating in Montana that have been approved by the Montana Department of Environmental Quality (MDEQ) involve treating water to a very low SAR, approximately 0.04, and EC to about 233 uS/cm and then mixing at a rate (approximately 75% treated water to 25% untreated water) to meet instream water quality standards at the end of pipe. Adoption of the proposed rule would probably require treatment of more water overall and curtail the ability to blend treated with untreated water before discharging.

The Wyoming DEQ would also be required to meet the non-degradation standards at the state line if the Montana standards are approved by the EPA.

The only way to obtain a permit if the 40% or 10% thresholds are exceeded would be to obtain a permit from the MDEQ to degrade. Although the MDEQ has a method for processing a permit to degrade, no such permits have ever been requested by any party in Montana.

Rejected

The BER rejected the portion of the proposed rule that requires injection of CBNG produced water and a rigorous process to bypass the requirement to use injection.

The Environmental Quality Council determined the proposed rule requiring CBNG companies to use injection as the initial method for disposal of produced water is outside of the jurisdiction of the Montana BER. Comments on the proposal from the public; the Environmental Quality Council findings; and the State's review (Montana Bureau of Mines and Geology Study) of the feasibility of injection in the Power River Basin are all reasons this portion of the rule was rejected.

Other Actions

The BER adopted the rule deleting the requirement to use a flow-based permit calculation method, and rejected the proposed rule to use the 7Q10 flow (lowest flow conditions). The MPDES section of the MDEQ has the discretion to use either method for calculating approved discharges for other MPDES permits, and has used both. This action

preserves the MDEQ's discretion to use either, or a combination of the two, and makes the analysis and calculation of CBNG produced water permits consistent with other MPDES efforts.

The BER postponed ruling on the requirement to treat CBNG waters and the effluent limits proposed for treatment. The BER directed the MDEQ to return a proposal to the Board on this matter after performing additional analysis of proposed effluent limitations and documentation of the technical, economic, and environmental feasibility and cost-effectiveness of those effluent limitations. This matter is scheduled to be presented to the BER at its September 29, 2006 meeting.

On March 10, 2006, the Northern Plains Resource Council (NPRC) proposed amending its own petition regarding effluent limits with an EPA-recommended statistical approach. This was proposed in response to numerous comments received on effluent limits of the proposed rule. The NPRC's March 10 proposal also included exceptions to a requirement to treat CBNG water for any permitted beneficial uses. No interested parties were provided an opportunity to review or comment on the amended language provided by the NPRC. The BER did not consider the March 10 proposal a part of the proposed rule making under review.

WQS for Electrical Conductivity (EC) and Sodium Adsorption Ratio (SAR) Adopted by the Northern Cheyenne Tribe

The Northern Cheyenne Tribe's EC and SAR numerical standards were adopted by the Tribal Council on May 28, 2002. The numerical standards apply to the Tongue River, Rosebud Creek and tributaries to each within the boundaries of the Reservation.

Tongue River and Rosebud Creek (within the Reservation Boundaries)	**Irrigation Season (4/1 - 11/15)**	**Criteria Applicable All Year**		**Notes**
	EC (30-day ave.)	EC (inst. max.)	SAR (inst. max.)	The Tribe has also adopted indicator values for total dissolved solids (TDS) that will be used to monitor conditions and trends of these waters.
Southern Boundary	1000	2000	2.0	
Northern Boundary	1500	2000	3.0	
Tributaries	1500	2000	3.0	

EXAMPLE WATER WELL MITIGATION AGREEMENT

WHEREAS, Owner has existing water wells within its property boundaries, providing Owner water for domestic and agricultural/livestock water, and

WHEREAS, Operator has acquired leases for the development of Coalbed Natural Gas (CBNG) and intends to drill and complete wells for production of CBNG, and

WHEREAS, the development and production of CBNG usually requires the production of water in conjunction with CBNG and may require the localized reduction of water levels within certain individual strata of the Ft. Union Coals, and

WHEREAS, Operator has advised Owner that the production of water in association with gas could adversely affect the productive capacity of Owner's existing water wells which draw water from the Ft. Union aquifer.

NOW, THEREFORE, as consideration for the mutual covenants herein, in order to facilitate the multiple usage of the natural resources consistent with sound environmental practices, to mitigate potential adverse affects on the Owner's water wells, to assure prompt and effective remediation, and to reduce the need for regulatory intervention by State and Federal agencies, the Owner and Operator agree as follows:

DEFINITIONS

Ft. Union Coals – The Ft. Union Coals, as used herein, shall mean those individual coalbeds or several coal beds contained within the Tongue River member of the Ft. Union Formation, bounded above by the Wasatch Formation of Eocene, and below by the Lebo Shale member.

Circle of Influence (COI) – The area that falls within a circle, the center of which is the location of a producing CBNG well, which has a radius of one mile (5,280 feet).

Impaired Water Well – Any water well or spring existing on the Owner's property within the COI, existing at the time of the CBNG development, that experiences a reduction of capacity to deliver water in quantity and/or quality sufficient to support the ordinary and customary use of the well or spring.

Strat Test – Any test well that is drilled with the purpose of obtaining geologic information that is not completed for production and is subsequently plugged and abandoned. Strat test may produce water and/or gas for a period not to exceed thirty (30) days without creating a COI.

CBNG Well – Any well drilled and completed for the production of CBNG that withdraws water and/or gas and water from the aquifer for a period exceeding sixty (60) days.

AGREEMENT

1. Upon the establishment of a COI, the Operator, at its sole cost and risk, will measure, or cause to be measured, the static water level and productive capacity ("the baseline measurement") of all water wells and springs within the COI and will attempt to determine the depth and configuration of these wells through consultation with the Owner and from the records of the Montana Department of Natural Resources. Upon request, Owner shall provide Operator with the location of all wells and springs within one mile of Operator's drilling operations. The Operator shall also test for the presence of methane in the water wells.

2. Owner shall, upon reasonable notice, allow the testing of water wells and springs within COI, including a static water level test which may require the cessation of withdrawals of water from the well or spring for a period not to exceed twenty-four (24) hours.

3. Operator shall establish a continuing water well monitoring program, the intent of which is to enable the Operator to identify changes in capacity of the Owner's water wells and springs within the COI. The Owner shall allow continued periodic testing of the water wells and springs within the COI for this purpose. Operator shall immediately provide all test data, both "baseline data" and monitoring data, to the Owner as it is acquired by Operator.

4. If a water well or spring within the COI becomes impaired as defined herein, Owner shall first take reasonable steps to verify that the impairment is not due to mechanical, electrical, down hole integrity, or pump problems, and, if none of these problems appear to be the cause of the impairment, Owner shall notify Operator of the impairment. Notice shall be made by phone and by writing, delivered by hand or by registered mail to the Operator at the above address.

5. Within sixty (60) days of the receipt of notice of impairment, Operator shall restore the Owner's access to water of sufficient quantity and quality to offset such impairment by reconfiguring, redrilling the well, the drilling of a new well, or by other means. It is recognized that additional power costs may be associated with any reconfiguration of an impaired water well which additional power costs shall be paid for by the Operator. The specific site of the well or water access may be changed by mutual agreement of Operator and Owner.

6. Operator agrees that upon notice of impairment and during the curative period, to provide and make available water for domestic and livestock usage in quantity, quality, and location required for the maintenance of normal and customary domestic, grazing, and livestock operations. Operator shall develop emergency procedures for immediate delivery of water to any such affected Owner within twenty-four (24) hour emergency contact. Owner shall make a good faith effort to inform Operator, by phone, fax, or other expedient method of communicating, of any impending loss or damage to livestock, allowing Operator a reasonable opportunity to mitigate such damage.

7. In the event it is determined that there is an impaired water well or spring, as defined above, in any COI, that COI shall be expanded based on the location of the impaired wells or springs. The COI shall be divided into quadrants (NE, NW, SW, SE) and based upon which quadrant the impaired water well or spring is located in, that quadrant shall be expanded by the area included within a arc one-eighth (1/8) of a miles wide (660 feet) outside the existing COI. Likewise, should it be determined that there is an impaired water well or spring within the expanded quadrant of the COI, that quadrant shall be again expanded by another 660 feet increment. This expansion approach shall be used to expand any COI in any direction where impairment is determined during the life of the CBNG well. Notwithstanding the above, if no water well or spring exists within the expanded area, the arc and associated quadrant shall be expanded to included the next nearest water well or spring.

8. At any time that the Lessee undertakes activities to enhance Owner's water well capacity or to restore Owner's impaired water well capacity, and should such activities require permits from regulatory agencies or permissions from third parties for surface entry, Owner shall aid and assist Operator in the obtaining of permits and permissions necessary to conduct the operations. All costs of the operations, including fees for obtaining permits and permissions, shall be borne by the Operator.
9. In the event that the interpretation or enforcement of this Agreement results in legal action, the costs of such action, including reasonable attorneys' fees, shall be borne by the individual parties, except in the event that the Owner is the prevailing party, in which case the Operator shall bear the costs and attorneys fees of the Owner.
10. The terms and provisions contained herein shall run with the land and shall be binding on the heirs, successors, and assigns of Owner and Operator. This Agreement shall terminate upon the expiration of the last Oil and Gas Lease or the Plugging and abandonment of the last CBNG well to which this Agreement applies, whichever is the later date.

This Agreement may be executed in any number of counterparts, each of which shall be considered an original.

OWNER:	**OPERATOR:**
Owner	Company
By:_____	**By:**_____

Montana Code Annotated 2005

TITLE 82. MINERALS, OIL, AND GAS
CHAPTER 11. OIL AND GAS CONSERVATION
Part 1. Regulation by Board of Oil and Gas Conservation

Sub-Part 175

82-11-175. Coal bed methane wells -- requirements.

(1) Coal bed methane production wells that involve the production of ground water must comply with this section.

(2) Ground water produced in association with a coal bed methane well must be managed in any of the following ways:

(a) used as irrigation or stock water or for other beneficial uses in compliance with Title 85, chapter 2, part 3;
(b) reinjected to an acceptable subsurface strata or aquifer pursuant to applicable law;
(c) discharged to the surface or surface waters subject to the permit requirements of Title 75, chapter 5; or
(d) managed through other methods allowed by law.

(3) (a) Prior to the development of a coal bed methane well that involves the production of ground water from an aquifer that is a source of supply for appropriation rights or permits to appropriate under Title 85, chapter 2, the developer of the coal bed methane well shall notify and offer a reasonable mitigation agreement to each appropriator of water who holds an appropriation right or a permit to appropriate under Title 85, chapter 2, that is for ground water and for which the point of diversion is within:

(i) 1 mile of the coal bed methane well; or
(ii) one-half mile of a well that is adversely affected by the coal bed methane well.

(b) The mitigation agreement must address the reduction or loss of water resources and must provide for prompt supplementation or replacement of water from any natural spring or water well adversely affected by the coal bed methane well. The mitigation agreement is not required to address a loss of water well productivity that does not result from a reduction in the amount of available water because of production of ground water from the coal bed methane well.

History: En. Sec. 4, Ch. 578, L. 2001; Sec. , MCA 2001; redes. by Sec. 1, Ch. 117, L. 2003.

Montana Code Annotated 2005

TITLE 76. LAND RESOURCES AND USE
CHAPTER 15. CONSERVATION DISTRICTS
Part 9. Coal Bed Methane Protection Program

76-15-901. Short title. This part may be cited as the "Coal Bed Methane Protection Act".

76-15-902. Legislative findings and declaration of purpose.

(1) The legislature finds that the need for an economical supply of clean-burning energy is a national and state priority.

(2) The legislature further finds that Montana possesses plentiful reserves of clean-burning natural gas contained in coal beds.

(3) The legislature further finds that the extraction of natural gas from coal beds may result in unanticipated adverse impacts to land and to water quality and availability.

(4) The legislature declares that there is a compelling public need to promote efforts that preserve the environment and protect the right to use and enjoy private property. The legislature further declares that the purpose of this part is to establish a long-term coal bed methane protection account and a coal bed methane protection program for the purpose of compensating private landowners and water right holders for damage to land and to water quality and availability that is attributable to the development of coal bed methane wells.

(5) The legislature further declares that the provisions of this part do not relieve coal bed methane developers or operators that own, develop, or operate coal bed methane wells and collection systems of their legal obligation to compensate landowners and water right holders for damages caused by the development of coal bed methane.

(6) The legislature further declares that the provisions of this part do not relieve coal bed methane developers or operators from:

(a) any liability associated with the exploration or development of coal bed methane; or

(b) the responsibility to comply with any applicable provision of Titles 75, 82, and 85 and any other provision of law applicable to the protection of natural resources or the environment.

76-15-903. Definitions. As used in this part, unless the context requires otherwise, the following definitions apply:

(1) "Agricultural production" means the production of:

(a) any growing grass, crops, or trees attached to the surface of the land; or

(b) farm animals with commercial value.

(2) "Coal bed methane developer or operator" means the person who acquires a lease for the purpose of extracting natural gas from a coal bed.

(3) "Department" means the department of natural resources and conservation as provided for in Title 2, chapter 15, part 33.

(4) "Emergency" means the loss of a water supply that must be replaced immediately to avoid substantial damage to a landowner or a water right holder.

76-15-904. Coal bed methane protection account -- use.

(1) There is a coal bed methane protection account in the state special revenue fund.

(2) There must be deposited in the account the proceeds from the distribution of oil and natural gas production taxes, as provided in 15-36-331.

(3) All money paid into the account must be invested by the board of investments. Earnings from investments must be deposited in the account.

(4) Subject to the conditions of subsection (5), money deposited in the account must be used to compensate landowners and water right holders for damages attributable to coal bed methane development as provided in this part.

(5) Money deposited in the fund and earnings of the fund may not be expended until after June 30, 2005. For fiscal years beginning after June 30, 2005, principal and earnings may be expended only in the case of an emergency. For fiscal years beginning after June 30, 2011, principal and earnings in the account may be expended for any purpose authorized pursuant to this part.

(6) Money in the account must be appropriated to the department for use by conservation districts that have private landowners or water right holders who qualify for compensation as provided in 76-15-905. *(Subsection (2) terminates June 30, 2011--sec. 10, Ch. 531, L. 2001.)*

76-15-905. Coal bed methane protection program -- restrictions.

(1) There is a coal bed methane protection program administered by conservation districts that have coal beds within the exterior boundary of the district or whose water sources may be adversely affected by the extraction of coal bed methane. The purpose of the coal bed methane protection program is to compensate private landowners or water right holders for damage caused by coal bed methane development.

(2) A conservation district shall establish procedures, approved by the department, for evaluating claims for compensation submitted by a landowner or water right holder. The procedures must include:

(a) a method for submitting an application for compensation for damages caused by coal bed methane development;

(b) a process for determining the cost of the damage to land, surface water, or ground water, if any, caused by coal bed methane development;

(c) the development of eligibility requirements for receiving compensation that include an applicant's access to existing sources of state funding, including state-mandated payments, that compensate for damages; and

(d) criteria for ranking applications related to available resources.

(3) An eligible recipient for compensation includes private landowners and water right holders who can demonstrate as the result of damage caused by coal bed methane development:

(a) a loss of agricultural production or a loss in the value of land;

(b) a reduction in the quantity or quality of water available from a surface water or ground water source that affects the beneficial use of water; or

(c) the contamination of surface water or ground water that prevents its beneficial use.

(4) (a) Subject to the conditions of subsections (5) through (8), an eligible landowner may be compensated for the damages incurred by the landowner for loss of agricultural production and income, lost land value, and lost value of improvements caused by coal bed methane development. A payment made under this subsection (4)(a) may only cover land directly affected by coal bed methane development.

(b) Subject to the conditions of subsections (5) through (8), an eligible water right holder may be compensated for damages caused by the contamination, diminution, or interruption of surface water or ground water.

(5) In order to qualify for a payment of damages under this section, the landowner or water right holder shall demonstrate that it is unlikely that compensation will be made by the coal bed methane developer or operator who is liable for the damage to land or the reduction in or contamination of surface water or ground water as the result of coal bed methane development.

(6) Compensation made to a landowner or a water right holder under this section may not exceed 75% of the cost of the damages. The maximum amount paid to a landowner or water right holder may not exceed $50,000.

(7) Conservation district administrative expenses for services provided under this section are eligible costs for reimbursement from the coal bed methane protection account.

(8) (a) Except as provided in subsection (8)(b), compensation for damages allowed under this section may be made only after June 30, 2011.

(b) Compensation for an emergency may be made after June 30, 2005.