Agricultural Practices Used in Source Control of Acid Mine Drainage Problems, Central Montana

Prepared for

Montana Department of Environmental Quality,
Remediation Division, Abandoned Mines Section
and
U.S. Department of Agriculture, Natural Resources Conservation Services

February 2011

Prepared by
Ted Duaime, Ken Sandau, and Garrett Smith

Montana Bureau of Mines and Geology
1300 West Park Street
Butte, MT 59701-8997

With Special Contribution by
Montana Salinity Control Association
Jane Holzer and Scott Brown
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Contract No. 400022-TO-31 MBMG Open File 596

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Executive Summary

The Montana Department of Environmental Quality, Abandoned Mine Bureau (DEQ-AMB) identified acidic-metal-laden water discharging from abandoned underground coal mines as a significant environmental concern. Previous attempts to mitigate acid mine drainage (AMD) from these coal mines, e.g., bulkheads and wetlands, have failed for various reasons, leading investigators to consider other options to treat or limit the volume of water discharging. Many of the coal mines with AMD problems are located throughout central Montana, in areas where significant farming and ranching occur. A proposal was funded through the Natural Resources Conservation Services (NRCS), Conservation Innovative Grant Program (CIG) to look at changes in cropping and land-use management in a demonstration area overlying an abandoned coal mine near Belt, Montana.

Work conducted during the three-year project period (October 2007–October 2010) funded by the NRCS-CIG provided information detailing the large seasonal water-level increases in the shallow groundwater system that exists underneath the study area. Water-level increases in excess of 20 ft were noted in monitoring wells during late winter and early spring, periods of little or no cereal grain water usage. Work also showed the interconnection of this system and groundwater entering the abandoned underground mine system that lies beneath the area. Water-quality monitoring and sampling documented the changes (degradation) in water quality as water entered the mine system and eventually discharged to Belt Creek. The concentrations of iron, aluminum, and sulfate increased within the mine workings as water flowed from the flooded portion of the mine to areas only partially flooded, due to the oxidation of pyrite present in the coal and the corresponding decrease in the pH of the water. pH in the flooded portions of the mine was near neutral (6.5–7.0), and dropped to 3.0 in the discharge from the mine. The discharge from the mine drainage added over 130,000 pounds of iron and aluminum to Belt Creek annually. Water quality in the shallow (Sunburst Sandstone) aquifer that overlies the mine workings was of good quality and suitable for use in any of the proposed land-use changes or drainage through the use of horizontal wells (drains) for discharge to nearby coulees and adjacent surface waters (Belt Creek and Box Elder Creek).

The implementation of source control measures and land-use changes to control the AMD problem requires the cooperation of land managers operating above and adjacent to the underground

mine workings. Ownership overlying the mine workings and adjacent areas is divided between five different owners; two deemed a higher priority due to current cropping practices and location above unflooded portions of the mine. Farm plans were developed for both priority ownership blocks, with the cropping changes implemented on one site by planting alfalfa. The second site consists of 450 acres, and recommended cropping and land-use changes are significant to the owners' overall farming–ranching operation. The short length of the current project and limited funding were not adequate to begin implementing the various components of the proposed farm plan. Considerable coordination between the landowners, NRCS, DEQ, and other potential stakeholders (i.e., Montana Department of Transportation; Cascade County; and Fish, Wildlife & Parks) will be necessary to implement the proposed changes. Integrating changes with current landowner commitments to several federal farm programs and future programs may take years and result in loss of revenue to the landowners; therefore, consideration of methods to help offset financial losses, i.e., cost-sharing for proposed fencing changes or installation of groundwater pumps and water lines to distribute stock water, will be important for successful implementation of the full farm plan. However, the estimated costs for the farm plan are millions of dollars less than other options for capture and treatment of the contaminated mine water, which makes source control through changes in land use such a favorable option.

The last option considered in this project, installation of bulkheads within the mine workings, was found to be unfeasible due to access problems caused by roof collapses and pooled water inside the mine workings.

To monitor the effects of land-use changes on reducing groundwater levels and recharge to the mine workings, a limited monitoring program is necessary. The monitoring program can use existing monitoring wells and flumes to record discharge rates from the mine adit. Such a program would last at least five years and, optimally, ten years or longer, since it takes about five years to see the full effects of alfalfa water usage and other land-use changes.

The long-term improvement to water quality in Belt Creek and other drainages makes the use of source-control measures to reduce acid mine drainage a high value option that should be seriously considered at this site and others in the region with similar problems.

Introduction

This project was conducted jointly by the Montana Department of Environmental Quality (MDEQ) and the Montana Bureau of Mines and Geology (MBMG), through funding provided by the USDA-Natural Resources Conservation Services, Conservation Innovation Grant (CIG) program, MDEQ, and MBMG. Conventional methods of acid mine drainage (AMD) treatment have either failed or have been found to be too costly for abandoned underground coal sites in central Montana. Previous attempts to treat AMD water in wetlands were unsuccessful due to the harshness of Montana's winters and the high iron concentrations in the mine water. The primary goal of this project was to look at changes in agricultural land-use practices as a method to mitigate AMD from abandoned underground coal mines. Changes in land-use practices have been an accepted and well-documented technique for controlling saline seep development and reclaiming saline-seep-impacted lands associated with dry land farming throughout central and south-central Montana. Saline seep reclamation and mitigation practices look to identify key groundwater recharge zones and to change or modify cropping practices to better consume excess soil moisture in the root zone, thus reducing the amount of water entering the groundwater system. Changes in cropping practices have reduced the spread of saline seep and in many areas reversed the effects of saline seep, e.g., Highwood Bench area, near Fort Benton, in central Montana. A reduction in the amount of water entering the groundwater system above the abandoned coal mines would result in less AMD development and reduce the quantity of contaminated water discharged from these mine sites into streams and riparian zones. Land-use changes may also lead to better diversification of agricultural practices and add more stability to individual farm and ranch operations.

Additional approaches considered for mitigating the AMD problem in this project included drilling horizontal wells and installing bulkheads in the mine to help control waters within the mine workings. Horizontal drill holes would provide a method of further dewatering the groundwater system overlying the mine workings, also reducing AMD development. Water from the drill holes would have the potential for providing additional stock water supply or supplementing the flow of water in natural drainages. Water intercepted above the mine workings would be of suitable quality for stock water use or discharge to surface water.

Project Background

The eastern portion of Cascade County and the counties to the east, e.g., Fergus and Judith Basin, are significant agricultural areas of Montana. This region includes a predominately agricultural 1,500 square mile area (or almost 1 million acres) known as the Great Falls-Lewistown Coal Fields (fig. 1).

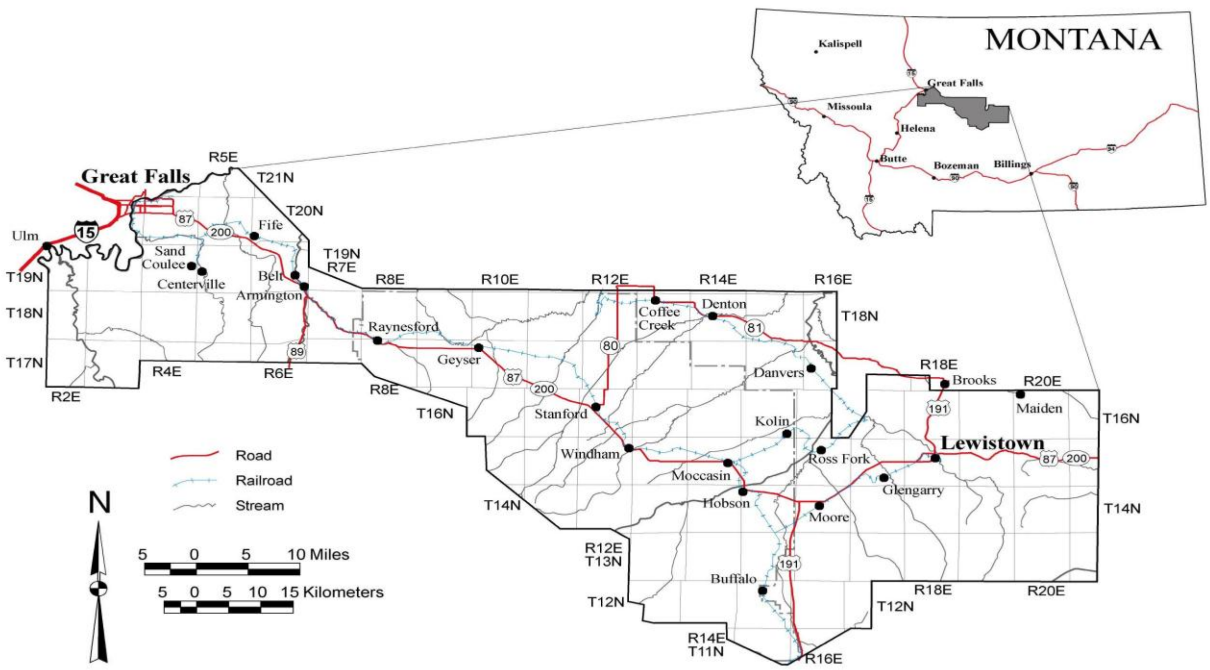


Figure 1. Map showing location of the Great Falls-Lewistown Coal Field, central MT.

Throughout the latter part of the 1800s and early 1900s, a number of coal mines were developed in the region, especially in the Belt, Stockett, Sand Coulee, and Lewistown areas (fig. 2). Concurrent with the development of these underground coal mines was the development of a substantial agricultural industry in the areas overlying the mines. Not only was the mined coal used to fuel Montana's industrial development, it was also used by the homesteaders, and later, farmers and ranchers, to heat their homes.

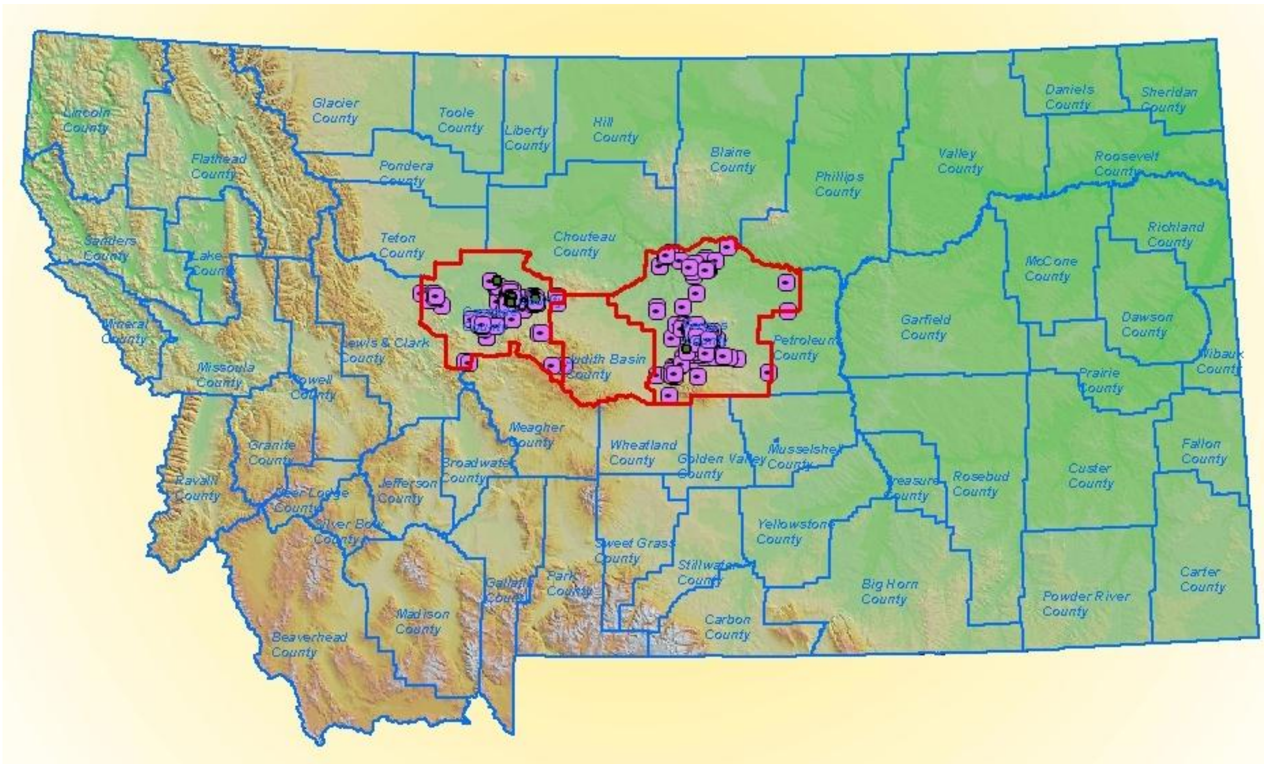


Figure 2. Coal mines in the Belt, Stockett, Sand Coulee, and Lewiston areas, 1800s–1900s.

MDEQ estimates over 350 now-abandoned underground coal mines operated in this area at one time. These mines underlie many thousands of acres of agricultural land in the Belt, Sand Coulee, and Stockett areas alone. The coal and overlying sandstones in this region provide an abundant source of pyrite, which is necessary in the generation of acidic, metal-laden water, commonly referred to as "acid mine drainage" or AMD.

One of the major coal mines in the region was the Anaconda/Castner Mine, located in Belt, MT. The mine workings extend almost 2 miles in a west-southwest direction from Belt. Figure 3 shows the approximate boundary of the mine workings and the major haulage routes within the mine, and locations of monitoring wells associated with previous investigations. Underground coal mining occurred at the Anaconda Mine in Belt from 1877 through 1922. Groundwater encountered during mine operations was allowed to drain toward the town of Belt and has drained from the abandoned mine workings for over 80 years. The mine discharge contributes over 180,000 gallons per day of contaminated water that flows directly into Belt Creek, upstream of the town of Belt. The discharge from the Anaconda Mine contributes over 82,000 pounds of iron, 55,000 pounds of aluminum, and 983,000 pounds of sulfate each year to Belt Creek.

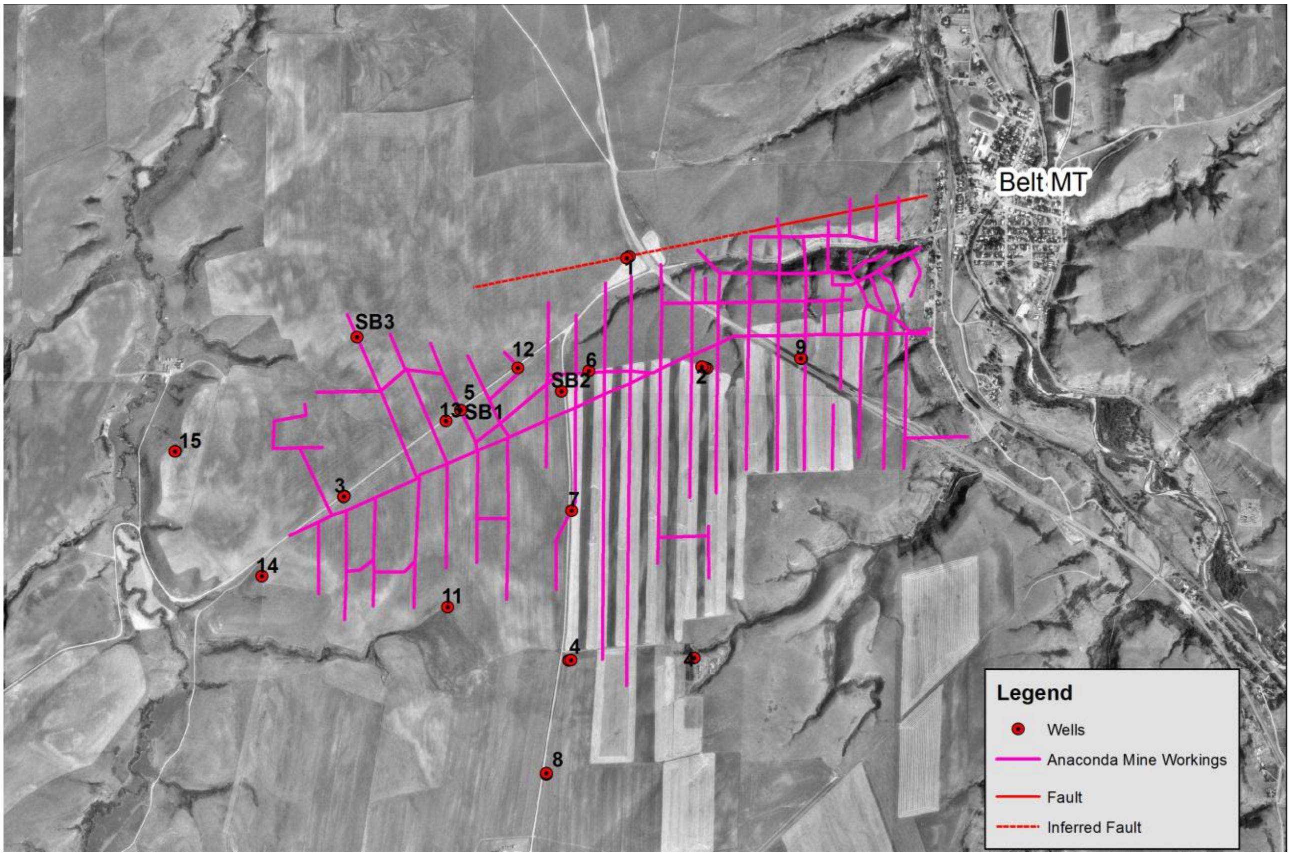


Figure 3. Approximate extent of major haulage routes within the Anaconda Mine.

The natural flow in Belt Creek is intermittent and fluctuates considerably depending upon seasonal conditions; however, the AMD discharge is continuous, which results in the AMD contributing a greater percentage to the stream flow throughout the periods of low flow (fig. 4). This results in much higher contamination levels at those times, when the aquatic environment is most stressed and more susceptible to water-quality changes.


Figure 4. Photo of acid mine discharges into Belt Creek during low-flow conditions.

Previous attempts to mitigate AMD from this mine included wetland treatment, but the high iron content of the water and the severity of Montana's winters contributed to an overall failure. The failure of wetlands at this mine site and the failure of conventional bulkheads at other mines in the region dictate that other options for control of AMD must be considered. The agricultural land surrounding this mine was selected for this demonstration project since other work was underway by the MDEQ and MBMG to characterize the sources of water entering the mine. This work included monitoring water-level fluctuations and water quality in the groundwater system and discharge from the mine adit.

Project Objectives

The objectives of this project were to reduce the quantity of contaminated water discharging from the Anaconda Mine workings into Belt Creek by taking a more holistic approach, looking to incorporate changes in land-use practices along with engineering approaches in reclamation alternatives. Methods considered were:

1. Land-use changes, changing crop types and converting agricultural land to grazing;
2. Installation of wells equipped with solar-powered pumps in areas identified for grazing to use additional groundwater in the shallow aquifer;
3. Identification of areas within the mine workings where bulkheads could be installed to limit the amount of contaminated water discharging from the abandoned mine workings; and
4. Identification of areas where horizontal wells (drains) could be installed to help drain water in the shallow aquifer overlying the workings to limit the amount of water entering the mine workings.

The project focused on identifying key agricultural areas where excess recharge water enters the mine workings, developing plans for cropping and land-use changes on land above and adjacent to the mine, and understanding the movement of water through the mine. Discussions with producers about potential operational changes were combined with information from the other parts of the project to develop an overall AMD reduction plan.

Land Ownership and Site Prioritization

Ownership of land within the study area is distributed within five entities (fig. 5):

1) State of Montana (former Larson property)
2) James Larson-Diamond Willow Ranch
3) Pleasant Valley Hutterite Colony
4) James Warehime
5) WilaMae Keaster

The first three owners control the largest percent of land overlying the mine workings and were initially identified as being critical for this project. As the project developed, the focus shifted to the State land and Larson land, due to hydrogeologic conditions, cropping practices, access, time, and money constraints.

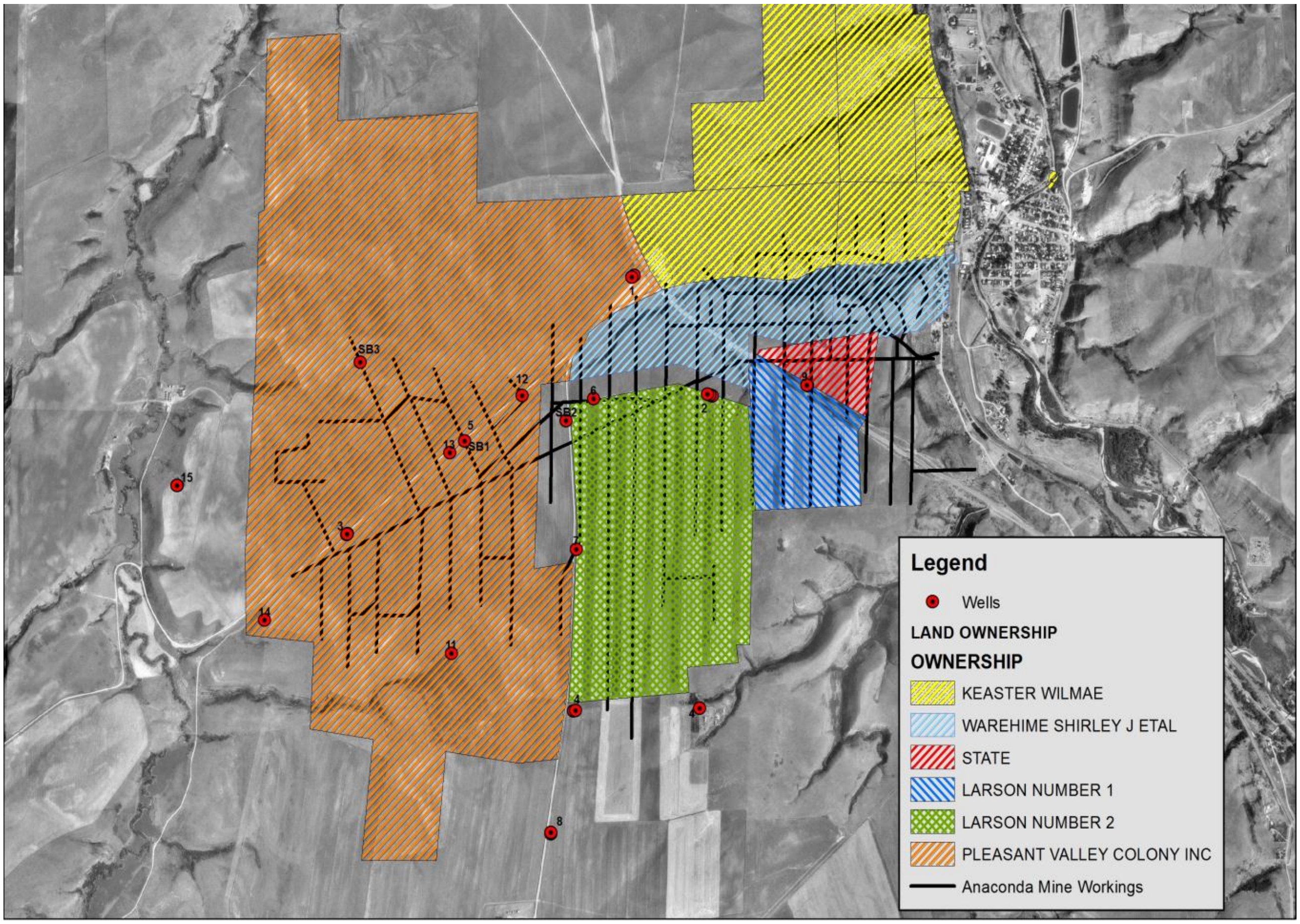


Figure 5. Location map identifying land ownership within the study area.

__State Land Site__

The State of Montana purchased 98 acres of land adjacent to and overlying the Anaconda Mine workings shortly after the start of this project. The land overlying the mine workings had been in a crop-fallow rotation and was given top priority for cropping changes. The Montana Salinity Control Association (MSCA) worked with representatives of DEQ to develop a cropping system on approximately 42 acres of this site. Prior to making cropping changes, DEQ had the land sprayed for weeds twice by Cascade County Weed Control.

Alfalfa was planted during 2009 and harvested for the first time in 2010 (fig. 6). The site produced 1.75 tons/acre of alfalfa from the 2010 cutting. The alfalfa had a good second growth; however, it was not sufficient enough for a second cutting. The first-year production from this site was excellent and demonstrates that implementing alfalfa into the cropping system is very feasible in this area. To better improve alfalfa production, some areas need additional weed control and reseeding where grass and alfalfa growth are sparse.

Appendix A contains pictures of the area seeded to alfalfa and 2010 hay production.

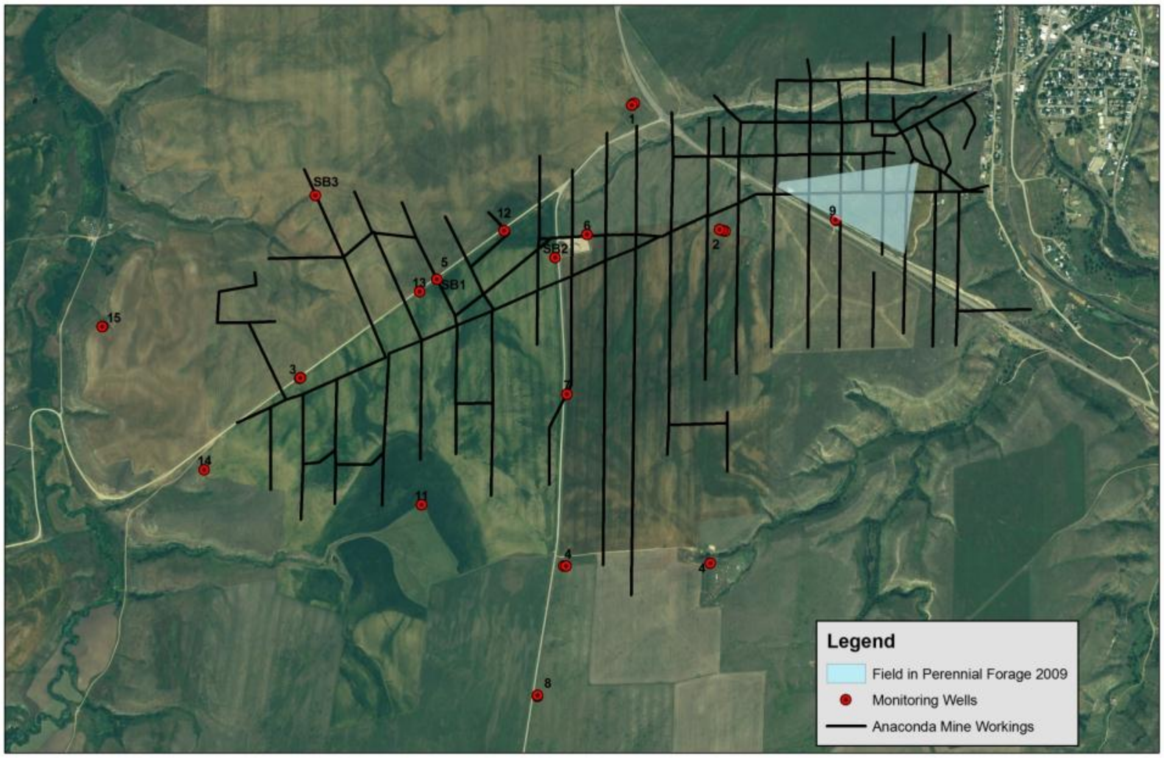


Figure 6. Map showing location of State land where alfalfa was planted in 2009.

James Larson-Diamond Willow Ranch

The property owned by James Larson (Larson 1 and Larson 2) and family—Diamond Willow Ranch, which overlies the Anaconda Mine (fig. 5), was identified as the second priority for implementing land-use changes/cropping practices. This portion of the study area consists of approximately 450 acres; 330 acres were high priority for changes. The Larson acreage is in a combination of crop-fallow, Conservation-Reserve Program (CRP) grass, and grazing parcels. The crop-fallow portion is of primary importance for implementing cropping changes. Since Larson's operation is a combination cereal grain–livestock operation, it was ideal for developing multiple changes in land use to better control recharge of groundwater to the mine workings. Appendix B contains a more detailed farm plan and recommendations for this property developed by MSCA.

The plan developed by MSCA was intended to lead to greater diversification of the Larson operation and greater use of water in the shallow aquifer system by developing its use for livestock consumption. Installation of solar-operated pumps for water withdrawals and the use of pipelines and water tanks to divert water to other areas of the site would enable greater grazing flexibility and should limit erosion and sedimentation problems in riparian zones currently being grazed.

Water-Level Monitoring

A groundwater monitoring network consisting of 29 monitoring wells was established during previous DEQ-MBMG investigations. It was maintained during this study to provide information on water-level changes as they relate to cropping/land-use practices. Monitoring wells were completed in various geologic units underlying the study area. Table 1 contains a breakdown of the number of wells in each geologic unit.

Table 1. Breakdown of groundwater monitoring wells by geologic unit, shallowest to deepest, Belt, MT.

Geologic Unit/Formation	Number of Wells
Kootenai Sandstone-Sunburst Sandstone	8
Kootenai Sandstone-Cut Bank Sandstone	3
Morrison Coal Seam	15
Madison Limestone	3
Total Number of Wells	29

Figure 7 shows the location of monitoring well sites and their relationship to the mine workings. At selected locations, more than one well was installed; e.g., site 2 had four wells installed, one in each stratigraphic unit shown in table 1. Water levels exhibited the greatest amount of seasonal variation, up to 25 ft, in the shallowest unit (Sunburst Sandstone). Figures 8 and 9 show water-level trends for two Sunburst monitoring wells; well 2C is located in an area where traditional crop-fallow rotation has been followed, while well 5C is located adjacent to areas re-cropped. Both wells showed a quick water-level response to spring precipitation events, with water levels gradually declining through the summer and winter.

Figure 10 is a water-level hydrograph for well 8C, which is located in a CRP area on the Larson property. Water-level response to increased precipitation in the spring was much more muted, with increases on the order of 5 ft, versus 20–25 ft in cropped areas. Figure 11 is a comparison of water-level trends in wells 5C (re-crop) and 8C (CRP) that show the dramatic difference in water-level response based upon cropping practices.

Alfalfa has not only been shown to reduce the seasonal water-level increases at sites where it has been planted for saline seep reclamation, but also has been effective in a net lowering of water levels due to its increased water consumption. Figure 12 shows historic water-level changes from monitoring wells located on the Highwood Bench, Fort Benton, MT, when alfalfa was included in the cropping system.

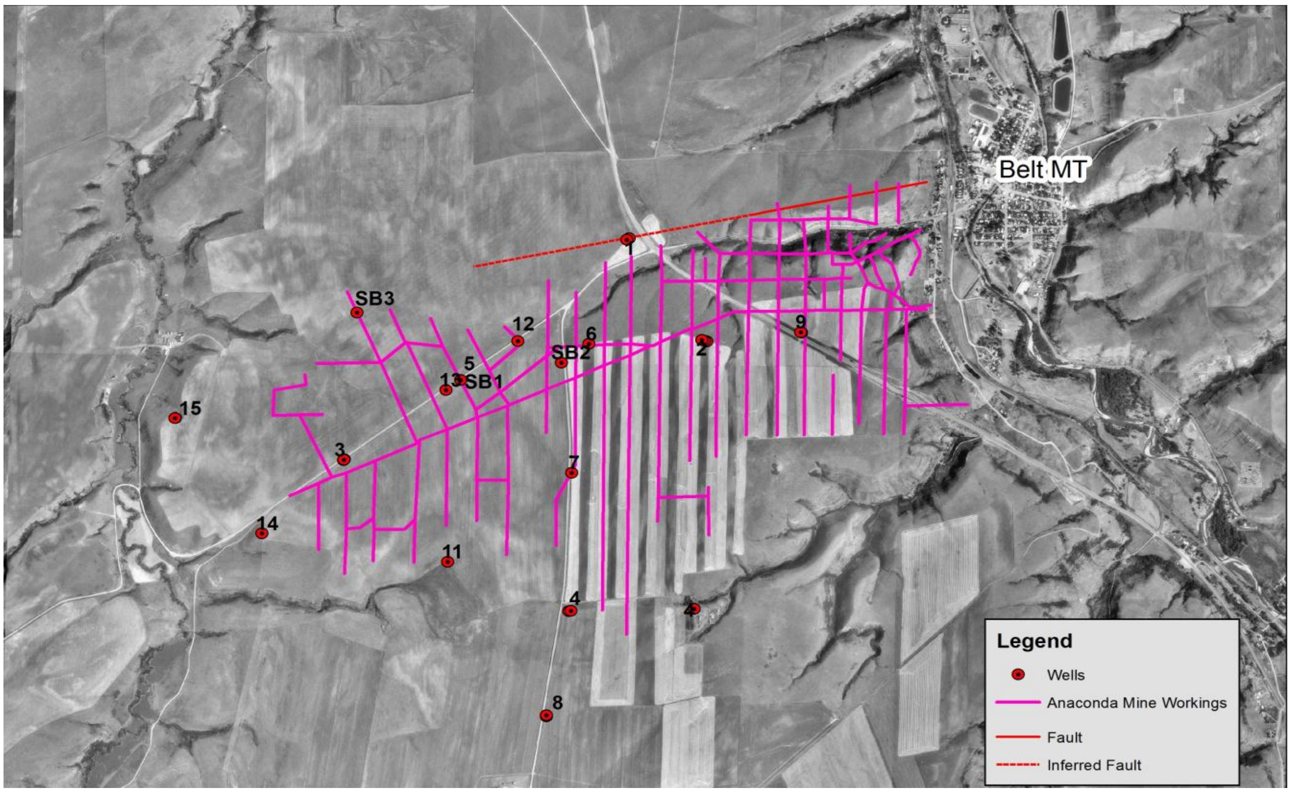


Figure 7. Location of monitoring wells and their relationship to mine workings.

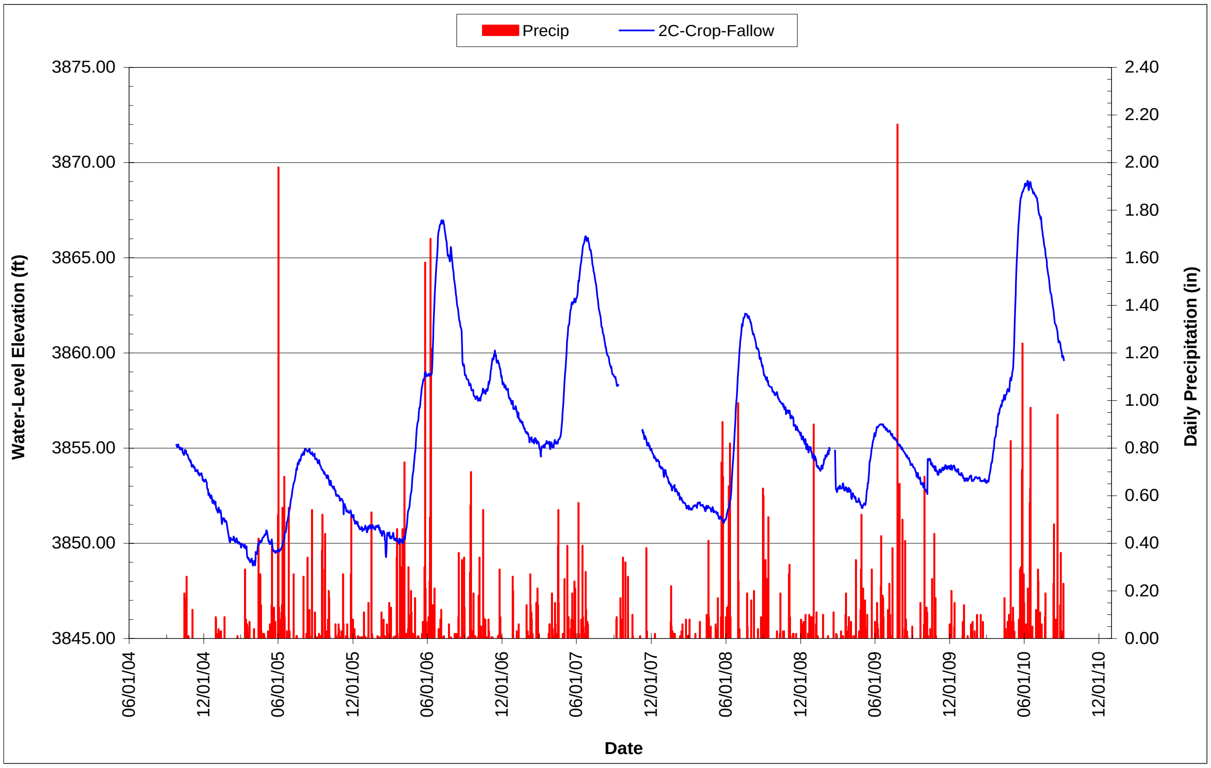


Figure 8. Hydrograph showing water-level variations in well 2C located in crop-fallow.

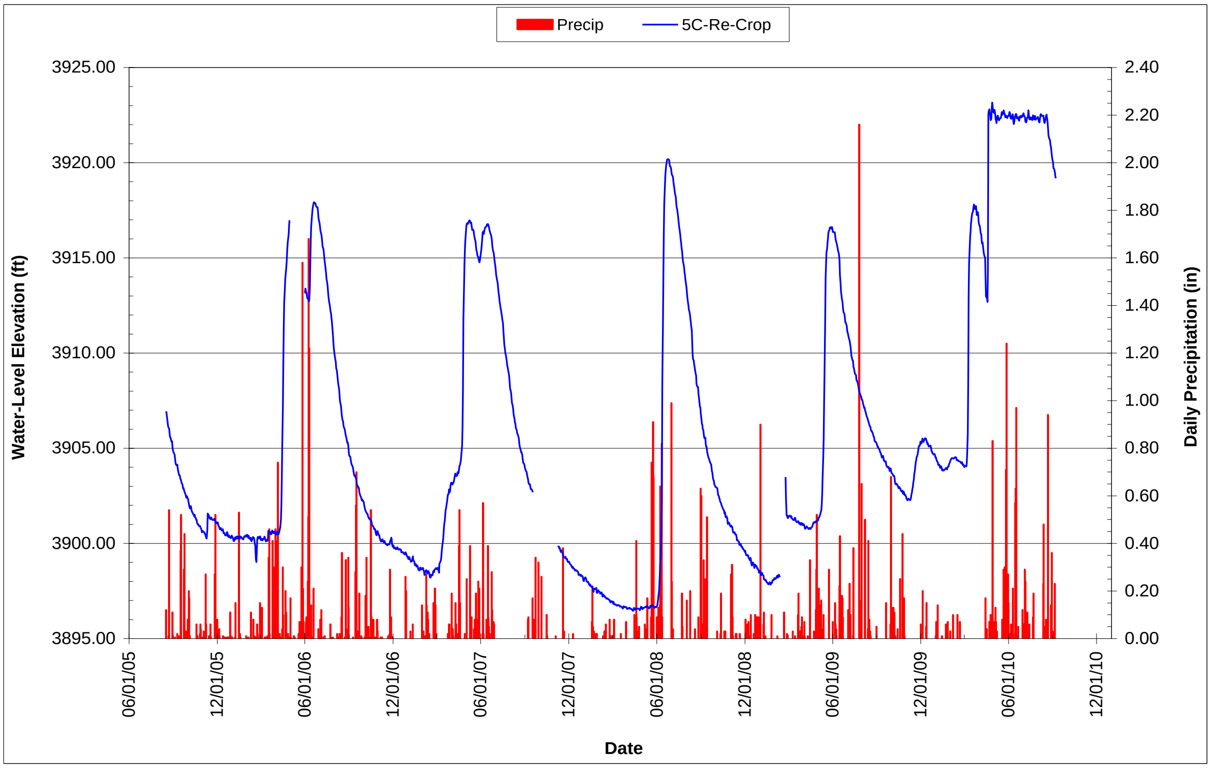


Figure 9. Hydrograph showing water-level variations in well 5C located in re-crop.

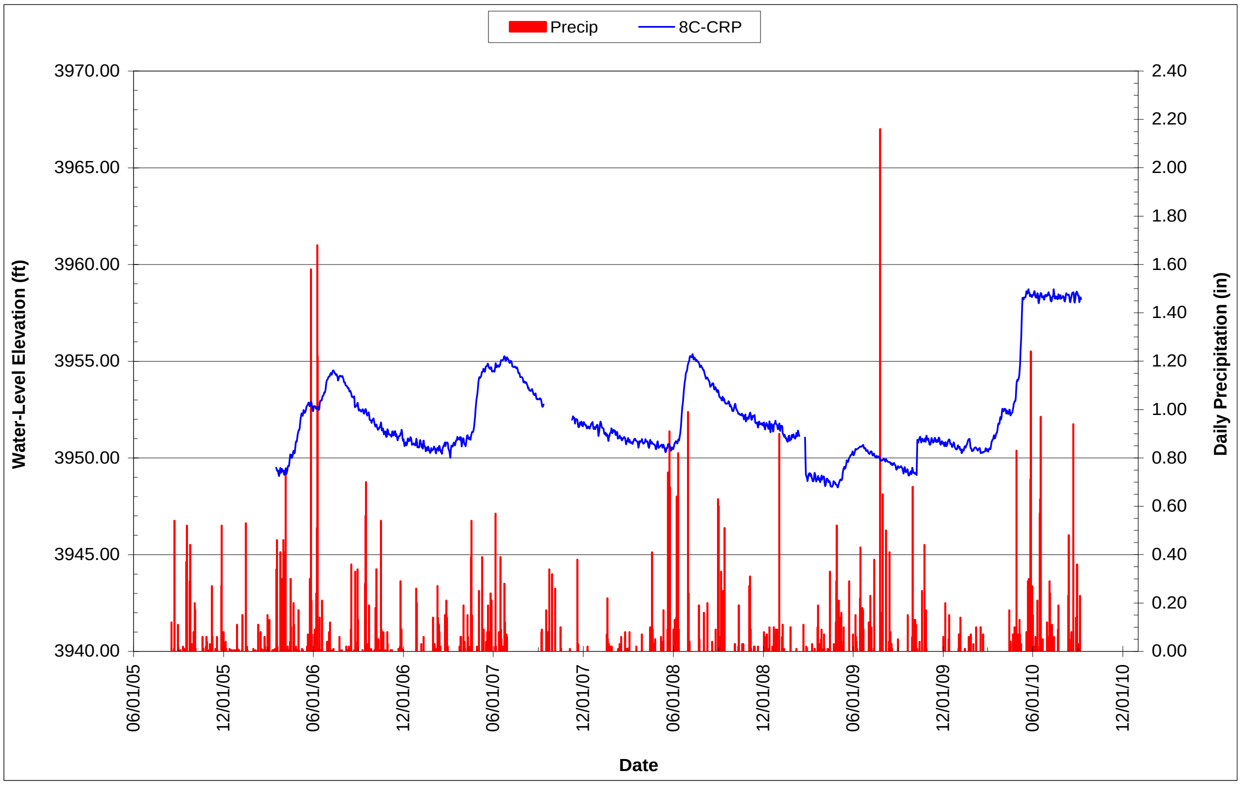


Figure 10. Hydrograph showing water-level variations in well 8C located in CRP.

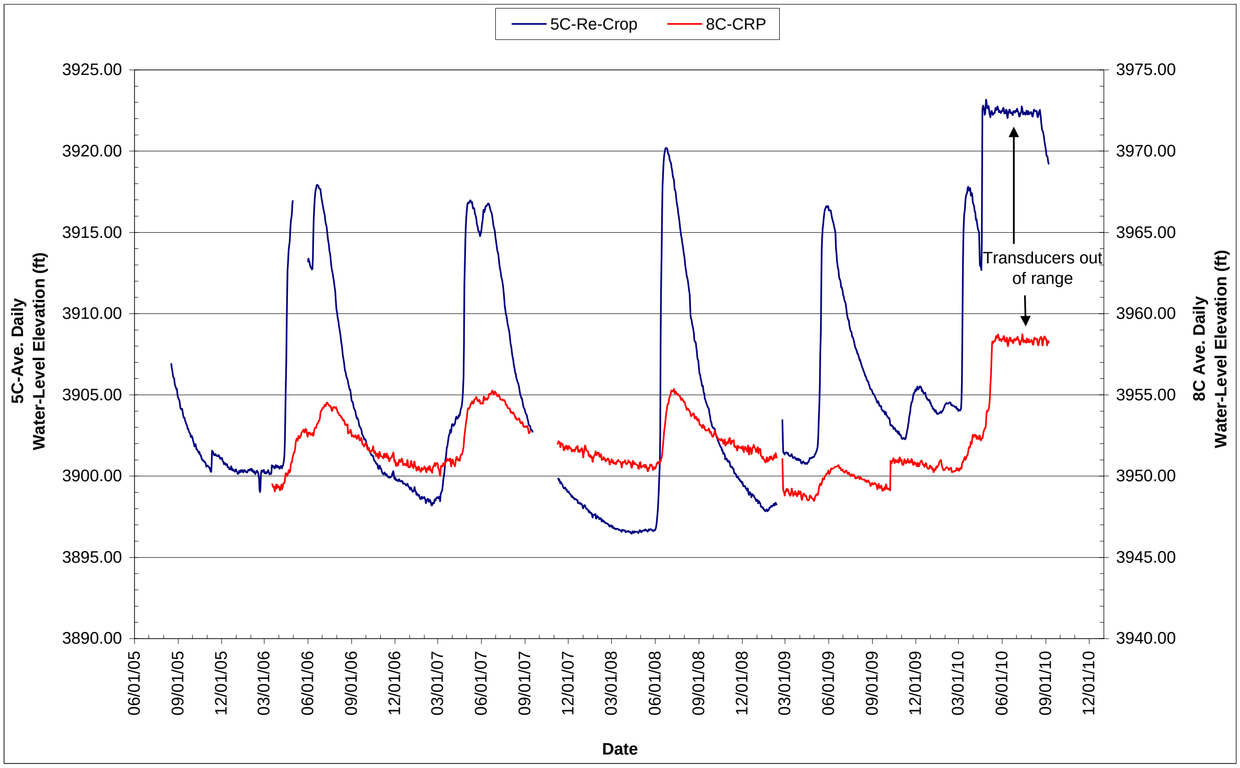
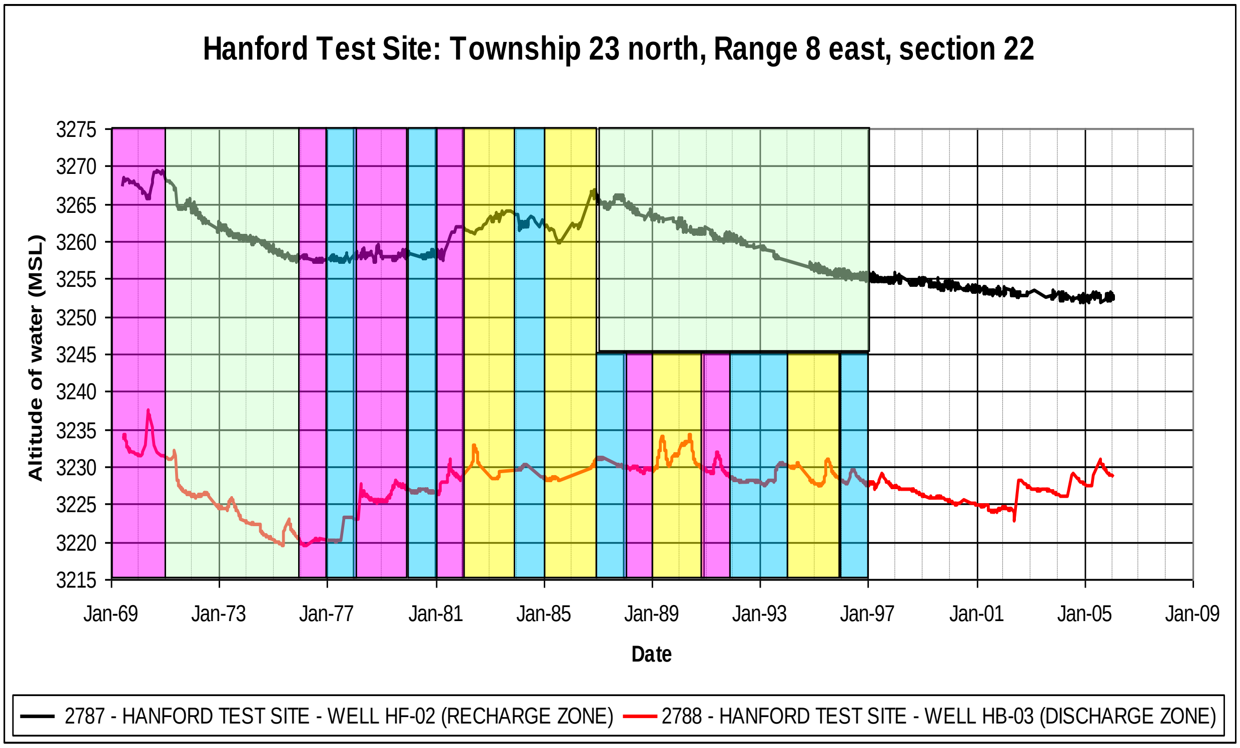


Figure 11. Hydrograph comparing water-level trends in wells 5C and 8C.



Purple = Barley; Green = alfalfa; Blue = winter wheat; Yellow = spring wheat

Figure 12. Hydrograph showing historic water-level changes on the Highwood Bench (Hanford Test Site) versus cropping.

The State land and Larson property overlying the mine workings have the potential to provide recharge water to the underground mine workings. As less water is used by crops, grasses, or livestock watering, etc., more is left to enter the mine workings and the greater the AMD problems become. It takes 4–5 years for alfalfa's root zone to become well established at deeper depths (20–25 ft); therefore, no significant changes in water levels were seen in the area adjacent to the alfalfa planted on State land. Figure 13 is a hydrograph from the only well (well 9C) adjacent to the alfalfa plot; however, the well is upgradient and may not accurately reflect water-level changes for the limited acreage planted in alfalfa. Changes in cropping and land-use practices are most effective when applied in the upper portion of the recharge area, which is why changes in land management on the Larson property, in particular, and Pleasant Valley Colony property are key to the success of the AMD problem.

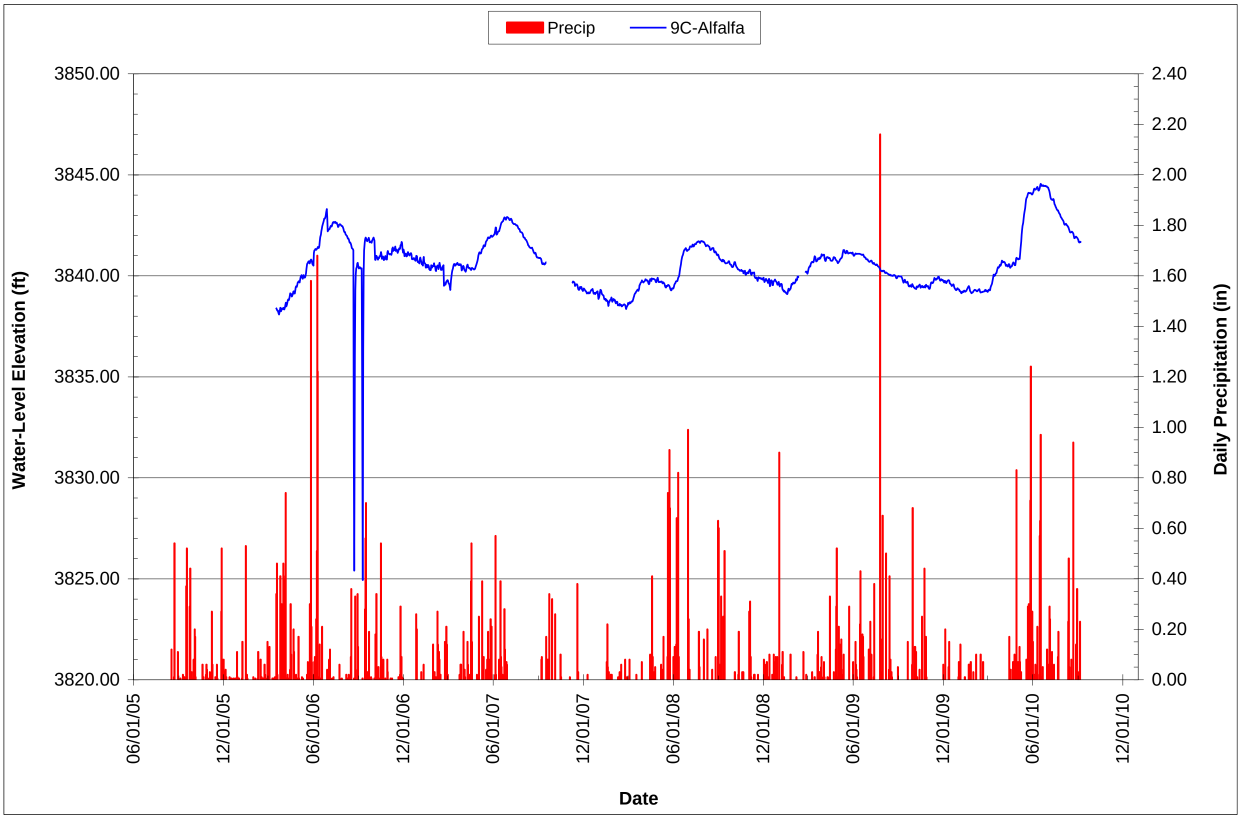


Figure 13. Hydrograph for well 9C adjacent to area planted to alfalfa in 2009.

Water-Quality Monitoring

Water quality within the groundwater system is very important when considering land-use changes and other options for AMD mitigation. Two options considered during this project were using groundwater for additional stock watering purposes and draining groundwater to adjacent streams and coulee drainages through the use of horizontal drain wells. For either of these options to be viable, water quality had to be sufficient to meet stock water and aquatic standards. Table 2 shows water-quality comparisons for five Sunburst wells (wells 2C, 3C, 5C, 8C, and 9C) for various analytes. Stock water, irrigation water, and acute-aquatic life standards are shown in this table. Water quality met recommended standards for all but one analyte, aluminum, in well 5C. While the aluminum concentration was above the standard in this sample, all previous samples from this well were well below the recommended limit. Water quality in the Sunburst aquifer would be suitable for any of the proposed land-use changes, i.e., providing stock water or draining to existing streams through the use of horizontal wells.

Water-quality samples were collected from the mine discharge (AMD), a spring discharge in French Coulee impacted by AMD, Box Elder Creek, and a spring in the Box Elder Creek drainage and then compared to water-quality standards (table 3). Both sites in the Box Elder Creek drainage showed relatively good water quality when compared to standards; however, the two AMD sites had elevated concentrations of trace metals and sulfate and low pH. When the flow rate of each site is considered, the AMD sites contribute over 82,000 pounds of iron, 55,000 pounds of aluminum, and 983,000 pounds of sulfate per year to Belt Creek. The iron and aluminum in the AMD waters precipitate out in Belt Creek, causing considerable staining of the streambed (iron) and a white precipitate in the water (likely aluminum hydroxides and or sulfates; figs. 14 and 15).

Appendix C contains water-quality results for groundwater samples collected from monitoring wells, while appendix D contains water-quality data for springs, AMD sources, and other surface waters.

Table 2. Comparison of recommended water-quality standards to water quality of selected wells completed in the Sunburst Sandstone (shallow aquifer). Concentrations exceeding a standard are shown in red.

Constituent	Stock Water Std.	Irrigation Water Std.	Aquatic Life-Acute Std.	Well 2C (11/8/05)	Well 3C (10/7/09)	Well 5C (10/7/09)	Well 8C (8/24/06)	Well 9C (8/22/06)
pH	**6.5-8.5**	**6.5-8.5**	**6.5-8.5**	**7.69**	**6.69**	**7.70**	**7.09**	**7.37**
Calcium (Ca)	---	---	---	43.2 mg/L	54.8 mg/L	37.8 mg/L	52.6 mg/L	54.5 mg/L
Magnesium (Mg)	2,000 mg/L	---	---	50.8 mg/L	43.1 mg/L	63.7 mg/L	45.5 mg/L	56.5 mg/L
Sodium (Na)	2,000 mg/L	---	---	7.8 mg/L	17.8 mg/L	7.97 mg/L	9.0 mg/L	19.2 mg/L
Iron (Fe)	---	---	---	0.016 mg/L	0.30 mg/L	2.15 mg/L	0.40 mg/L	0.04 mg/L
Manganese (Mn)	---	2.0 mg/L	---	0.026 mg/L	0.047 mg/L	0.109 mg/L	0.08 mg/L	0.111 µg/L
Bicarbonate (HCO_3)	---	---	---	352 mg/L	411 mg/L	364 mg/L	387 mg/l	452 mg/L
Sulfate (SO_4)	1,500 mg/L	---	---	28 mg/L	<25 mg/l	<25 mg/l	32.3 mg/L	59.2 mg/L
Nitrate (NO_3 as N)	100 mg/L	---	---	11.7 mg/L	<0.5 mg/L	16.74 mg/L	<0.05 mg/L	0.26 mg/L
Aluminum (Al)	---	1,000 µg/L	750 µg/L	<10 µg/L	<7.6 µg/L	2,346 µg/L	<10 µg/L	21 µg/L
Arsenic (As)	50 µg/L	100 µg/L	340 µg/L	1.8 µg/L	6.19 µg/L	0.834 µg/L	1.3 µg/L	<1 µg/L
Cadmium (Cd)	10 µg/L	5 µg/L	6.52 µg/L @300 mg/L hardness	<1 µg/L	<0.1 µg/L	<0.3 µg/L	<1 µg/L	<1 µg/L
Chromium (Cr)	1,000 µg/L	100 µg/L	---	9.87 µg/L	<0.1 µg/L	6.44 µg/L	<2 µg/L	2.06 µg/L
Cobalt (Co)	1,000 µg/L	50 µg/L	---	<2 µg/L	0.29 µg/L	3.87 µg/L	<2 µg/L	<2 µg/L
Copper (Cu)	500 µg/L	200 µg/L	39.4 µg/L @300 mg/L hardness	<2 µg/L	<0.4 µg/L	8.64 µg/L	<2 µg/L	<2 µg/L
Lead (Pb)	50 µg/L	5,000 µg/L	330 µg/L @300 mg/L hardness	<2 µg/L	<0.4 µg/L	3.47 µg/L	<2 µg/L	<2 µg/L
Nickel (Ni)	---	200 µg/L	1188 µg/L @300 mg/L hardness	<2 µg/L	1.04 µg/L	6.36 µg/L	<2 µg/L	5.7 µg/L
Selenium (Se)	50 µg/L	20 µg/L	20 µg/L	8.29 µg/L	0.13 µg/L	1.98 µg/L	<1 µg/L	1.88 µg/L
Zinc (Zn)	24,000 µg/L	2,000 µg/L	304 µg/L @300 mg/L hardness	112 µg/L	<0.9 µg/L	7.68 µg/L	6 µg/L	2.69 µg/L

Table 3. Comparison of recommended water-quality standards to water quality of selected acid mine drainage, surface water, and spring sites. Concentrations exceeding a standard are shown in red.

Constituent	Stock Water Std.	Irrigation Water Std.	Aquatic Life-Acute Std.	Mine Drain	French Coulee AMD	Box Elder Cr.	Box Elder Spring
pH	**6.5-8.5**	**6.5-8.5**	**6.5-8.5**	**2.31**	**2.75**	**8.21**	**8.12**
Calcium (Ca)	---	---	---	173 mg/L	186 mg/L	68.6 mg/L	51.8 mg/L
Magnesium (Mg)	2,000 mg/L	---	---	73.3 mg/L	94 mg/L	40.7 mg/L	56.9 mg/L
Sodium (Na)	2,000 mg/L	---	---	8.9 mg/L	10.3 mg/L	9.05 mg/L	10.2 mg/L
Iron (Fe)	---	---	---	162 mg/L	706 mg/L	0.01 mg/L	0.01 mg/L
Manganese (Mn)	---	2.0 mg/L	---	0.62 mg/L	0.76 mg/L	0.006 mg/L	0.002 mg/L
Bicarbonate (HCO_3)	---	---	---	0.0 mg/L	0.0 mg/L	322 mg/L	322 mg/L
Sulfate (SO_4)	1,500 mg/L		---	2,166 mg/L	4,887 mg/L	28.6 mg/L	<25 mg/L
Nitrate (NO_3 as N)	100 mg/L	---	---	<1 mg/L	<2.5 mg/L	13.8 mg/L	26.8 mg/L
Aluminum (Al)	---	1,000 µg/L	750 µg/L	121,337 µg/L	342,394 µg/L	<7.6 µg/L	<7.6 µg/L
Arsenic (As)	50 µg/L	100 µg/L	340 µg/L	1.0 µg/L	22.1 µg/L	0.84 µg/L	0.36 µg/L
Cadmium (Cd)	10 µg/L	5 µg/L	6.52 µg/L @300 mg/L hardness	13.1 µg/L	6.85 µg/L	<0.1 µg/L	<0.1 µg/L
Chromium (Cr)	1,000 µg/L	100 µg/L	---	30.4 µg/L	106 µg/L	<0.1 µg/L	0.2 µg/L
Cobalt (Co)	1,000 µg/L	50 µg/L	---	292 µg/L	226 µg/L	0.61 µg/L	0.08 µg/L
Copper (Cu)	500 µg/L	200 µg/L	39.4 µg/L @300 mg/L hardness	55.6 µg/L	30.7 µg/L	0.64 µg/L	<0.4 µg/L
Lead (Pb)	50 µg/L	5,000 µg/L	330 µg/L @300 mg/L hardness	2.15 µg/L	5.39 µg/L	<0.4 µg/L	<0.4 µg/L
Nickel (Ni)	---	200 µg/L	1188 µg/L @300 mg/L hardness	696 µg/L	533 µg/L	0.13 µg/L	<0.1 µg/L
Selenium (Se)	50 µg/L	20 µg/L	20 µg/L	0.69 µg/L	<1 µg/L	0.95 µg/L	2.39 µg/L
Zinc (Zn)	24,000 µg/L	2,000 µg/L	304 µg/L @300 mg/L hardness	4,109 µg/L	3,329 µg/L	<0.9 µg/L	<0.9 µg/L

Figure 14. Iron precipitate in Belt Creek resulting from AMD discharge (looking downstream).

Figure 15. Aluminum precipitates in Belt Creek resulting from AMD discharge (looking upstream).

Water-quality monitoring was performed periodically in two wells completed within the mine workings. Well 3B is located within a portion of the mine that is fully flooded, while well 12B is located in the middle of the mine workings where flooding is only partially complete. *In situ* monitoring also occurred in the AMD discharge. The following parameters were recorded in two-hour increments: pH, specific conductance (SC), temperature, and oxidation-reduction potential (ORP). Figures 16, 17, and 18 present comparisons of pH, SC, and temperature during late winter, spring, and fall for wells 3B, 12B, and the mine discharge. The change in water quality is apparent; pH decreased and SC increased as water moved from the flooded to partially flooded portions of the mine, to the discharge at the mine adit. The SC during the late winter (Feb–March 2009), in the mine discharge, showed considerable fluctuation and was related to additional mine de-watering activities. Water pooled inside the mine adit was being pumped during the period of fluctuation, resulting in less flow in the AMD drainage ditch. The reduced flow caused the SC sensor to be only partially submerged, so readings were abnormally low. Figure 19 shows SC trends in 2006 when mine de-watering was not occurring. It is apparent that groundwater that enters the mine workings quickly degrades as it is exposed to oxygen and pyrite in the workings.

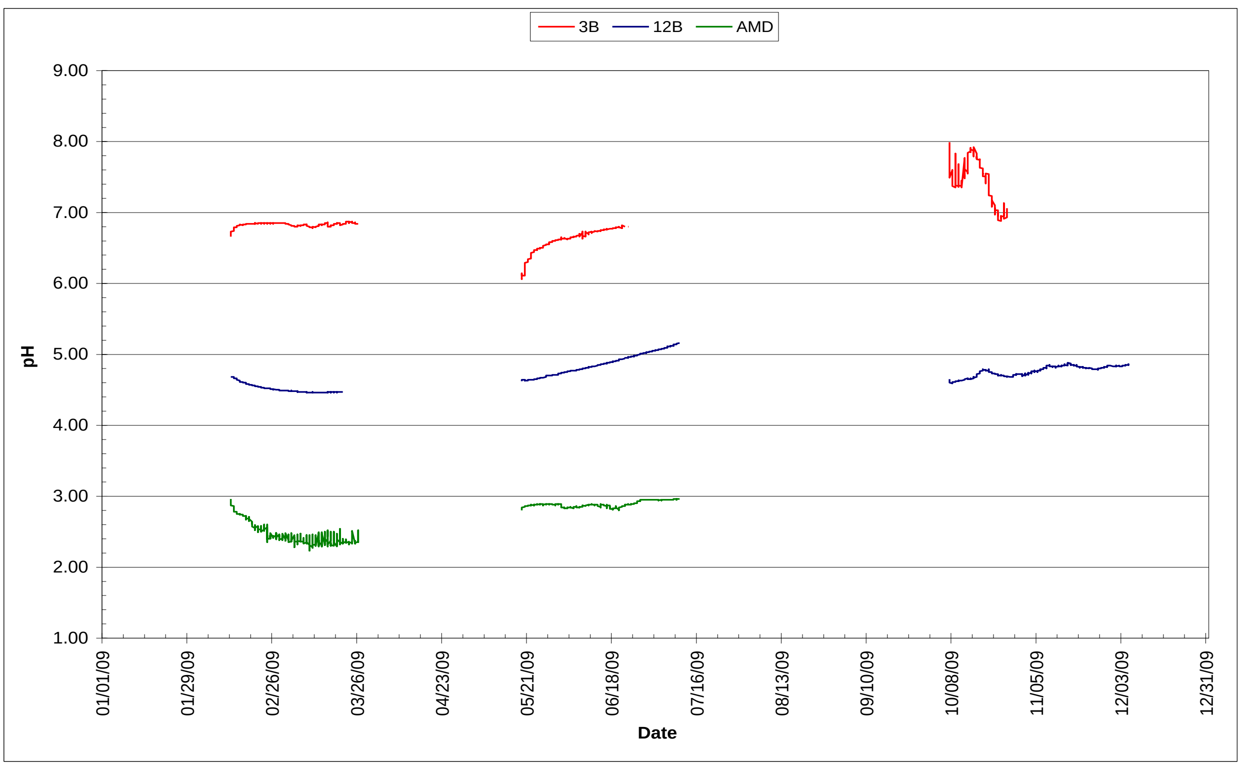


Figure 16. Comparison of pH values in wells 3B, 12B, and the mine discharge.

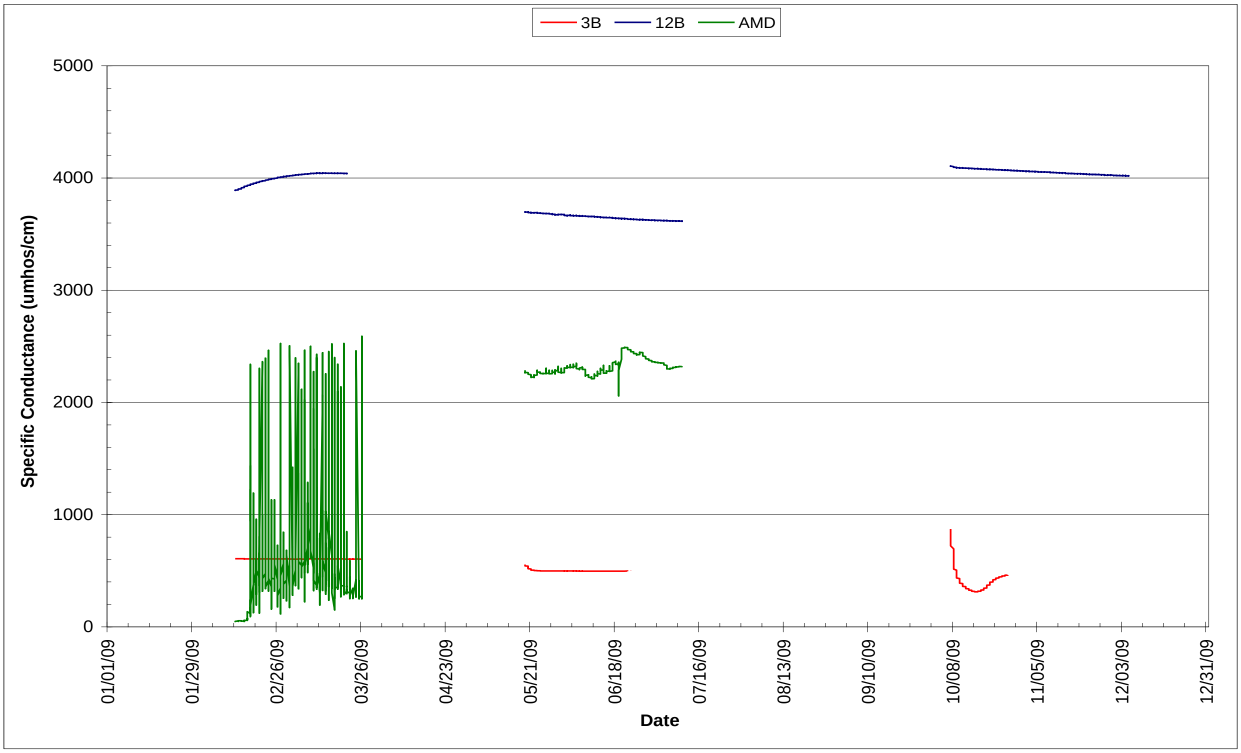


Figure 17. Comparison of specific conductance values in wells 3B, 12B, and the mine discharge.

Figure 18. Comparison of temperature values in wells 3B, 12B, and the mine discharge.

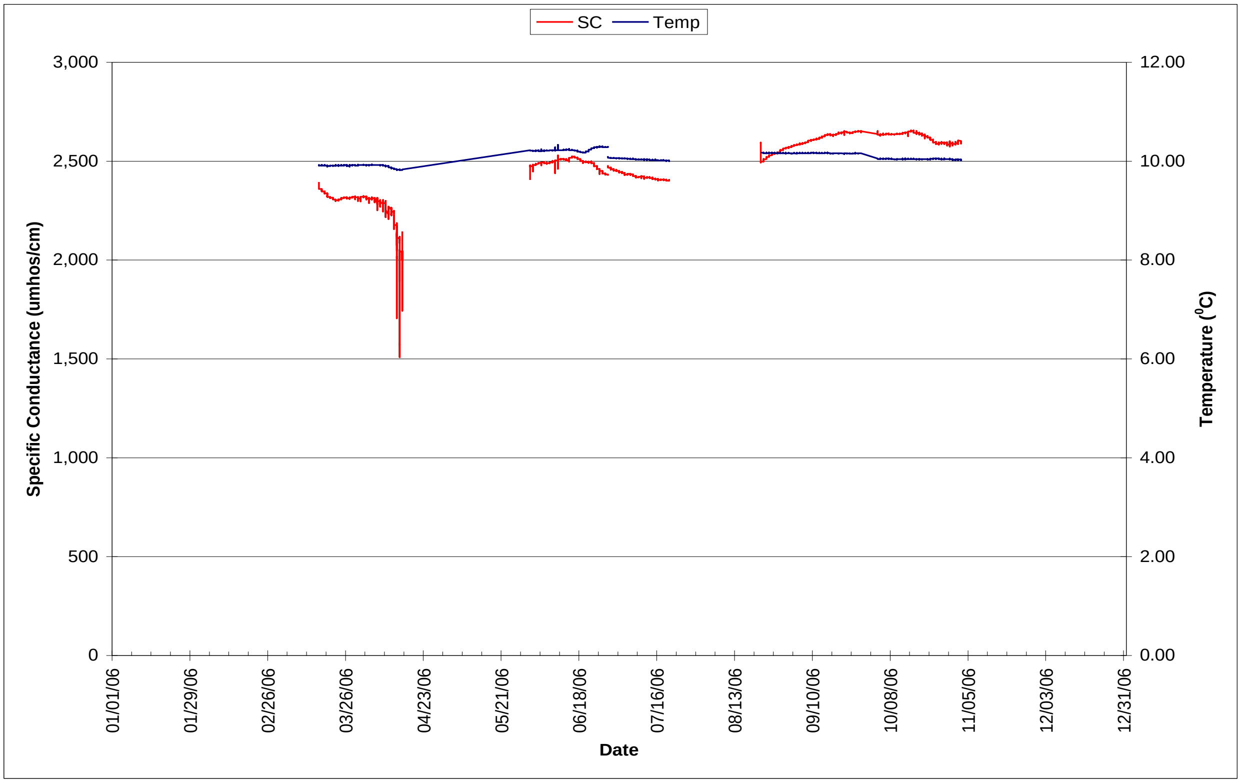


Figure 19. Specific conductance values from mine drainage during 2006.

Horizontal Drains

The second option to reduce the amount of groundwater entering the mine workings, following cropping and land-use changes, would be the installation of horizontal drill holes (drains). Water-quality sampling and physical parameter monitoring established that groundwater within the shallow (Sunburst) aquifer and the flooded portion of the mine was of sufficient quality to be used for livestock or allowed to discharge to adjacent drainages, and eventually reach Belt Creek or Box Elder Creek. Numerous springs currently exist within the two major drainages at the base of the Sunburst Sandstone Unit. The water from the drains would be similar in quality to the springs and would increase the flow of water in the drainages. Using the images developed from a previously constructed 3-dimensional model, the locations for potential horizontal wells were identified.

In order to drain water effectively from the Sunburst Sandstone, it is important that the horizontal drain is installed directly into the formation, with a screen interval that is completely within the target aquifer. To maximize the volume of water that can be removed, the drain should be situated in a relatively thick section, along the bottom half of the formation. During the installation of the drain, the drill cuttings should be carefully examined to ensure that the drill is staying within the permeable yellowish-brown sandstone, and not drifting into other, shale-dominated units.

Due to the accuracy that is required to install a horizontal drain that meets these specifications, it is crucial to know the thickness and elevation at the top of the Sunburst Sandstone in the target zone. A model is shown in figure 20, indicating the top of each major geologic unit in relation to the mine workings. There may be many suitable locations for a drain, but for optimal performance, the Sunburst should be sufficiently thick (>40 ft) and the drain should lie beneath the upper aquifer's water surface (fig. 21). When selecting an entry point for the drain, it may be easiest to select a point on one of the many steep valley walls near the site, where an outcrop of the Sunburst can be used as a guide.

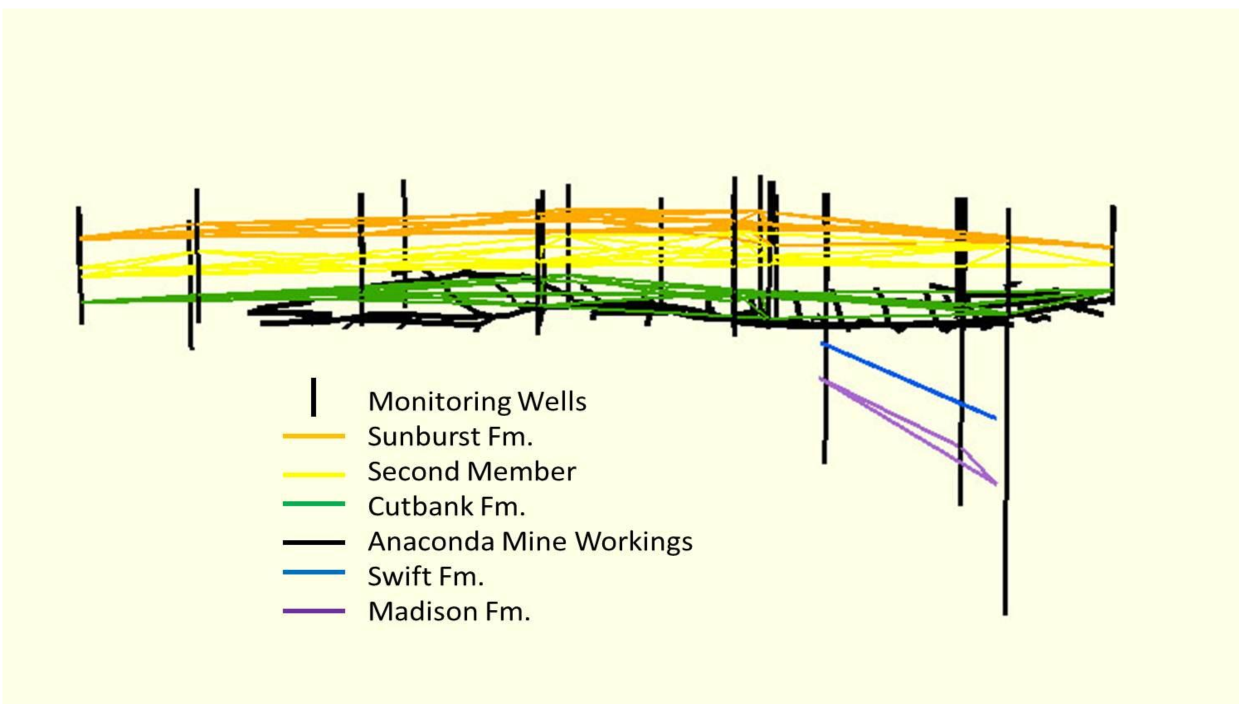


Figure 20. Side view of a 3-D representation of the study area, looking north. Colored lines indicate the top of the major geologic units and mine workings (ground surface is not shown).

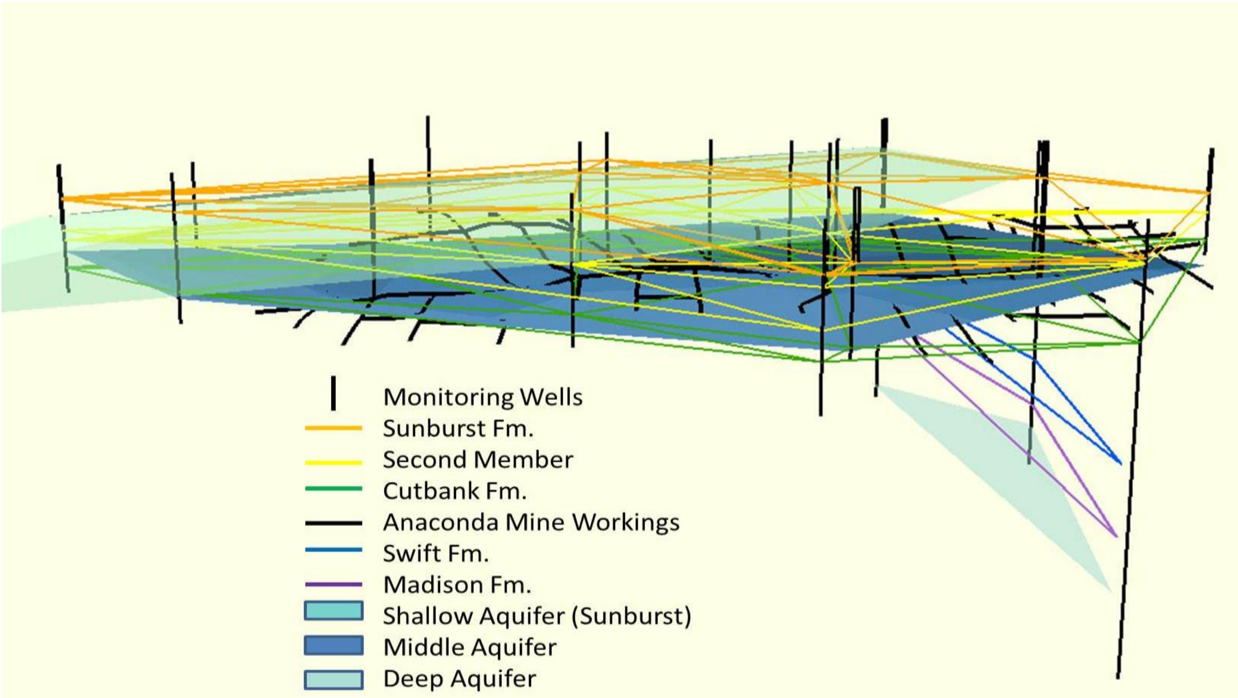


Figure 21. Side view of a 3-D representation of the study area, looking north. Note the three distinct aquifers in relation to the geologic units and mine workings.

Possible Drain Locations

To better understand the trajectory and possible locations of drains, nine hypothetical drains were plotted on a map of the study area (fig. 22). Drain outlet locations were chosen on both sides of/ the site (into Box Elder and Belt Creek drainages), using the steep valley walls as access points. Three potential drains discharge into French Coulee on the southeast side of the site (#7, #8, and #9) and one drain discharges into the coulee on the north end of the site, following Belt Creek Road into Belt (#4).

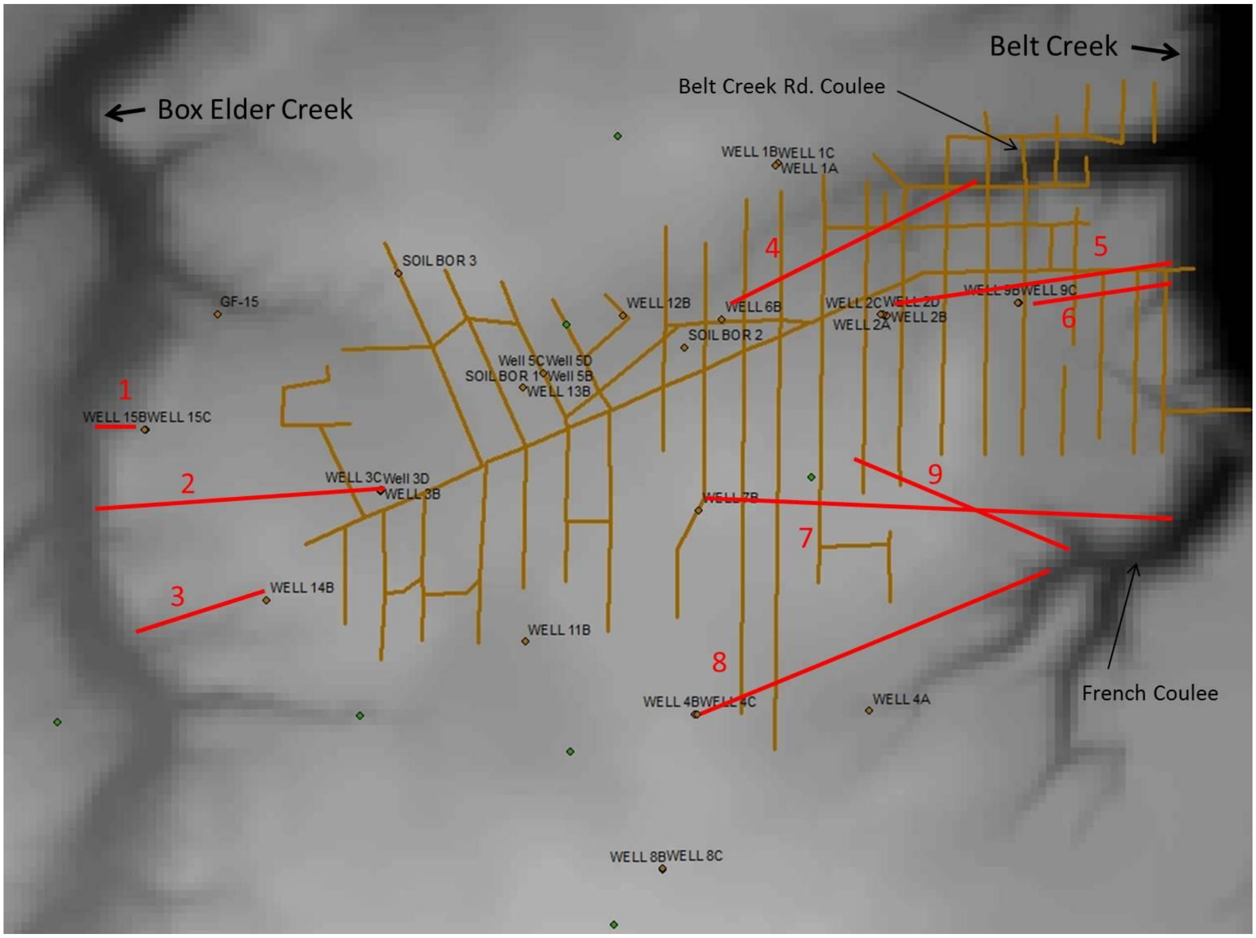


Figure 22. Potential locations of horizontal wells in relationship to the mine workings.

Most of these drains (except #9) would be drilled toward an existing monitoring well. While the final drain would not necessarily need to end at a well, it was useful to do so for analysis during this planning investigation. By using the lithology record from each of the well logs, it was much easier to determine the elevation and thickness of the Sunburst Sandstone, and therefore the correct placement of the drain, for each respective location. As in the case of drain #9, it would be possible to install a drain between existing wells, but it would be important to identify the elevation and thickness of the Sunburst for the chosen target location. The data used to calculate the trajectory and placement of each drain (e.g., elevation and thickness of Sunburst, outlet elevation, etc.) are found in tables 4A and 4B. Many of the elevation and thickness values were taken from lithology records and imported into ESRI® ArcMap™ for spatial accuracy.

Table 4A. Monitoring well data (all values in feet).

Monitoring Well	Ground Elev.	Well Depth	Depth to Sunburst	Sunburst Thickness	Sunburst Top Elev.	Sunburst Bottom Elev.
Well 15C	3906	129	68	62	3838	3776
Well 3D	3940	220	88	75	3852	3777
Well 14B	3955	272	68	58	3887	3829
Well 6B	3923	286	78	72	3845	3773
Well 2B	3915	308	78	80	3837	3757
Well 9B	3896	231	95	44	3801	3757
Well 7B	3978	289	75	95	3903	3808
Well 4B	3977	285	122	3	3855	3852

Table 4B. Potential drain trajectory estimates, using the locations indicated in figure 22 (all units in feet, unless noted).

Drain Number	Target Well	Sunburst Target Elev.	Outlet Elev.	Drain Length	Elev. Diff. (Outlet - Target)	Drain Angle (°)
1	Well 15C	3791	3840	492	49	-5.71
2	Well 3D	3795	3870	3511	75	-1.22
3	Well 14B	3844	3870	1800	26	-0.83
4	Well 6B	3791	3855	3611	64	-1.02
5	Well 2B	3777	3855	3611	78	-1.23
6	Well 9B	3768	3775	1900	7	-0.22
7	Well 7B	3832	3810	5740	-22	0.22
8	Well 4B	3852	3810	4590	-42	0.53
9	-	3839	3775	2626	-64	1.39

The target elevation for each drain was calculated to fall within the bottom half of the formation at each location. The outlet elevation and the resulting calculated parameters (length of drain, drain angle, etc.) were estimated from maps and have not been surveyed, so these values have an inherent degree of uncertainty. Therefore, these calculations should be performed using more accurate values when an actual field location is selected for a drain. It is also difficult to estimate the discharge rate for a potential drain, but this too can be calculated once the location, diameter, and screen interval of the drain have been selected.

Although many of the values presented in table 4 are estimations, they offer insight into the orientation and length of a potential drain. Based upon the elevations in the table, all of the drains (except #1) enter the formation at a low angle (<1.5°). This should make the installation of a drain relatively easy; however, the drill bit might drift vertically over long distances. This could be especially problematic considering the average drain length is approx. 3,100 ft. Based upon these considerations, some of the potential drain sites might be too difficult or expensive to install correctly.

Using data from table 4 with the models shown in figures 20 and 21, figure 23 was created, showing which drain locations might be the most effective at diverting water from the Sunburst Sandstone. The drains shown in red are considered to be less effective and are not recommended due to the following reasons:

> Drains #1 and #3 are located along the bottom of the Sunburst; however, the formation is relatively unsaturated in this area, and it is unlikely that these drains would produce large volumes of water.

> Drain #7 is completed in a thick section of the Sunburst (>90 ft) and should produce a large volume of water, but the drain extends over 5,700 ft. At this length, the drain would be expensive to drill and the accuracy of the drain placement may be compromised.

> Drain #8 is relatively long as well (~4,600 ft), but the Sunburst Sandstone pinches down to a thickness of 3 ft in this location. This would be a hard target to hit, and volume of water present is limited.

The drains shown in green have greater estimated potential for success, with consideration to the following characteristics:

Drain #2 is completed at a low angle, in an area where the Sunburst is relatively thick (~75 ft) and almost entirely saturated. However, this drain is ~3,500 ft long, which may increase cost and compromise accuracy.

Drains #4 and #5 are similar in length (~3,600 ft) and the Sunburst is consistently thick in that area (70–80 ft). It may be more difficult to install #4 if access to the steep valley wall is limited in the narrow coulee. Drain #5 is close to the existing “Anaconda Drain,” which removes water from the mine workings.

Drain #6 is relatively short (~1900 ft) and located close to the “Anaconda Drain” as well. The Sunburst is a sufficiently thick target here (~40 ft), but it continues to thin toward the edge of Belt Creek valley.

Drain #9 is completed between existing monitoring wells, and drains into French Coulee. From nearby lithology reports, the Sunburst is estimated to be ~50 ft thick here, with a sufficient volume of water present. This drain is moderately long (~2600 ft), and again, access to the steep valley wall may be limited in the narrow coulee.

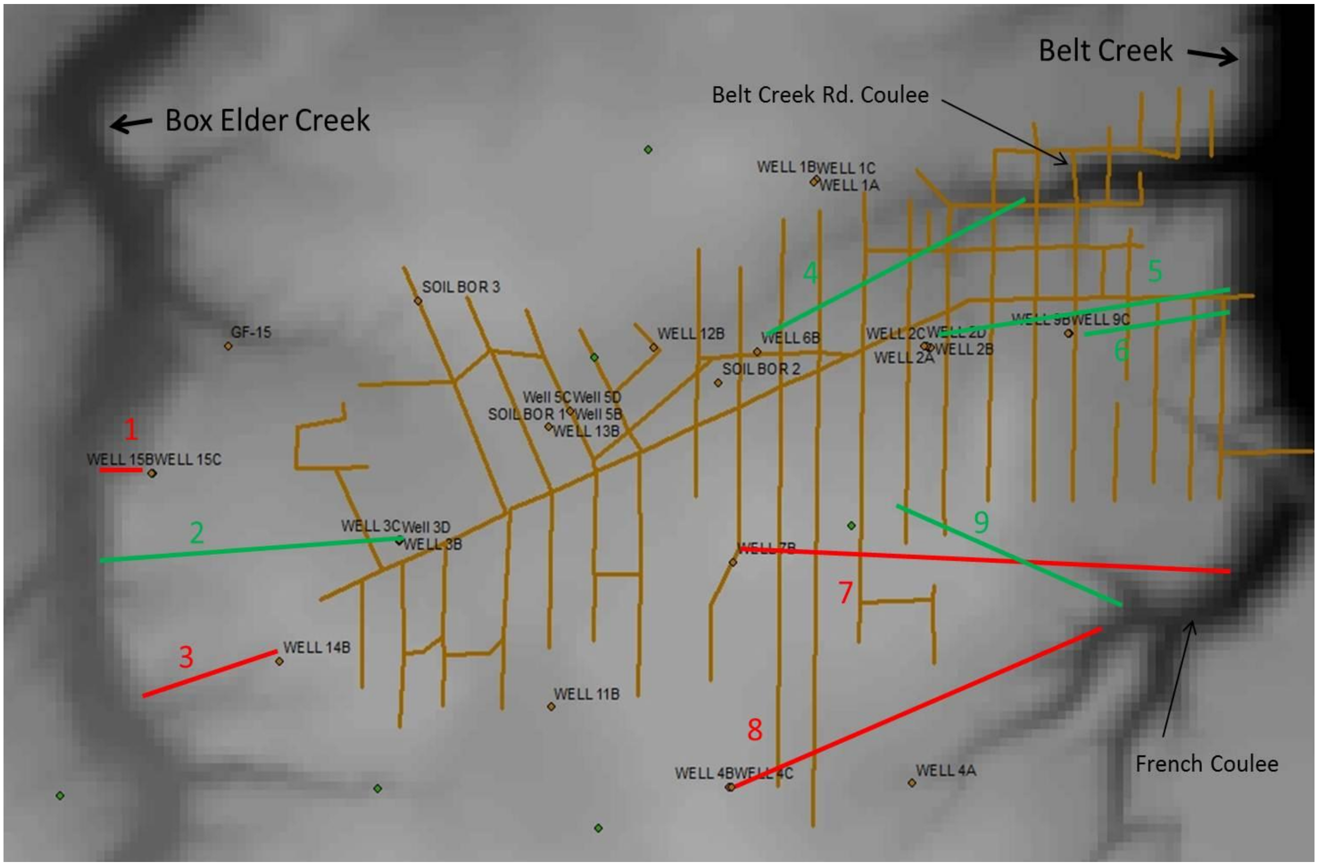


Figure 23- Potential drain locations. Drains shown in green have greater estimated potential for success, while those in red are considered less effective or possibly too expensive, and are not recommended.

Long-term monitoring of the AMD discharges and water levels in selected wells should be conducted post-drain construction to determine the effectiveness of the drains. It may be necessary to install drains in multiple locations, depending on drain effectiveness (and budget constraints).

Bulkhead Installation

The last option for controlling the discharge of AMD water from the mine was to identify locations for the installation of bulkheads within the mine workings. For this option to be evaluated, it was necessary to have access to the underground workings. During a companion project undertaken by DEQ and MBMG, the former mine adit was opened and a 60-inch steel culvert was installed for access (figs. 24, 25, and 26). Preliminary inspection of the mine workings was promising, as the main haulage ways were open and accessible; however, as personnel went further into the mine workings, they encountered more areas of roof collapse and areas where water had pooled. Attempts to lower water levels by pumping to allow further safe entry into the mine were not successful. Because the forward locations for bulkhead installation were approximately ¾ mile (4,000 ft) from the mine entry and safe access was possible only about 1,000 ft into the mine, the bulkhead option was abandoned and no further work was conducted on this portion of the project (fig. 27).

Figure 24. Excavating cover material for access to old mine adit, Anaconda Coal Mine.

Figure 25. Entry of old mine adit.

Figure 26. Culvert installed in mine adit and security gate.

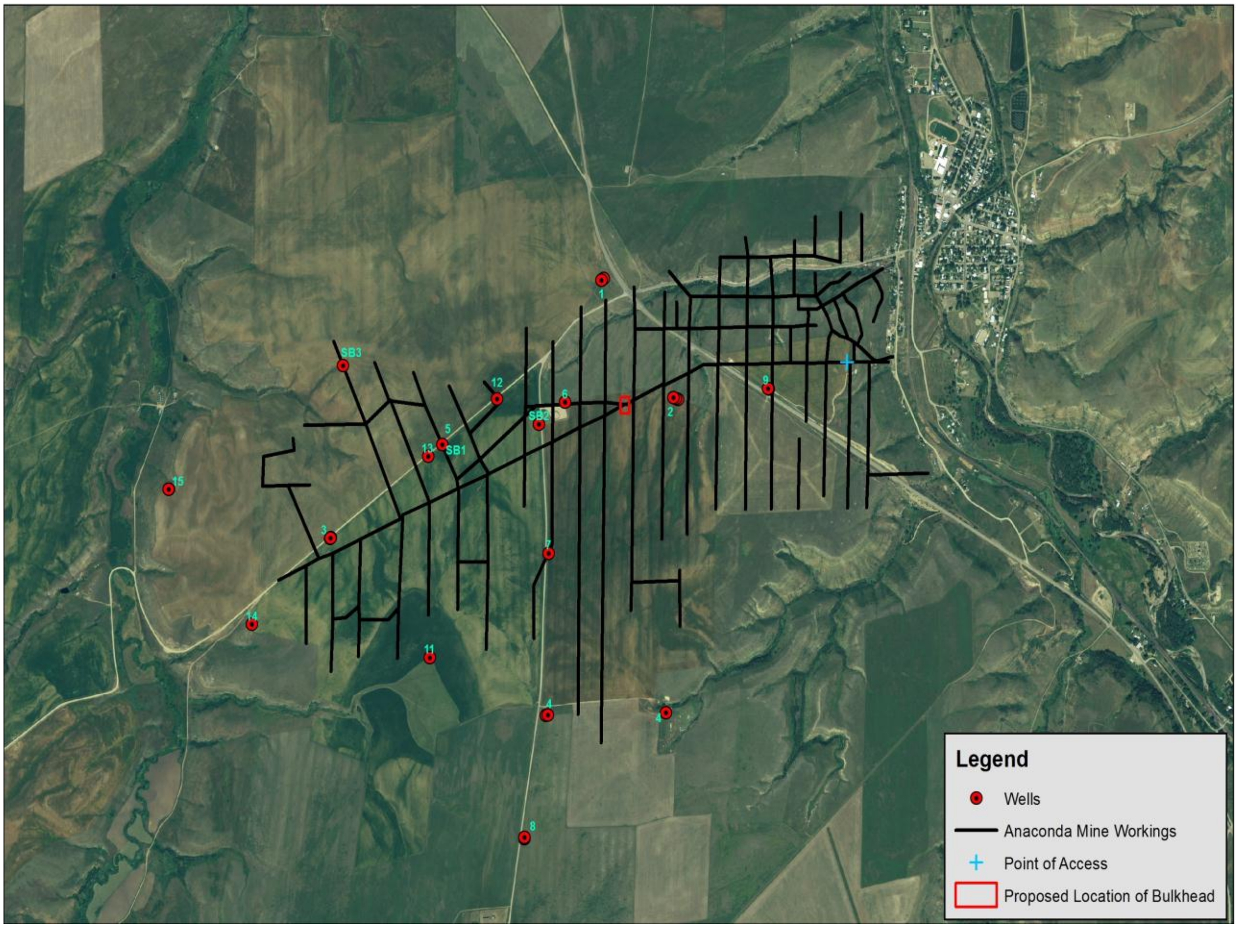


Figure 27. Potential location of bulkhead within the mine and location where access was gained into mine workings.

Recommendations

Previous attempts to control drainage from abandoned underground coal mines have proven to be expensive and less than successful. Montana's harsh winters and the high concentrations of contaminants in the water make wetlands treatment ineffective, while the capital costs and long-term operation and maintenance costs associated with conventional treatment plants, e.g., lime treatment, limit that option. This project looked at three alternative methods for source control of the water, two of which focused on preventing water from entering the mine workings and one attempted to control the water within the mine.

After review the most cost-effective and implementable option appears to be source control through land-use changes. This option has the least amount of risk and cost. The major obstacles surrounding this alternative are:

1. Landowner cooperation;

2. Coordination of land-use practices and changes to match the Federal Farm Programs; and
3. Compensation for landowners to offset costs of lost revenue during implementation of changes and to assist with new operational costs, i.e., fencing, pipelines to distribute stock water to different pastures.

The installation of horizontal drain holes may successfully reduce the volume of water entering the mine; however, it has a high initial cost. The advantages are that the system is relatively passive and does not require constant maintenance. This option might be worth considering after implementing land-use changes and monitoring the effectiveness over a number of years. If areas are identified where land-use changes are not meeting their objectives, horizontal wells could be installed in selected areas. The possibility of obstructions within the drains is a possibility and may require periodic maintenance.

AMD is a long-term problem that will take continued attention to reduce excess water from reaching the underground mine workings. As such, it will take a similar long-term commitment by all parties to solve the problem.

Acknowledgments

The authors would like to thank the following landowners who allowed access to their property for monitoring and sampling during the duration of this project: Jim Larson-Diamond Willow Ranch, Pleasant Valley Hutterite Colony, Ken Maki, and Jim Warehime. Without their cooperation this project could not have been completed.

The State of Montana, Department of Environmental Quality, and U.S. Department of Agriculture, Natural Resources and Conservation Services provided funding and support for the work undertaken. Their willingness to consider alternative solutions to the acid mine drainage problems that exist throughout much of central Montana is greatly appreciated. The support of Vic Andersen (retired), John Koerth, and Bill Botsford of DEQ and Dale Krause (retired) and Phyllis Philips, NRCS, in developing and supporting the project is appreciated.

Special acknowledgment is given to the Cascade County Conservation District, Cascade County Commissioners, and Belt City Council who supported the initial proposal. Their willingness to support the Conservation Innovation Grant proposal is greatly appreciated.

Finally, special recognition is given to the Montana Salinity Control Association, Jane Holzer and Scott Brown, who worked directly with the individual property owners to review current land-use practices and develop new farm plans to aid in the development of source-control measures.

Appendix A

Montana Salinity Control Association
Final CIG Report Narrative
Prepared by
Jane Holzer and Scott Brown
Conrad, Montana

and

August 2010 Photos of DEQ Property
Converted to Perennial Forage (Alfalfa) Production in 2009
from Dryland Grain Production in Crop-Fallow System

Agricultural Practices Used in Source Control of Acid Mine Drainage Problems, Central Montana

Prepared by

Montana Salinity Control Association

Final CIG Report Narrative

October 2010

Belt Creek-Acid Mine Discharge

Proposed Remediation Using Land-use Management

Project Background

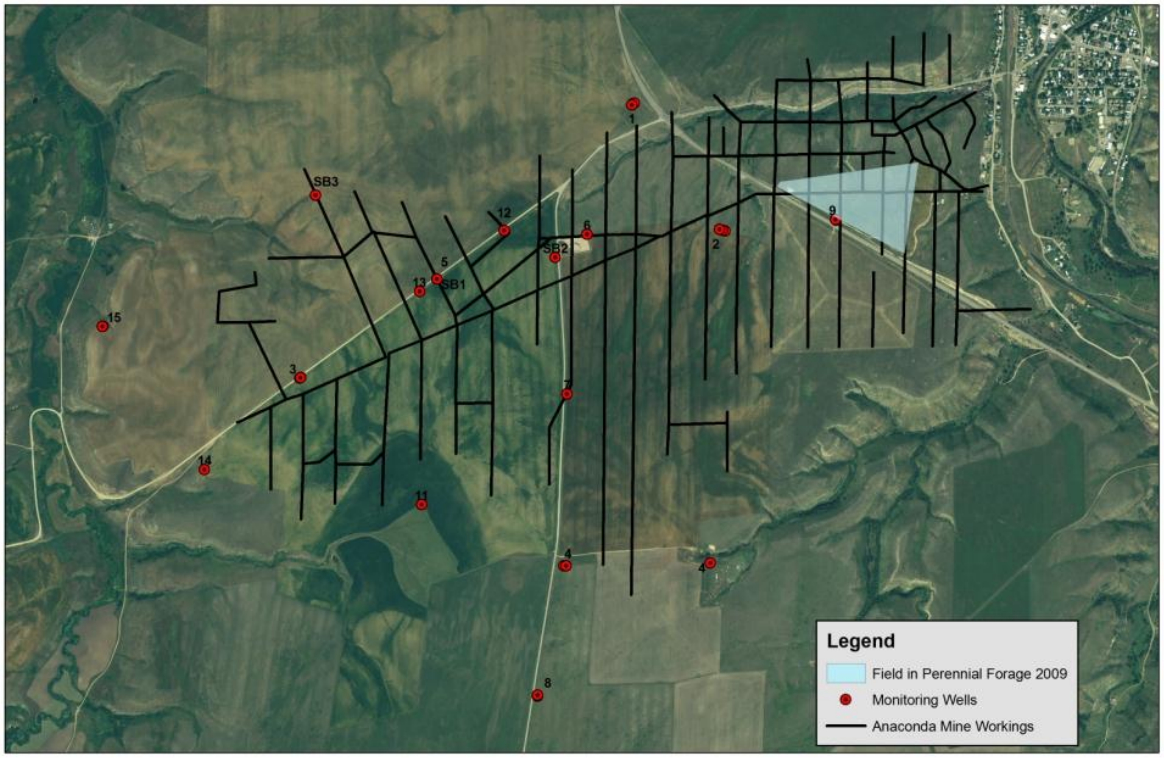
The broad bench land on the Belt Hill overlying abandoned mine workings has traditionally been managed through the crop-fallow system for cereal grain production. The crop-fallow system leaves the cropland idle for up to 21 months out of a 24-month cycle, and a growing crop in place for only 3-6 months to utilize growing season precipitation. More rain and snowmelt is received in the long fallow period than can be stored in the annual-crop rooting zone - so the unused portion evaporates or leaches through the soil overlying the abandoned mine workings. The unused moisture eventually reaches the mine voids and travels down-gradient to the mine adits and across the surface waterway to Belt Creek as a point-source acidic pollutant, or via the ground water through coal mine waste to enter Belt Creek as a non-point source acidic pollutant.

The recharge-discharge relationship on the bench land is similar to the process that creates nonpoint source saline seepage under dryland cropping systems using the crop-fallow system in eastern Montana and other Northern Great Plains states and Canadian provinces. The recently developed saline seeps, occurring since the 1940's, can be remediated with periodic rotations of perennial forage between annual cropping periods. The agronomic practices and USDA programs to encourage the rotations have been well documented and utilized in Montana for saline soil and water reclamation. One of the objectives of the Conservation Innovation Grant (CIG) was to develop and test cultural and new economic practices for Acid Mine Discharge (AMD) remediation. This model project would capitalize on Montana's success using land management measures for saline seep control. Montana Salinity Control Association (MSCA) was contracted by the Montana Bureau of Mines and Geology (MBMG) to provide the technical assistance in land-use management planning and finding economical alternatives acceptable to the bench landowners and funding agencies.

Project Progress

The State of Montana, via the Department of Environmental Quality (DEQ)-Abandoned Mined Lands (AML), purchased private land from Jim Larson, a portion of which (43 acres) had been managed with cereal grain production using the alternate crop-fallow system. The purchase was made with the intent of developing a repository for acidic wastes that would be removed from an area close to Belt Creek. This mine waste supplies a nonpoint source of AMD directly into Belt Creek. The repository plan is being re-evaluated by DEQ due to the perceived high cost-benefit ratio. The 43-acre cropland field was rotated to perennial forage (in other words, it was planted to an alfalfa-grass mixture) with the highest soil-moisture use species. The perennial forage will significantly reduce the rainfall leaching into the mine workings below this parcel of land. Since MBMG and AML staffs have a limited background in agricultural management, MSCA staff provided the agronomic recommendations and organized the options for the custom operators and prices for pre-plant weed control, species selection, seed source, fertilizer requirements and source, and the planting operation. These options were provided to DEQ-AML to make the final decisions and financial obligations.

The alfalfa/grass mixture was planted on the DEQ-AML owned cropland by a custom operator on May 29, 2009. Hay was harvested in 2010 by the previous owner on contract with DEQ. MSCA monitored the hay field in 2010 and made recommendations to DEQ to improve the forage stand quality. There are areas with low plant density and/or high weed population that should be addressed with agronomic practices for the maximum recharge reduction via plant water-use. The poor establishment would be a soil-related problem at the time of germination. MSCA recommended that DEQ replant the sparse areas to improve the soil moisture efficiency and hay yield. A map of the new DEQ property is attached to indicate the area planted to forage.



Map showing the location of DEQ land planted to alfalfa in 2009.

Financial Assistance

None of the current USDA programs provide enough economic return or incentive for the priority landowner to consider changing existing management on private land. The landowner has limited use for additional perennial forage acreage managed for haying and/or grazing to accommodate his present-day cattle enterprise. The income off additional hayland, even with current USDA forage establishment options, would not meet or exceed the income derived from the grain production. Additional perennial forage on the bench land enrolled through the Conservation Reserve Program (CRP) would now only receive an annual rental rate of $26/acre/year for ten years. This rental rate is not sufficient to expand the land already enrolled in CRP since it is much lower than the rate for the acreage that was enrolled 10-15 years ago. At this point the current CRP land will be rotated back to cropland in 2013-14 for economic reasons when the contracts expire, unless alternatives can be offered.

The DEQ-AML Program does not have the ability to supplement the economic return for the private landowners to rotate cropland to perennial forage production. MSCA staff explored ideas for USDA programs that could provide adequate economical opportunities for landowners to rotate cropland to perennial forage and maintain existing forage on the bench land above the mine workings. The Natural Resources Conservation Service (NRCS) and Farm Service Agency (FSA) on a state level did not have any options at their decision-level to offer. Therefore, MSCA met with national program managers for NRCS and FSA in Washington, D.C. in April 2009 to discuss options. Jane Holzer, MSCA Program Director, and Gayla Wortman-Oehmcke, Cascade County Conservation District Supervisor, met with the program managers and decision makers to find what was available and what variances or new practices would be allowed. Phyllis Philipps, MT NRCS Assistant State Conservationist, participated in the NRCS national office meeting, which was very helpful in explaining the current NRCS program limitations and how any new practices could be administered.

NRCS national program staff specialists recommended using the existing **Practice-455 Land Reclamation – Toxic Discharge Control**; heretofore unknown to Montana NRCS, instead of **Practice-610 Salinity and Sodic Soil Management.** Practice-455 is a national practice that can provide payments for the four primary methods of controlling toxic mine drainage. They include 1) mine sealing, 2) infiltration control, 3) 'daylighting', and 4) neutralization and precipitation. Montana can make its own standards and payment levels – this would be accomplished through the NRCS State Conservationist with approval by the State Technical Committee. For the Belt Creek pilot project, infiltration control would be the obvious first step. Potentially the other components could be used on smaller mine site reclamation for the series of abandoned mines between Great Falls and Lewistown.

Since no other state has used Practice-455 for 'infiltration control' in the manner needed for the Belt Creek project, new practice standards and specifications must be developed and approved by NRCS for Montana. MSCA will use MSU Extension data to justify the cropping rotation expenses to rotate to perennial forage. The data will be incorporated into suggested solutions that will be forwarded to the Montana NRCS State Conservationist for consideration.

With support from the Cascade County NRCS District Conservationist and the NRCS Assistant State Resource Conservationist, a request will be sent to the State Conservationist to utilize the technical assistance from a resource team in Montana to develop the financial assistance for implementing the holistic plan. This includes the adoption of new Montana standards to utilize NRCS National Practice 455 Land Reclamation – Toxic Discharge Control that can provide payment for controlling toxic mine drainage through infiltration control. The funding options include

Cascade County EQIP allocation and potential Special Initiative (SI) allocation if approved by the State Conservationist. There is a specific procedure to apply for the SI funding which involves documentation of the resource problem, potential solutions and economic analyses to support the solutions.

MSCA is in the process of updating an economical comparison of expenses for dryland cereal grain production and dryland hay production. Then the cost to a producer to rotate from winter wheat/fallow to alfalfa/grass-based hay production, including the perennial forage establishment expenses, can be determined. There must be compensation for management changes and income foregone (loss) in making the land-use rotation that would be done for the public benefit to improve Belt Creek water quality. The land-use change will not be accomplished on the large scale required otherwise. The economic information should be acceptable by NRCS and MSU/Extension economists before it becomes part of the NRCS Best Management Practices.

The priority landowner is eligible for NRCS-Environmental Quality Incentive Program (EQIP) to implement the suggested changes within this document. However, this is a large scale project and the landowner will be competing for funding through the annual county allocation with all other Cascade County operators. The landowner would not be adopting this extensive land-use change on his own, but is willing to consider the changes to reduce ground water recharge and acid mine discharge into Belt Creek. NRCS funding should not be considered exclusively since the goal is ultimately for public benefit.

Since the management change is for public benefit, this project should garner non-traditional funding and revenue compensation with the support of NRCS and other parties as appropriate. The land-use changes and increased management level suggest the capital costs will result in benefits to the resource owner, nonagricultural users, and the environment through improved water quality. Therefore, the capital costs should be shared by both the resource owner and society in some proportion to benefits, assuming that the benefits are measurable.

Priority Land Use Management Changes

Ted Duaime, MBMG, provided a series of maps and data to MSCA that prioritizes the acreage on the Belt Hill for importance in contributing recharge to the acid mine drainage into Belt Creek. In order for the landowner with the highest priority recharge area to change the traditional land-use from winter wheat to hay and grazing for public benefit, a reasonable contribution to the management expense must be offered.

In an effort to make the significant land-use management change acceptable to the producer(s) with the priority recharge areas, the changes must fit into their entire farm/ranch operation. MSCA retained Dale Krause, retired NRCS District Conservationist, in June 2010 to work with Jim Larson/Diamond Willow Ranch to develop a holistic resource plan for the land-use changes on the highest priority land. Initially Larson would rotate 330 acres of dry cropland to hay and pasture/grazing, plus a second priority cropland area of 130 acres, for a total of 460 acres converted to hayland or pasture. Also, Larson would retain the CRP forage as pastureland rather than converting it to cropland.

The Belt Creek Land Management Unit will include the new perennial forage acreage, native and introduced grass pastures, plus the CRP fields when the contracts expire in 2013-14. The plan includes property boundary and interior fencing, livestock water development with tanks and pipelines, perennial forage establishment, and weed control. Approximately ten miles of fencing must be built with 5.7 miles of old fencing that must be removed and/or replaced. A grazing plan with pasture rotation for optimum resource protection will be included. A livestock water system must be installed including a pump, 5-6 stock tanks, and nearly 15,000 ft of water pipeline. The resource plan is still in draft stage, but it will be available once it has been approved by the landowner and funding has been secured.

An attached "Summary Table of Land Management & Infrastructure" provides the summary on 1,136 acres. A narrative report describing the proposed management was prepared by Krause and Jane Holzer, MSCA Program Director and Agronomist. The report entitled 'Diamond Willow Ranch Plan Narrative' is attached. A map with the Draft Management Plan on the Belt Creek Mine Unit is attached.

It must be clearly noted that the landowner is willing to convert all cropland and retain all CRP acreage in perennial forage for public benefit. However, financial compensation for the conversion expense and loss in revenue during the initial conversion period must be commensurate with the risk involved. This conversion will require significant out-of-pocket expense for additional equipment and livestock purchases. The time and labor to build and maintain the extensive fencing and livestock watering system will also add to the expenses incurred by the landowner.

The degree of plan implementation will be dependent on the level of USDA or other funding available to the landowners. This compensation will dictate how successfully the remediation techniques will be adoptable in the Belt/Stockett coal complex. The abandoned underground coal mines extend from Great Falls to Lewistown with varying degrees of acid mine discharge. Therefore, this pilot project for the Belt Creek Mine Unit could lead to more AMD reclamation by voluntary land management changes. MSCA would point out that land management changes with compensation will be less expensive in the long run than water treatment and other engineered approaches.

Monitoring

The MBMG has a water quantity and quality monitoring program in place through the ground water investigation. MSCA strongly recommends that this monitoring program be continued long term in order to measure the success of the initial perennial forage on DEQ-land and subsequent perennial forage rotations on private land. It is important to have specific documentation that AMD problems are reduced using perennial forage as a Best Management Practice for NRCS to utilize Practice 455 elsewhere in Montana. There are other abandoned coal mines with AMD across the U.S. that could be remediated if Montana can prove the value of recharge area control with agronomic surface management. NRCS standards and specifications developed in Montana would become a nation-wide BMP using Practice-455 for infiltration control.

MSCA would support lowering the water table in the recharge area through a siphon system using existing monitoring wells and the steep terrain in adjacent coulees. Good quality water would be discharged for use with livestock, irrigation, to create wildlife habitat and add to base flow in Belt Creek. Water discharged into French Coulee would supplement Belt Creek flow above the main acid mine discharge zone and provide a dilution effect. The siphoned water would have extensive public benefit. A siphon test should be performed to determine the yield level from each well. The combination of land-use change to reduce recharge and the siphon system to reduce the static water level could be significant across the broad bench-land.

Acid Mine\CIG Grant\MSCA Final report narrative October 2010

Figure A-1. Dense alfalfa (foreground), brown weedy vegetation (background), looking NE, 8/22/10.

Figure A-2. Brown weedy vegetation, sparse grass, 8/22/10.

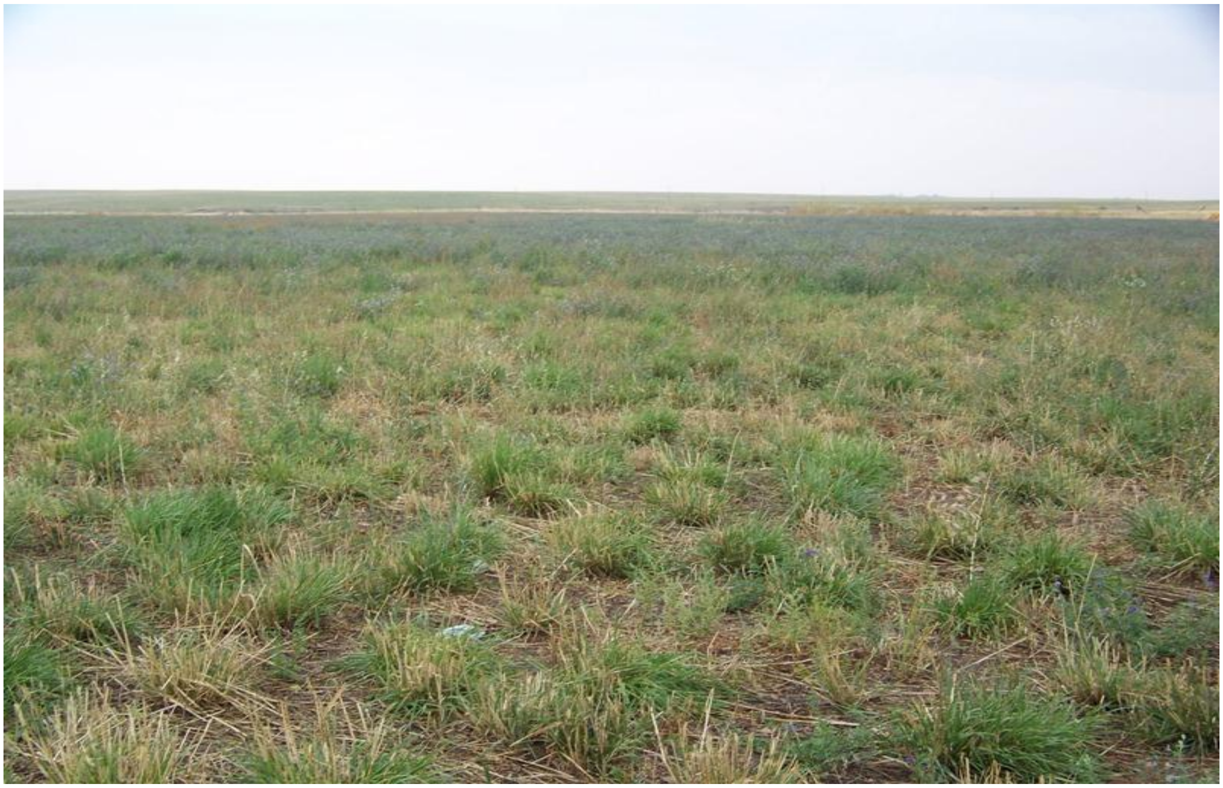


Figure A-3. Random robust grass, no alfalfa, 8/22/10.

Figure A-4. Sparse grass and alfalfa-weedy, 8/22/10.

Figure A-5. Looking south at area with weeds and sparse grass, 8/22/10.

Figure A-6. Big round hay bales on field edge, 8/22/10.

Appendix B

Detailed Farm Plan for Larson-Diamond Willow Ranch

Prepared by

Montana Salinity Control Association

Dale Krause

(Retired NRCS Conservationist on contract with Montana Salinity Control Association)

Conrad, Montana

Diamond Willow Ranch – Belt Creek Mine Unit
Resource System Plan Review

Prepared by

Montana Salinity Control Association
Conrad, Montana

Resource Unit Background

The Belt Creek Mine unit is operated by owner Jim Larson as a small grain/livestock operation. The planning unit encompasses approximately 460 acres dryland small grains, 265 acres Conservation Reserve Program (CRP) perennial forage, 304 acres native forage grazing land, 86 acres dryland alfalfa hayland, 21 acres dryland introduced forage pasture, and 22 acres associated with buildings and headquarters. Additional dry land cropland acreage on the southeastern side of the property will not to be considered under this planning effort at the request of the owner. The small grain operation has focused primarily on winter wheat production as a 50/50 grain/fallow system or utilizing a flexible cropping system with re-crop winter wheat. The operation maintains adequate residue for erosion control between crops using a minimal tillage program along with chemical application. Winter wheat yields have been near or above the county average of 45 bushels per acre.

The acres of the unit set aside in the CRP program have been through one ten-year contract period and were successfully accepted for contract extension for another five-year period. The contracted acres are scheduled to expire in 2013 and 2014. Primary species growing on the acreage include alfalfa, intermediate wheatgrass, and pubescent wheatgrass. There is scattered crested wheatgrass in the stand, but not enough to alter grazing plans. Vigor appears good to excellent, but there is significant decadent litter on the surface to warrant management to improve productivity.

The native grazing land has only been utilized during the latter part of the year following harvest. With this limited grazing, the existing species are generally good vigor. The native grazing land is generally considered to be a Salty ecological site in the 13-19” precipitation zone. Predominant species identified are blue bunch wheatgrass, western wheatgrass, needle and thread grass, prairie junegrass, and Sandberg bluegrass with limited green needlegrass. The ecological site description notes that rough fescue should be present; however, elevation and precipitation influences would indicate that the site is on the lower and dryer end for the plant community. Carrying capacity based on observable site conditions would be approximately 0.3 AUM/Acre.

The native grazing land portion of the operating unit is also heavily influenced by French Coulee. This steep drainage has an excellent complement of woody species, both tree and shrub, within its riparian area. There is generally flowing water in the bottom of the drainage, but flow level fluctuates annually based on environmental conditions. According to Mr. Larson, the flow has never ceased to be year-round. From a livestock management perspective, French Coulee offers additional grazing and water resources. However, the steepness of the topography severely reduces livestock access, especially under a cow/calf type operation. Mr. Larson has commented that his cows will walk around French Coulee to come to the headquarters to drink water rather than walk down into the drainage for water.

The dryland alfalfa hay is located on the northeastern portion of the unit. The harvestable acreage is determined annually based on growing season precipitation. Soil types are also varied within the field. Most of the field has a deep clay loam which provides a positive growing medium for the deep-rooted alfalfa. However, there is approximately a third of field (gravel pit area) which has slopes in the 8-15% category, loam surface textures, and root-limiting subsoils consisting of channery loams occurring at less than 20 inches in depth. These soils have significant impact on yield potential for the hay field because of moisture availability. Overall yield has generally been 0.5—1 Ton/Acre when sufficient rainfall occurs and in a timely manner. The stand still has good vigor and is generally free of weeds even though it is about 10 years old. Mr. Larson does utilize the acreage in late fall for aftermath grazing.

Conservation Plan Overview

The conservation planning effort for the Belt Creek Mine unit has concentrated on converting the existing dry cropland to permanent vegetative cover. While this conversion will benefit Larson's operation, the primary reason for conversion is for the public benefit of reducing ground water recharge and subsequent reduction of acid mine discharge into Belt Creek. A negative impact to the proposed conversion would be associated with lost revenue during the conversion period from cropland to introduced pasture/hay. It would be highly beneficial to the adoption of this plan if financial assistance is attained to offset income foregone in the conversion in land use and management.

In discussing long term goals for the unit, Mr. Larson would like to set up the land base for livestock grazing. Utilizing the unit for livestock could accomplish several resource benefits. First, it would reduce and/or eliminate the potential of seasonal precipitation to influence ground water movement into the underlying coal mine voids. Second, the need for fossil fuel inputs associated with fuel, fertilizer, and pesticides would be significantly reduced as well as the labor for application. Third, Mr. Larson would have the option of either haying or grazing the unit to meet forage and roughage requirements for the current livestock operation and potentially expand the operation. Significant infrastructure improvements will be needed for sustainability of an on-site livestock operation.

Proposed management strategies for conversion and sustainability of the Belt Creek Mine unit would likely follow Natural Resources Conservation Service (NRCS) Field Office Technical Guide (FOTG) Standards and Specifications for Forage Harvest Management, Prescribed Grazing, and Herbaceous Weed Control. Conservation practices for re-establishment of dry cropland to permanent perennial plant cover, developing livestock water, cross fencing, and noxious weed control would also utilize NRCS Standards and Specifications.

Permanent Forage Establishment

The first step in the conversion would be seeding about 325 acres on the north end of the unit to permanent perennial forage, potentially starting in the spring of 2011. A 50/50 mixture of alfalfa and introduced grasses are recommended. However, Mr. Larson has expressed specific interest in using the northern most field strictly for hay production to complement his overall livestock operation. In the other fields, selected grass species would be similar to the CRP forage stand in order to complement prescribed grazing strategies and allow for the flexibility of either haying and/or grazing as future conditions dictate. As an alternative legume for the seeding mixture, sainfoin could be included or substituted for non-bloat grazing benefits and work well for dry land haying. The first year growing season would be used only for stand establishment so no forage or income would be realized. Grazing and haying in the second year would occur to the level growing should conditions would allow it. An on-site review would assist with this determination. Potential forage hay production could be approximately one Ton/Acre/Year if harvested. However, forage yields may be highly influenced by the predominately loamy surface textures and root-limiting/moisture limiting channery loam subsoils. If the stand was used for grazing, the initial stocking rate would be about 0.5-0.75 AUM/Acre. Monitoring during the grazing period would provide an observable evaluation of utilization and NRCS guidelines for stubble height that could be used as a standard for measurement.

The remaining cropland acreage, approximately 130 acres, would be seeded to perennial forage one to two years following the first seeding. This would allow for continued grain income until the first seeding was established. The species recommendation would be consistent with the first planting, and would follow similar NRCS guidance for establishment and management.

The CRP acreage, as noted previously, would be available for incorporation into the planned grazing/haying strategy once contract expiration occurred in 2013 and 2014. With water and cross fencing, these acres could be readily grazed, although perimeter fencing would need to be constructed, improved and/or replaced. Options for management following contract expiration include high intensity grazing to reduce plant litter and improve the nutrient and mineral cycles. A one-time prescribed burn in early spring prior to wildlife nesting is also an option. Prescribed burns should be staggered to reduce impacts to wildlife, and a burn plan with applicable approved permits is recommended. Additional options include a light tillage operation with a disc or spikes to help incorporate some of the annual growth and existing litter to help stimulate the stand further, or mowing to reduce the decadent old growth infused with new growth. Mowing would also provide better dry matter-soil surface contact for decomposition, as well as set a pre-determined grazing height. Again, considerations for wildlife are recommended. The CRP acreage would provide approximately 0.75 AUM/Acre of available forage without causing concerns with stand longevity.

Grazing Management and Infrastructure Plan

As a resource management plan, the overall strategy would be to implement a series of pastures to be rotated throughout the growing season and from year-to-year. The changes in season of use will limit impacts to the resources and allow for recovery of the plant species. Depending on final decisions by the landowner, a deferred or rest rotation grazing system will be drafted. The anticipated season of use would be from approximately May 15th to November 15th or December 1st. A preliminary pasture layout (See Plan Map Attached) has been identified using a combination of existing fencing, boundary fencing, and new cross fencing.

Integral to the pastures would be the development of a livestock watering system to provide one to two drinking tanks within each pasture. Based on water availability from existing monitoring wells installed by Montana Bureau of Mines and Geology (MBMG) with MT Dept of Environmental Quality (DEQ)-Abandoned Mine Land (AML) funding, a combination pumped-gravity pipeline system has been drafted to meet planned livestock watering requirements.

The infrastructure and management plan is designed for about 80 animal units. This number could be either continuance of the cow/calf program or move toward grazing yearlings, a landowner option. Yearlings would work well for the land base since the livestock could be purchased in the spring and sold in the fall. Yearlings would also travel the terrain better than cow/calf pairs, especially utilizing the steep coulees associated with French Coulee more effectively.

Since most of the forage base within the system is planned for introduced species, the overall management strategy should further consider the addition of nutrient management and soil testing. There is a nutrient benefit with the legume component of the planned perennial forage and in the existing CRP stands. However, to maximize forage production benefits and stand longevity, a 3-year cycle of soil testing would also serve to help monitor nutrient conditions as well as identify needs for nutrient application.

Weed Control

Within the entire operating unit, monitoring for noxious weeds is an on-going need. Spotted knapweed has already been identified in and around the headquarters and is being targeted by Mr. Larson for control. Knapweed has a significant threat for spreading into the perennial forage fields, but control measures are expensive in time and money. Additional assistance with weed control would be warranted to reduce the current infestation. Technical assistance is available through the Cascade County Weed Supervisor, and in fact, Mr. Larson has used the county weed personnel to help spray for noxious weeds in the past.

Financial Assistance

Financial assistance may be available through NRCS cost share programs. Jim Larson is eligible to apply for Environmental Quality Incentive Program (EQIP) to implement the suggested changes within this document. However, this is a large scale project and Larson will be competing for funding through the annual county allocation with all other Cascade County operators. Larson would not be adopting this extensive land-use change on his own, but is willing to consider the changes to reduce ground water recharge and acid mine discharge into Belt Creek. Since the goal is ultimately for public benefit, this project may garner non-traditional funding with the support of NRCS and other parties as appropriate.

Prepared by Dale Krause, retired NRCS Conservationist on contract with Montana Salinity Control Association, in conjunction with Jane Holzer/MSCA Agronomist. Autumn, 2010.

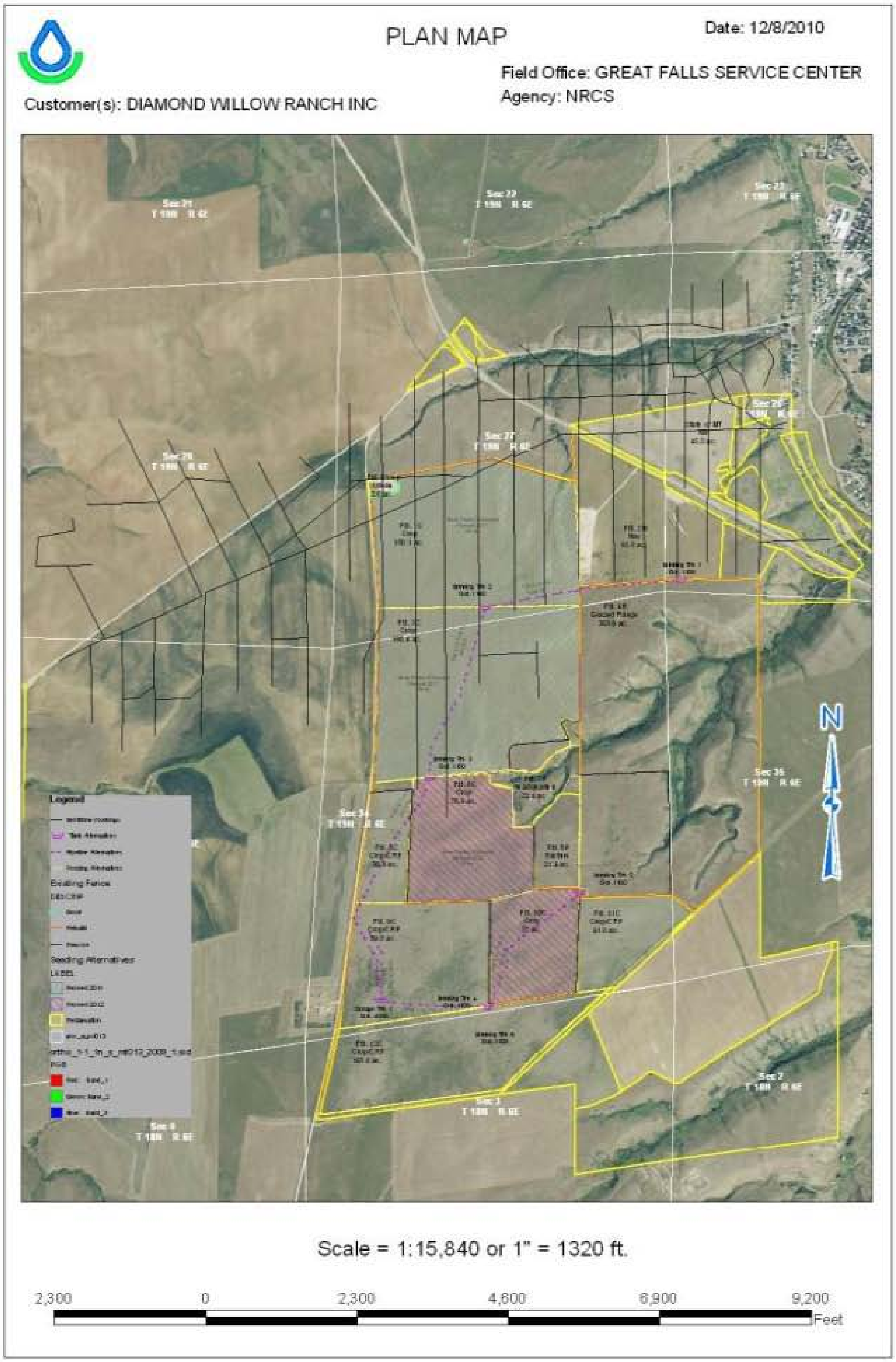


Figure B-1. Diamond Willow Ranch Farm Plan layout.

Table B-1. Summary table of land management and infrastructure needs.

Belt Creek Management Unit
Willow Creek Ranch
Jim Larson - Private Landowner

	Priority Mine Shaft Recharge Acreage					
	Grain Cropland	Hayland	CRP Forage	Pasture	Native Range	Total
2010 Land Management	460	86	265	21	304	1136
Proposed Land Management	0	546	0	286	304	1136

	Infrastructure to Support Land Use Changes
Pasture/Hayland Planting	460 acres cropland converted to perennial forage
Livestock Water System - pump	1 unit
Livestock Water Pipeline	14,900 feet to service multiple pastures
Water Tanks - 1100 gallons each	5-6 tanks to service multiple pastures
Old Fence Removal	29,895 feet or nearly 5.7 miles of old fencing needs to be replaced
New Fence Construction	53,780 feet or nearly 10 miles for new pastures 29,895 Feet to Replace Old Fences 23,885 Feet Cross Fencing for Pasture Rotation

	Other Management Expense
Noxious Weed Control	30 acres need control and preventative management

Acid Mine\CIG Grant\Diamond Willow Ranch-Larson\Summary Table of Land Mgt & Infrastructure October 2010

Appendix C

Ground Water
Inorganic Water Quality Data

Belt, MT Project
Water Quality Results
(All concentrations are dissolved, unless otherwise noted)

					PHYSICAL PARAMETERS									Water Type				
					FIELD	FIELD	FIELD	FIELD	FIELD	LAB	LAB			PERCENT MEQ/L				
Analy. Lab	Lab No.	DATE (mm/dd/yy)	TIME (HRS)	SWL (ft)	pH	SC (uMHOS)	Temp (C)	ORP (MV)	DO (mg/l)	pH	SC (uMHOS)	Hardness (mg/l)	Alkalinity (mg/l)	Ca	Mg	Na	Fe	HCO3
Burge Exploration Well GF-15		**M:207662**																
MBMG	2004Q0468	04/25/04	13:00	118.58	7.21	220	11.1	310	4.90	7.28	295	104	90	45.8	33.7	6.4	0.5	74.8
Tot Rec	2004Q0469	04/25/04	13:00									103		44.4	31.9	6.1	3.9	
MBMG	2004Q0513	05/07/04	11:00	118.00	6.92	610	10.0	--	--	7.58	575	328	249	53.6	40.1	4.9	0.0	75.0
MBMG	2005Q0340	02/04/05	12:40	118.27	--	--	--	--	--	7.32	610	322	268	55.1	37.9	5.5	0.1	74.9
Tot Rec	2005Q0341	02/04/05	12:40									328		55.0	38.0	5.6	0.1	
	Mean			118.28	7.07	415	10.6	310	4.90	7.39	493	237	202	50.8	36.3	5.7	0.9	74.9
	Maximum			118.58	7.21	610	11.1	310	4.90	7.58	610	328	268	55.1	40.1	6.4	3.9	75.0
	Minimum			118.00	6.92	220	10.0	310	4.90	7.28	295	103	90	44.4	31.9	4.9	0.0	74.8
	Number			3	2	2	2	1	1	3	3	5	3	5	5	5	5	3
Well 1A		**M:217046**																
MBMG	200Q0118	08/03/05	12:30	62.36	7.42	536	10.8	-17	--	7.86	613	338	167	66.2	30.1	2.6	0.0	45.6
MBMG	2006Q0431	11/10/05	14:15		7.74	495	10.8	286		7.48	588	321	169	4.4	2.0	0.2	0.0	3.4
	Mean			62.36	7.58	515.60	10.80	134.50	#DIV/0!	7.67	600.50	329.22	167.97	35.31	16.02	1.38	0.01	24.47
	Maximum			62.36	7.74	536.00	10.83	286.00	0.00	7.86	613.00	337.59	169.12	66.21	30.06	2.61	0.01	45.55
	Minimum			62.36	7.42	495.20	10.76	-17.00	0.00	7.48	588.00	320.84	166.82	4.42	1.99	0.15	0.00	3.38
	Number			1	2	2	2	2	0	2	2	2	2	2	2	2	2	2
Well 1C	**Sunburst**	**M:217048**																
MBMG	2005Q0348	02/03/05	15:40	62.36	--	--	--	--	--	7.91	915	526	464	38.7	55.7	4.3	0.1	88.9
Total Rec	2005Q0349	02/03/05	15:40									534						
MBMG	2005Q0425	04/08/05	14:30	63.12	6.76	890	10.1	365	1.88	7.31	905	524	454	38.2	56.1	4.5	0.1	88.5
Total Rec	2005Q0426	04/08/05	14:30									534						
MBMG	2006Q00117	08/02/05	11:30	60.02	6.99	793	16.0	1		7.63	881	518	480	38.1	56.0	4.7	0.1	88.9
MBMG	2006Q0433	11/10/05	11:15	61.05	7.35	743	14.0	180		7.74	868	495	490	39.1	55.3	4.4	0.1	88.5
MBMG	2010Q0397	10/07/09	10:30	59.24	6.65	901	12.7	242	6.81	7.57	899	530	502	37.7	56.5	4.7	0.1	91.6
	Mean			61.16	6.94	832	13.2	197	4.35	7.63	894	523	478	38.4	55.9	4.5	0.1	89.2
	Maximum			63.12	7.35	901	16.0	365	6.81	7.91	915	534	502	39.1	56.5	4.7	0.1	91.6
	Minimum			59.24	6.65	743	10.1	1	1.88	7.31	868	495	454	37.7	55.3	4.3	0.1	88.5
	Number			5	4	4	4	4	2	5	5	7	5	5	5	5	5	5

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Water Quality Results
(All concentrations are dissolved,

Analy. Lab	Lab No.	SO4	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	Fe (mg/l)	Mn (mg/l)	SiO2 (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3-N (mg/l)	NO2-N (mg/l)	F (mg/l)	Oxygen 18O	Deuterium 2H	Tritium TU
Burge Exploration Well GF-15																			
MBMG	2004Q0468	13.6	24.0	10.7	3.9	3.2	0.23	0.184	6.6	110	0.0	3.9	16	2.17	0.83	0.26	-18.77	-144.88	9.7
Tot Rec	2004Q0469		24.1	10.5	3.8	3.0	1.98	0.180											
MBMG	2004Q0513	23.2	75.2	34.1	7.8	2.9	0.03	0.015	6.3	304	0.0	2.9	74	<0.5	<0.5	0.70			
MBMG	2005Q0340	23.2	76.5	31.9	8.7	2.7	0.13	0.021	6.1	327	0.0	3.1	80	0.20	--	0.72			
Tot Rec	2005Q0341		77.7	32.6	9.1	2.4	0.19	0.019											
	Mean	20.0	55.5	24.0	6.7	2.8	0.51	0.084	6.3	247	0.0	3.29	56	1.18	0.83	0.56	-18.77	-144.88	9.7
	Maximum	23.2	77.7	34.1	9.1	3.2	1.98	0.184	6.6	327	0.0	3.89	80	2.17	0.83	0.72	-18.77	-144.88	9.7
	Minimum	13.6	24.0	10.5	3.8	2.4	0.03	0.015	6.1	110	0.0	2.90	16	0.20	0.83	0.26	-18.77	-144.88	9.7
	Number	3	5	5	5	5	5	5	3	3	3	3	3	3	3	3	1	1	1
Well 1A																			
MBMG	200Q0118	53.5	93.0	25.6	4.2	1.4	0.01	<.001	9.0	203	0.0	1.05	188	0.33		0.30			12.7
MBMG	2006Q0431	3.6	88.6	24.2	3.5	1.2	0.01	<0.001	7.0	206	0.0	<5.0	175	<.5		0.53			
	Mean	28.57	90.80	24.90	3.84	1.31	0.01	#DIV/0!	8.04	204.80	0.00	1.05	181.50	0.33	#DIV/0!	0.41	#DIV/0!	#DIV/0!	12.70
	Maximum	53.50	93.00	25.60	4.20	1.38	0.01	0.00	9.03	206.20	0.00	1.05	188.00	0.33	0.00	0.53	0.00	0.00	12.70
	Minimum	3.65	88.60	24.20	3.48	1.24	0.01	0.00	7.04	203.40	0.00	1.05	175.00	0.33	0.00	0.30	0.00	0.00	12.70
	Number	2	2	2	2	2	2	0	2	2	2	1	2	1	0	2	0	0	1
Well 1C	**Sunburst**																		
MBMG	2005Q0348	10.2	86.4	75.3	11.1	4.0	0.18	0.097	6.8	566	0.0	2.98	51	<0.05	<0.05	0.23			
Total Rec	2005Q0349		88.5	76.0	10.7	3.8	0.25	0.096											
MBMG	2005Q0425	10.5	85.0	75.7	11.5	4.0	0.20	0.065	6.8	553	0.0	2.74	52	<0.05	<0.05	0.36			
Total Rec	2005Q0426		84.3	78.6	11.7	3.7	0.24	0.064											
MBMG	2006Q00117	10.2	83.9	74.9	11.8	3.9	0.15	0.061	6.9	585	0.0	2.80	53	<0.05	<0.05	0.33			30
MBMG	2006Q0433	10.3	82.2	70.5	10.6	3.6	0.18	0.048	6.0	597	0.0	3.27	55	<.05		0.77			
MBMG	2010Q0397	8.1	84.8	77.2	12.2	3.8	0.13	0.049	6.7	612	0.0	<5.0	43	<0.5	<0.5	0.72			0
	Mean	9.9	85.0	75.5	11.4	3.8	0.19	0.069	6.6	583	0.0	2.95	51	#DIV/0!	#DIV/0!	0.48	#DIV/0!	#DIV/0!	15.00
	Maximum	10.5	88.5	78.6	12.2	4.0	0.25	0.097	6.9	612	0.0	3.27	55	0.00	0.00	0.77	0.00	0.00	30.00
	Minimum	8.1	82.2	70.5	10.6	3.6	0.13	0.048	6.0	553	0.0	2.74	43	0.00	0.00	0.23	0.00	0.00	0.00
	Number	5	7	7	7	7	7	7	5	5	5	4	5	0	0	5	0	0	2

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Inorganic Water Quality Data

Belt, MT Project
Water Quality Results
(All concentrations are dissolved,

DISSOLVED CONCENTRATION

Analy. Lab	Lab No.	Tritium Pico curies/L	Al (ug/l)	Ag (ug/l)	As (ug/l)	B (ug/l)	Cd (ug/l)	Co (ug/l)	Cr (ug/l)	Cu (ug/l)	Li (ug/l)	Mo (ug/l)	Ni (ug/l)	Pb (ug/l)	Se (ug/l)	Sr (ug/l)	Ti (ug/l)	U (ug/l)	Zn (ug/l)
Burge Exploration Well GF-15																			
MBMG	2004Q0468	30.5	58.4	<1	<1	<30	1.9	4.4	<2	92.8	8.9	<10	7.1	<2	<1	215	<1	0.59	8,249
Tot Rec	2004Q0469			<1	<1		2.1	4.8	<2	137	7.3	<10	8.2	4.1	<1	215	10.60	0.71	9,176
MBMG	2004Q0513		<30	<1	<1	67.6	<1	<2	8.8	<2	25.1	23.1	8.0	<2	<1	536	1.26	0.51	57
MBMG	2005Q0340		<30	<1	<1	39.8	<1	<2	<2	<2	27.1	17.5	15.7	<2	<1	609	<1	0.91	312
Tot Rec	2005Q0341		41	<1	<1		<1	<2	<2	<2	29.4	18.4	17.6	<2	<1	662	1.25	1.03	301
	Mean	30.5	49.6	#DIV/0!	#DIV/0!	53.7	2.0	4.6	8.8	114.9	19.6	19.7	11.3	4.1	#DIV/0!	447	4.37	0.75	3619.1
	Maximum	30.5	58.4	0.00	0.00	67.6	2.1	4.8	8.8	137.0	29.4	23.1	17.6	4.1	0.00	662	10.60	1.03	9176.0
	Minimum	30.5	40.8	0.00	0.00	39.8	1.9	4.4	8.8	92.8	7.3	17.5	7.1	4.1	0.00	215	1.25	0.51	57.3
	Number	1	4	5	5	3	5	5	5	5	5	5	5	5	5	5	5	5	5
Well 1A																			
MBMG	200Q0118		<10	<1	<1	<30	<1	<2	2.2	<2	10.4	<10	<2	<2	<1	1902	<1	1.60	21.9
MBMG	2006Q0431		<10	<1	<1	<30	<1	<2	<2	<2	7.6	<10	<2	<2	<1	1583	<1	1.63	<2
	Mean	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	2.15	#DIV/0!	9.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1742.50	#DIV/0!	1.62	21.90
	Maximum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.15	0.00	10.40	0.00	0.00	0.00	0.00	1902.00	0.00	1.63	21.90
	Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.15	0.00	7.59	0.00	0.00	0.00	0.00	1583.00	0.00	1.60	21.90
	Number	0	0	0	0	0	0	0	1	0	2	0	0	0	0	2	0	2	1
Well 1C	**Sunburst**																		
MBMG	2005Q0348		<30	<1	<1	48.6	<1	<2	2.3	<2	36.5	<10	7.4	<2	<1	640	1.54	6.99	<2
Total Rec	2005Q0349		81.2	<1	<1		<1	<2	<2	<2	35.4	<10	16.3	<2	<1	655	3.24	7.31	10.6
MBMG	2005Q0425		42.3	<1	<1	45.7	<1	<2	3.8	<2	35.4	<10	4.1	<2	<1	629	<1	6.76	<2
Total Rec	2005Q0426			<1	<1		<1	<2	6.9	<2	33.4	<10	4.0	<2	<1	610	2.97	7.25	37.4
MBMG	2006Q00117		11.4	<1	1.2	47.3	<1	<2	3.8	<2	34.2	<10	<2	<2	<1	615	<1	6.70	269.0
MBMG	2006Q0433		<10	<2	1.2	54.4	<1	<2	10.5	<2	32.0	<10	<2	<2	1.78	567	<1	6.26	60.3
MBMG	2010Q0397		<7.6	<0.1	0.6	44.8	<0.1	1.2	0.6	<0.4	25.4	3.2	2.2	<0.4	0.14	518	<0.1	6.87	<0.9
	Mean	#DIV/0!	45.0	#DIV/0!	1.01	48.2	#DIV/0!	1.22	4.64	#DIV/0!	33.2	3.2	6.8	#DIV/0!	1.0	605	2.58	6.88	94.3
	Maximum	0.0	81.2	0.00	1.22	54.4	0.00	1.22	10.50	0.00	36.5	3.2	16.3	0.0	1.8	655	3.24	7.31	269.0
	Minimum	0.0	11.4	0.00	0.60	44.8	0.00	1.22	0.58	0.00	25.4	3.2	2.2	0.0	0.1	518	1.54	6.26	10.6
	Number	0	3	0	3	5	0	1	6	0	7	1	5	0	2	7	3	7	4

Appendix C
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Belt, MT Project
Water Quality Results
(All concentrations are dissolved, unless otherwise noted)

Analy. Lab	Lab No.	DATE (mm/dd/yy)	TIME (HRS)	SWL (ft)	PHYSICAL PARAMETERS FIELD pH	FIELD SC (uMHOS)	FIELD Temp (C)	FIELD ORP (MV)	FIELD DO (mg/l)	LAB pH	LAB SC (uMHOS)	Hardness (mg/l)	Alkalinity (mg/l)	Water Type PERCENT MEQ/L Ca	Mg	Na	Fe	HCO3
Well 2a	**Madison**	**M:215047**																
MBMG	2005Q0195	09/22/04	12:50	622	7.99	950	12.8	384		7.73	825	451	260	50.47	42.94	5.32	0.03	56.2
Total Rec	2006Qo398	10/14/05								7.41	1532	976	234	61.50	35.46	1.44	0.95	
MBMG	2006Q0431	11/08/05	16:15		7.44	1074	13.07	242		7.41	1195	781	217	61.53	36.21	1.52	0.08	25.9
	Mean			622	7.72	1012	12.9	313	#DIV/0!	7.52	1184	736	237	57.8	38.2	2.8	0.4	41.1
	Maximum			622	7.99	1074	13.1	384	0.00	7.73	1532	976	260	61.5	42.9	5.3	0.9	56.2
	Minimum			622	7.44	950	12.8	242	0.00	7.41	825	451	217	50.5	35.5	1.4	0.0	25.9
	Number			1	2	1	2	2	0	3	3	3	3	3	3	3	3	2
Well 2C	**Sunburst**	**M:217050**																
MBMG	2005Q0346	02/03/05	17:30	67.86	--	--	--	--	--	7.67	615	284	293	31.1	63.1	4.7	0.0	86.3
Total Rec	2005Q0347	02/03/05	17:30									310						
MBMG	2005Q0423	04/08/05	18:40	68.29	6.80	615	10.2	328	4.73	7.43	680	337	285	30.2	63.6	5.2	0.0	79.6
Total Rec	2005Q0424	04/08/05	18:40									339						
MBMG	2006Q0116	08/03/05	16:40	62.54	7.43	495	16.11	84		7.88	574	316	252	32.7	61.6	4.6	0.0	77.8
MBMG	2006Q0434	11/08/05	16:00	66	7.69	500.5	10.79	305		8.11	599	317	288	31.9	61.9	5.1	0.0	85.2
	Mean			66	7.31	537	12.4	239	4.73	7.77	617	317	280	31.5	62.6	4.9	0.0	82.2
	Maximum			68	7.69	615	16.1	328	4.73	8.11	680	339	293	32.7	63.6	5.2	0.0	86.3
	Minimum			63	6.80	0	10.2	84	4.73	7.43	574	284	252	30.2	61.6	4.6	0.0	77.8
	Number			4	4	1	4	4	2	4	4	6	4	4	4	4	4	4
Well 2D	**Cutbank**	**M:217051**																
MBMG	2006Q0115	8/5/05	14:00	237.11	7.50	493	10.9	20		7.93	559.0	300	249	35.7	58.8	4.7	0.0	77.8
	Mean			237.11	7.50	493.00	10.9	20	#DIV/0!	7.93	559.00	300	249	35.7	58.8	4.7	0.02	77.8
	Maximum			237.11	7.50	493.00	10.9	20	0.00	7.93	559.00	300	249	35.7	58.8	4.7	0.02	77.8
	Minimum			237.11	7.50	493.00	10.9	20	0.00	7.93	559.00	300	249	35.7	58.8	4.7	0.02	77.8
	Number			1	1	1	1	1	0	1	1	1	1	1	1	1	1	1

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Ground Water
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(All concentrations are dissolved,

Analy. Lab	Lab No.	SO4	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	Fe (mg/l)	Mn (mg/l)	SiO2 (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3-N (mg/l)	NO2-N (mg/l)	F (mg/l)	Oxygen 18O	Deuterium 2H	Tritium TU
Well 2a	**Madison**																		
MBMG	2005Q0195	36.6	97.5	50.3	11.8	3.13	0.06	0.177	16.0	318	0.0	1.78	163	7.94	<0.10	0.91			
Total Rec	2006Qo398		248	86.7	6.64	2.48	3.55	0.438	NR	286	0.0	0							
MBMG	2006Q0431	73.1	197	70.3	5.58	2.13	0.217	0.244	7.0	264	0.0	<5.0	12.206	1.63		0.92			
	Mean	54.9	180.8	69.1	8.0	2.6	1.28	0.286	11.5	289	0.0	0.89	88	4.79	#DIV/0!	0.92	#DIV/0!	#DIV/0!	#DIV/0!
	Maximum	73.1	248.0	86.7	11.8	3.1	3.55	0.438	16.0	318	0.0	1.78	163	7.94	0.00	0.92	0.00	0.00	0.0
	Minimum	36.6	97.5	50.3	5.6	2.1	0.06	0.177	7.0	264	0.0	0.00	12	1.63	0.00	0.91	0.00	0.00	0.0
	Number	2	3	3	3	3	3	3	3	3	3	3	2	2	1	2	0	0	0
Well 2C	**Sunburst**																		
MBMG	2005Q0346	6.2	37.5	46.2	6.6	1.7	0.008	0.015	7.3	357	0.0	1.46	20.1	5.95	0.05	0.91			
Total Rec	2005Q0347		42.2	49.6	6.9	2.4	0.668	0.105											
MBMG	2005Q0423	7.5	43.5	55.6	8.6	2.1	0.009	0.019	7.8	348	0.0	1.37	25.9	11.80	<0.05	0.84			
Total Rec	2005Q0424		45.4	54.8	8.6	2.3	0.271	0.064											
MBMG	2006Q0116	6.2	44.0	50.2	7.1	2.0	0.02	0.013	7.7	307	0.0	1.23	19.2	13.50		0.75			
MBMG	2006Q0434	0.8	43.2	50.8	7.8	2.1	0.016	0.026	7.0	352	0.0	1.81	2.8	11.70		0.06			
	Mean	5.2	42.6	51.2	7.6	2.1	0.17	0.040	7.4	341	0.0	1.47	17	10.74	0.05	0.64	#DIV/0!	#DIV/0!	#DIV/0!
	Maximum	7.5	45.4	55.6	8.6	2.4	0.67	0.105	7.8	357	0.0	1.81	26	13.50	0.05	0.91	0.00	0.00	0.0
	Minimum	0.8	37.5	46.2	6.6	1.7	0.01	0.013	7.0	307	0.0	1.23	3	5.95	0.05	0.06	0.00	0.00	0.0
	Number	4	6	6	6	6	6	6	4	4	4	4	4	4	2	4	0	0	0
Well 2D	**Cutbank**																		
MBMG	2006Q0115	4.8	45.3	45.3	6.9	1.3	0.01	0.01	8.37	303.1	0.00	1.39	14.6	14.60	0.00	0.65			
	Mean	4.8	45.3	45.3	6.9	1.3	0.01	0.01	8.4	303.1	0.00	1.39	14.6	14.60	0.00	0.65	#DIV/0!	#DIV/0!	#DIV/0!
	Maximum	4.8	45.3	45.3	6.9	1.3	0.01	0.01	8.4	303.1	0.00	1.39	14.6	14.60	0.00	0.65	0.00	0.00	0.00
	Minimum	4.8	45.3	45.3	6.9	1.3	0.01	0.01	8.4	303.1	0.00	1.39	14.6	14.60	0.00	0.65	0.00	0.00	0.00
	Number	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0

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(All concentrations are dissolved,

DISSOLVED CONCENTRATION

Analy. Lab	Lab No.	Tritium Pico curies/L	Al (ug/l)	Ag (ug/l)	As (ug/l)	B (ug/l)	Cd (ug/l)	Co (ug/l)	Cr (ug/l)	Cu (ug/l)	Li (ug/l)	Mo (ug/l)	Ni (ug/l)	Pb (ug/l)	Se (ug/l)	Sr (ug/l)	Ti (ug/l)	U (ug/l)	Zn (ug/l)
Well 2a	**Madison**																		
MBMG	2005Q0195		12.3	<1	1.25	60.6	<1	<2	5.6	<2	38.7	18.1	11.5	<2	5.08	1,109	<1	4.89	<2
Total Rec	2006Qo398			<10	<10		<10	<20	35.7	54.5	32.8	<100	82.2	<20	<10	1,935	10.3	6.55	261
MBMG	2006Q0431		11.4	<2	<1	32.1	<1	5.5	2.38	3.58	27	<10	27.8	<2	2.17	1,653	1.21	7.77	75.1
	Mean	#DIV/0!	11.9	#DIV/0!	1.25	46.4	#DIV/0!	5.50	14.56	29.04	32.8	18.1	40.5	#DIV/0!	3.63	1,566	5.76	6.40	168.1
	Maximum	0.0	12.3	0.00	1.25	60.6	0.00	5.50	35.70	54.50	38.7	18.1	82.2	0.0	5.08	1,935	10.30	7.77	261.0
	Minimum	0.0	11.4	0.00	1.25	32.1	0.00	5.50	2.38	3.58	27.0	18.1	11.5	0.0	2.17	1,109	1.21	4.89	75.1
	Number	0	2	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3
Well 2C	**Sunburst**																		
MBMG	2005Q0346		34.7	<1	<1	48.4	<1	<2	<2	<2	28.9	<10	3.9	<2	4.06	467	<1	3.59	5.92
Total Rec	2005Q0347		1624	<1	<1		<1	2.01	<2	5.65	31.1	<10	9.6	3.59	3.06	537	81.3	3.75	21.4
MBMG	2005Q0423		<10	<1	<1	42.2	<1	<2	<2	<2	35.7	<10	2.2	<2	3.58	545	<1	3.53	4.73
Total Rec	2005Q0424			<1	<1		<1	<2	<2	2.48	35	<10	2.3	<2	3.68	544	31.4	3.62	38.9
MBMG	2006Q0116		18.2	<1	<1	41.4	<1	<2	<2	<2	27.3	<10	<2	<2	4.11	542	<1	3.53	58.3
MBMG	2006Q0434		<10	<1	1.8	48.1	<1	<2	9.87	<2	31.6	<10	<2	<2	8.29	507	<1	3.08	112
	Mean	#DIV/0!	559.0	#DIV/0!	1.80	45.0	#DIV/0!	2.01	9.87	4.07	31.6	#DIV/0!	4.5	3.6	4.46	524	56.35	3.52	40.2
	Maximum	0.0	1624.0	0.00	1.80	48.4	0.00	2.01	9.87	5.65	35.7	0.0	9.6	3.6	8.29	545	81.30	3.75	112.0
	Minimum	0.0	18.2	0.00	1.80	41.4	0.00	2.01	9.87	2.48	27.3	0.0	2.2	3.6	3.06	467	31.40	3.08	4.7
	Number	0	5	6	6	4	6	6	6	6	6	6	6	6	6	6	6	6	6
Well 2D	**Cutbank**																		
MBMG	2006Q0115		<10	<1	1.34	36.00	<1	<2	2.50	<2	25.20	<10	<2	<2	3.75	558	<1	3.28	38.40
	Mean	#DIV/0!	#DIV/0!	#DIV/0!	1.34	36.00	#DIV/0!	#DIV/0!	2.50	#DIV/0!	25.20	#DIV/0!	#DIV/0!	#DIV/0!	3.75	558	#DIV/0!	3.28	38.40
	Maximum	0.00	0.00	0.00	1.34	36.00	0.00	0.00	2.50	0.00	25.20	0.00	0.00	0.00	3.75	558	0.00	3.28	38.40
	Minimum	0.00	0.00	0.00	1.34	36.00	0.00	0.00	2.50	0.00	25.20	0.00	0.00	0.00	3.75	558	0.00	3.28	38.40
	Number	0	0	0	1	1	0	0	1	0	1	0	0	0	1	1	0	1	1

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Water Quality Results
(All concentrations are dissolved, unless otherwise noted)

					PHYSICAL PARAMETERS									Water Type PERCENT MEQ/L				
Analy. Lab	Lab No.	DATE (mm/dd/yy)	TIME (HRS)	SWL (ft)	FIELD pH	FIELD SC (uMHOS)	FIELD Temp (C)	FIELD ORP (MV)	FIELD DO (mg/l)	LAB pH	LAB SC (uMHOS)	Hardness (mg/l)	Alkalinity (mg/l)	Ca	Mg	Na	Fe	HCO3
Well 3B	**Mine Void**	**M:217052**																
MBMG	2006Q0114	08/05/05	11:00	267.41	6.68	700	9.6	53		6.57	720	369	135	44.6	30.9	4.3	19.0	29.6
MBMG	2006Q0457	11/17/05	13:30	267.05	6.37	682	8.9	174		6.18	736	360	81	42.8	27.8	3.2	25.1	17.9
MBMG	2010Q0399	10/07/09	12:15	268.24	6.41	917	10.1	167	0	6.45	849	389	89	39.6	26.9	3.1	29.1	16.6
	Mean			267.57	6.49	766.43	9.6	131	0.46	6.40	768.33	373	101	42.3	28.5	3.52	24.40	21.4
	Maximum			268.24	6.68	917.00	10.1	174	0.46	6.57	849.00	389	135	44.6	30.9	4.28	29.13	29.6
	Minimum			267.05	6.37	682.30	8.9	53	0.46	6.18	720.00	360	81	39.6	26.9	3.12	18.99	16.6
	Number			3	3	3	3	3	1	3	3	3	3	3	3	3	3	3
Well 3C	**Sunburst**	**M:217053**																
MBMG	2005Q0344	02/04/05	10:40	48.09	--	--	--	--	--	7.56	630	310	337	35.7	52.0	9.8	0.2	91.3
MBMG	2005Q0345	02/04/05	10:40									321		36.3	51.8	9.6	0.2	
MBMG	2005Q0421	04/08/05	16:50	46.40	6.67	630	10.1	326	2.44	7.51	680	329	341	35.7	52.1	9.8	0.2	90.3
Total Rec	2005Q0422	04/08/05	16:50									331						
MBMG	2006Q0113	08/02/05	15:00	40.21	7.23	560	14.75	-20		7.72	653	336	339	36.5	50.6	10.4	0.3	90.3
MBMG	2006Q0435	11/10/05	13:45	40.90	7.4	510.4	11.68	116		7.82	582	317	335	37.2	50.3	10.0	0.3	89.9
MBMG	2010Q0398	10/07/09	11:49	42.04	6.69	598.4	8.99	151	0.32	7.5	637	314	337	37.9	49.1	10.7	0.2	98.6
	Mean			43.53	7.00	575	11.4	143	1.38	7.62	636	323	338	36.5	51.0	10.1	0.2	92.1
	Maximum			48.09	7.40	630	14.8	326	2.44	7.82	680	336	341	37.9	52.1	10.7	0.3	98.6
	Minimum			40.21	6.67	0	9.0	-20	0.32	7.50	582	310	335	35.7	49.1	9.6	0.2	89.9
	Number			5	5	5	5	5	3	5	5	7	5	6	6	6	6	5
Well 4A		**M217055**																
MBMG	2006Q0111	08/05/05	9:00		7.33	886	11.3	45		7.72	924	429	224	47.9	29.6	21.5	0.0	39.2
MBMG	2006Q0432	11/09/05	15:50	635.17	7.71	670	11.1	200		7.59	789	382	216	48.4	32.9	17.7	0.0	44.9
MBMG	2007Q0347	08/22/06	15:40	633.14	7.34	915	11.6	182		7.24	930	450	230	54.0	33.0	12.1	0.0	40.6
	Mean			634.16	7.46	824	11.4	142.33	#DIV/0!	7.52	881.00	420.27	223.44	50.10	31.83	17.08	0.04	41.57
	Maximum			635.17	7.71	915	11.6	200.00	0.00	7.72	930.00	450.48	230.14	53.99	32.99	21.46	0.04	44.90
	Minimum			633.14	7.33	670	11.1	45.00	0.00	7.24	789.00	381.83	216.36	47.87	29.64	12.14	0.03	39.25
	Number			2	3	3	3	3	0	3	3	3	3	3	3	3	3	3

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(All concentrations are dissolved,

Analy. Lab	Lab No.	SO4	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	Fe (mg/l)	Mn (mg/l)	SiO2 (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3-N (mg/l)	NO2-N (mg/l)	F (mg/l)	Oxygen 18O	Deuterium 2H	Tritium TU
Well 3B	**Mine Void**																		
MBMG	2006Q0114	68.8	87.3	36.6	9.6	3.5	34.5	0.20	6.4	164.7	0.00	3.3	301.0	0.06	<0.05	0.91			16
MBMG	2006Q0457	80.5	87.5	34.5	7.5	3.2	47.7	0.17	5.4	98.5	0.00	3.4	349.0	<.05		0.96			
MBMG	2010Q0399	83.0	92.7	38.2	8.4	3.6	63.3	0.19	6.0	108.0	0.00	<5.0	425.6	<0.5		0.96			
	Mean	77.4	89.2	36.4	8.5	3.4	48.5	0.19	5.9	123.7	0.00	3.32	358.5	0.06	#DIV/0!	0.95	#DIV/0!	#DIV/0!	15.50
	Maximum	83.0	92.7	38.2	9.6	3.6	63.3	0.20	6.4	164.7	0.00	3.36	425.6	0.06	0.00	0.96	0.00	0.00	15.50
	Minimum	68.8	87.3	34.5	7.5	3.2	34.5	0.17	5.4	98.5	0.00	3.27	301.0	0.06	0.00	0.91	0.00	0.00	15.50
	Number	3	3	3	3	3	3	3	3	3	3	2	3	1	0	3	0	0	1
Well 3C	**Sunburst**																		
MBMG	2005Q0344	6.7	50.6	44.7	16.0	4.9	0.22	0.104	6.3	411	0.0	2.11	23.6	0.06	--	1.55			
MBMG	2005Q0345		52.9	45.8	16.0	5.1	0.22	0.105											
MBMG	2005Q0421	8.0	53.5	47.4	16.9	4.9	0.28	0.097	6.2	416	0.0	1.92	28.9	<0.05	<0.05	1.34			
Total Rec	2005Q0422		53.9	47.7	17.4	4.9	0.33	0.099											
MBMG	2006Q0113	7.9	56.4	47.5	18.5	5.1	0.45	0.098	6.7	413	0.0	2.07	28.5	<0.05	<0.05	1.43			<8
MBMG	2006Q0435	8.0	53.9	44.2	1.7	4.8	0.47	0.080	5.6	409	0.0	2.28	28.6	<.05		1.71			
MBMG	2010Q0398	0.0	54.8	43.1	17.8	4.6	0.30	0.047	6.4	411	0.0	<5.0	<25	<0.5		1.80			
	Mean	6.1	53.7	45.8	14.9	4.9	0.32	0.090	6.2	412	0.0	2.10	27	0.06	#DIV/0!	1.57	#DIV/0!	#DIV/0!	#DIV/0!
	Maximum	8.0	56.4	47.7	18.5	5.1	0.47	0.105	6.7	416	0.0	2.28	29	0.06	0.00	1.80	0.00	0.00	0.0
	Minimum	0.0	50.6	43.1	1.7	4.6	0.22	0.047	5.6	409	0.0	1.92	24	0.06	0.00	1.34	0.00	0.00	0.0
	Number	5	7	7	7	7	7	7	5	5	5	5	5	5	3	5	0	0	1
Well 4A																			
MBMG	2006Q0111	59.4	106.0	39.8	54.5	2.5	0.075	0.071	9.5	273	0.0	1.97	325	0.64	<0.05	1.02			4.5
MBMG	2006Q0432	54.5	91.1	37.5	38.1	2.3	0.077	0.102	8.7	264	0.0	<5	252	<.5		1.11			
MBMG	2007Q0347	58.8	112.0	41.5	28.9	2.0	0.051	0.083	8.3	281	0.0	<5	320	<0.5	<0.5	1.31			
	Mean	57.57	103.03	39.60	40.50	2.28	0.07	0.09	8.80	272.43	0.00	1.97	299.00	0.64	#DIV/0!	1.15	#DIV/0!	#DIV/0!	4.50
	Maximum	59.40	112.00	41.50	54.50	2.52	0.08	0.10	9.45	280.60	0.00	1.97	325.00	0.64	0.00	1.31	0.00	0.00	4.50
	Minimum	54.50	91.10	37.50	28.90	2.01	0.05	0.07	8.30	263.80	0.00	1.97	252.00	0.64	0.00	1.02	0.00	0.00	4.50
	Number	3	3	3	3	3	3	3	3	3	3	1	3	1	0	3	0	0	1

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(All concentrations are dissolved,

DISSOLVED CONCENTRATION

Analy. Lab	Lab No.	Tritium Pico curies/L	Al (ug/l)	Ag (ug/l)	As (ug/l)	B (ug/l)	Cd (ug/l)	Co (ug/l)	Cr (ug/l)	Cu (ug/l)	Li (ug/l)	Mo (ug/l)	Ni (ug/l)	Pb (ug/l)	Se (ug/l)	Sr (ug/l)	Ti (ug/l)	U (ug/l)	Zn (ug/l)
Well 3B	**Mine Void**																		
MBMG	2006Q0114		<10	<1	<1	41.60	2.34	9.57	2.48	<2	42.30	<10	20.60	<2	<1	817	<1	<0.5	53.50
MBMG	2006Q0457		80	<1	1	40.50	<1	9.78	2.93	<2	41.00	<10	20.00	<2	1	797	<1	<.5	72.30
MBMG	2010Q0399		152	<1.0	1	37.50	<0.1	5.40	0.36	<0.4	34.40	1	12.50	<0.4	<0.1	813	4	0	10.00
	Mean	#DIV/0!	115.85	#DIV/0!	1.31	39.87	2.34	8.25	1.92	#DIV/0!	39.23	0.70	17.70	#DIV/0!	1.11	809	3.97	0.10	45.27
	Maximum	0.00	152.00	0.00	1.45	41.60	2.34	9.78	2.93	0.00	42.30	0.70	20.60	0.00	1.11	817	3.97	0.10	72.30
	Minimum	0.00	79.70	0.00	1.17	37.50	2.34	5.40	0.36	0.00	34.40	0.70	12.50	0.00	1.11	797	3.97	0.10	10.00
	Number	0	2	0	2	3	1	3	3	0	3	1	3	0	1	3	1	1	3
Well 3C	**Sunburst**																		
MBMG	2005Q0344		<30	<1	5.41	115	<1	5.07	2.03	<2	65.5	<10	23.3	<2	<1	915	<1	<1	<2
MBMG	2005Q0345		39.6	<1	4.35		<1	4.42	<2	<2	66.8	<10	19.9	<2	<1	932	<1	<1	10.9
MBMG	2005Q0421		47.2	<1	5.30	104	<1	3.74	<2	<2	61.6	<10	20.5	<2	<1	909	<1	<1	<2
Total Rec	2005Q0422			<1	5.23		<1	3.70	<2	<2	62.2	<10	21.1	<2	<1	928	1.49	<1	34.7
MBMG	2006Q0113		<10	<1	7.50	114	<1	<2	2.49	<2	64.7	<10	11.5	<2	<1	960	<1	<.5	20.4
MBMG	2006Q0435		<10	<1	8.76	122	<1	<2	6.92	<2	58	<10	7.51	<2	1.17	868	<5	<.5	5.82
MBMG	2010Q0398		<7.6	<0.1	6.19	107	<0.1	0.292	<0.1	<0.4	47.1	3.82	1.04	<0.4	0.13	804	<0.1	<0.205	<0.9
	Mean	#DIV/0!	43.4	#DIV/0!	6.11	112.4	#DIV/0!	3.44	3.81	#DIV/0!	60.8	3.8	15.0	#DIV/0!	0.65	902	1.49	#DIV/0!	18.0
	Maximum	0.0	47.2	0.00	8.76	122.0	0.00	5.07	6.92	0.00	66.8	3.8	23.3	0.0	1.17	960	1.49	0.00	34.7
	Minimum	0.0	39.6	0.00	4.35	104.0	0.00	0.29	2.03	0.00	47.1	3.8	1.0	0.0	0.13	804	1.49	0.00	5.8
	Number	0	6	7	7	5	7	7	7	7	7	7	7	7	7	7	7	7	7
Well 4A																			
MBMG	2006Q0111		57.2	<1	1.82	50.9	<1	<2	<2	<2	41.9	24.9	2.2	<2	2.70	1,304	1.12	6.02	11.4
MBMG	2006Q0432		<10	<1	2.16	40.8	<1	<2	<2	<2	31.2	33.2	3.4	<2	3.02	1,215	<1	4.08	17.0
MBMG	2007Q0347		<10	<1	1.97	32.4	<1	<2	7.07	<2	29.0	27.9	3.8	<2	2.76	1,304	<1	5.53	18.9
	Mean	#DIV/0!	57.20	#DIV/0!	1.98	41.37	#DIV/0!	#DIV/0!	7.07	#DIV/0!	34.0	28.67	3.14	#DIV/0!	2.83	1,274	1.12	5.21	15.8
	Maximum	0.00	57.20	0.00	2.16	50.90	0.00	0.00	7.07	0.00	41.9	33.20	3.79	0.00	3.02	1,304	1.12	6.02	18.9
	Minimum	0.00	57.20	0.00	1.82	32.40	0.00	0.00	7.07	0.00	29.0	24.90	2.19	0.00	2.70	1,215	1.12	4.08	11.4
	Number	0	1	0	3	3	0	0	1	0	3	3	3	0	3	3	1	3	3

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(All concentrations are dissolved, unless otherwise noted)

					PHYSICAL PARAMETERS									Water Type				
					FIELD	FIELD	FIELD	FIELD	FIELD	LAB	LAB			PERCENT MEQ/L				
Analy. Lab	Lab No.	DATE (mm/dd/yy)	TIME (HRS)	SWL (ft)	pH	SC (uMHOS)	Temp (C)	ORP (MV)	DO (mg/l)	pH	SC (uMHOS)	Hardness (mg/l)	Alkalinity (mg/l)	Ca	Mg	Na	Fe	HCO3
Well 4B	**Coal**	**M:215048**																
MBMG	2005Q0290	10/29/04			6.59	880	8.83			7.37	920	446	342	49.48	38.92	9.58	0.05	73.05
MBMG	2006Q0112	08/05/05	8:45	273.53	7	748	10.49	-6		7.34	869	484	327	60.05	30.86	6.96	0.05	62.12
	Mean			274	6.80	814	9.7	-6	#DIV/0!	7.36	895	465	334	54.8	34.9	8.3	0.0	67.6
	Maximum			274	7.00	880	10.5	-6	0.00	7.37	920	484	342	60.0	38.9	9.6	0.0	73.1
	Minimum			274	6.59	748	8.8	-6	0.00	7.34	869	446	327	49.5	30.9	7.0	0.0	62.1
	Number			1	2	2	2	1	0	2	2	2	2	2	2	2	2	2
Well 4C	**Sunburst**	**M:217056**																
MBMG	2005Q0342	02/03/05	13:50	82.76	6.83	735	9.6	345	--	7.37	760	373	415	38.0	49.2	10.2	0.2	90.3
MBMG	2005Q0343	02/03/05	13:50									384		39.0	48.1	10.4	0.2	
MBMG	2006Q0120	08/04/05	14:15	73.95	7.17	659	13.07	25		7.75	745	394	407	37.6	49.0	10.9	0.2	90.3
MBMG	2006Q0436	11/09/05	15:10	76.11	7.35	743.4	15.47	180		7.72	710	373	400	38.5	48.2	10.8	0.2	90.2
	Mean			77.61	7.12	712	12.7	183	#DIV/0!	7.61	738	381	408	38.3	48.6	10.6	0.2	90.3
	Maximum			82.76	7.35	743	15.5	345	0.00	7.75	760	394	415	39.0	49.2	10.9	0.2	90.3
	Minimum			73.95	6.83	735	9.6	25	0.00	7.37	710	373	400	37.6	48.1	10.2	0.2	90.2
	Number			3	3	1	3	3	1	3	3	4	3	4	4	4	4	3
Well 5C	**Sunburst**	**M:220491**																
MBMG	2006Q0119	08/03/05	15:30	17.84	7.59	565	14.63	67		7.98	635	347	304	22.89	68.91	7.09	0.11	80.60
MBMG	2006Q0437	11/10/05	12:35	26.52	7.75	525.9	12.95	277		7.99	654	347	296	24.10	69.39	5.45	0.01	80.35
MBMG	2010Q0400	10/07/09	15:53	27.27	7.7	661	10.43	218	3.3	7.85	681	357	299	23.74	65.98	4.37	1.45	82.44
	Mean			23.88	7.68	584	12.7	187	3.30	7.94	657	350	300	23.6	68.1	5.6	0.5	81.1
	Maximum			27.27	7.75	661	14.6	277	3.30	7.99	681	357	304	24.1	69.4	7.1	1.4	82.4
	Minimum			17.84	7.59	565	10.4	67	3.30	7.85	635	347	296	22.9	66.0	4.4	0.0	80.4
	Number			3	3	1	3	3	1	3	3	3	3	3	3	3	3	3

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Analy. Lab	Lab No.	SO4	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	Fe (mg/l)	Mn (mg/l)	SiO2 (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3-N (mg/l)	NO2-N (mg/l)	F (mg/l)	Oxygen 18O	Deuterium 2H	Tritium TU
Well 4B	**Coal**																		
MBMG	2005Q0290	25.66	100	47.7	22.2	5.88	0.09	0.376	7.5	416	0.0	2.83	115	<0.25	<0.25	0.61			
MBMG	2006Q0112	36.48	128	39.9	17	6.71	0.10	0.579	7.1	398	0.0	3.87	184	0.08	<0.25	0.62			
	Mean	31.1	114.0	43.8	19.6	6.3	0.09	0.478	7.3	407	0.0	3.35	150	0.08	#DIV/0!	0.61	#DIV/0!	#DIV/0!	#DIV/0!
	Maximum	36.5	128.0	47.7	22.2	6.7	0.10	0.579	7.5	416	0.0	3.87	184	0.08	0.00	0.62	0.00	0.00	0.0
	Minimum	25.7	100.0	39.9	17.0	5.9	0.09	0.376	7.1	398	0.0	2.83	115	0.08	0.00	0.61	0.00	0.00	0.0
	Number	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0
Well 4C	**Sunburst**																		
MBMG	2005Q0342	8.2	65.1	51.2	20.1	6.1	0.32	0.051	6.0	506	0.0	2.51	35.9	<0.05	<0.05	1.35			
MBMG	2005Q0343		68.9	51.5	21.1	6.22	0.35	0.052											
MBMG	2006Q0120	8.3	68.6	54.2	22.9	6.32	0.36	0.052	6.4	497	0.0	2.22	35.8	<.05	<.05	1.26			0.8
MBMG	2006Q0436	8.0	66.3	50.4	21.3	6.02	0.37	0.045	5.6	488	0.0	2.52	34.3	<.05		1.57			
	Mean	8.2	67.2	51.8	21.4	6.2	0.35	0.050	6.0	497	0.0	2.42	35	#DIV/0!	#DIV/0!	1.39	#DIV/0!	#DIV/0!	0.8
	Maximum	8.3	68.9	54.2	22.9	6.3	0.37	0.052	6.4	506	0.0	2.52	36	0.00	0.00	1.57	0.00	0.00	0.8
	Minimum	8.0	65.1	50.4	20.1	6.0	0.32	0.045	5.6	488	0.0	2.22	34	0.00	0.00	1.26	0.00	0.00	0.8
	Number	3	4	4	4	4	4	4	3	3	3	3	3	3	2	3	0	0	1
Well 5C	**Sunburst**																		
MBMG	2006Q0119	5.56	34.6	63.2	12.3	1.68	0.14	0.019	8.7	371	0.0	1.95	20.1	13.10	<0.25	1.02			
MBMG	2006Q0437	4.92	35.8	62.5	9.29	2.3	0.02	0.003	6.8	361	0.0	2.25	17.4	13.30		1.35			
MBMG	2010Q0400	0.00	37.8	63.7	7.97	2.86	2.15	0.109	17.4	364	0.0	<5.0	<25	16.74		1.39			
	Mean	3.5	36.1	63.1	9.9	2.3	0.77	0.044	10.9	365	0.0	2.1	18.8	14.4	#DIV/0!	1.3	#DIV/0!	#DIV/0!	#DIV/0!
	Maximum	5.6	37.8	63.7	12.3	2.9	2.15	0.109	17.4	371	0.0	2.3	20.1	16.7	0.0	1.4	0.0	0.0	0.0
	Minimum	0.0	34.6	62.5	8.0	1.7	0.02	0.003	6.8	361	0.0	2.0	17.4	13.1	0.0	1.0	0.0	0.0	0.0
	Number	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	0	0	0

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DISSOLVED CONCENTRATION

Analy. Lab	Lab No.	Tritium Pico curies/L	Al (ug/l)	Ag (ug/l)	As (ug/l)	B (ug/l)	Cd (ug/l)	Co (ug/l)	Cr (ug/l)	Cu (ug/l)	Li (ug/l)	Mo (ug/l)	Ni (ug/l)	Pb (ug/l)	Se (ug/l)	Sr (ug/l)	Ti (ug/l)	U (ug/l)	Zn (ug/l)
Well 4B	**Coal**																		
MBMG	2005Q0290		16.0	<1	1.26	89.0	<1	3.38	<2	<2	61.5	<10	12	<2	<1	1,037	<1	3.05	13
MBMG	2006Q0112	<.8	<30	<1	3.56	53.1	<1	3.05	4.61	<2	48.6	<10	13.2	<2	<1	1,028	<1	3.07	23
	Mean	#DIV/0!	16.0	#DIV/0!	2.41	71.1	#DIV/0!	3.22	4.61	#DIV/0!	55.1	#DIV/0!	12.6	#DIV/0!	#DIV/0!	1,033	#DIV/0!	3.06	18.0
	Maximum	0.0	16.0	0.00	3.56	89.0	0.00	3.38	4.61	0.00	61.5	0.0	13.2	0.0	0.00	1,037	0.00	3.07	23.0
	Minimum	0.0	16.0	0.00	1.26	53.1	0.00	3.05	4.61	0.00	48.6	0.0	12.0	0.0	0.00	1,028	0.00	3.05	13.0
	Number	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Well 4C	**Sunburst**																		
MBMG	2005Q0342		<30	<1	1.14	175.0	<1	<2	2.1	<2	106	<10	4.7	<2	<1	1,211	<1	<1	<2
MBMG	2005Q0343		48.4	<1	1.09		<1	<2	<2	<2	103	<10	9.6	<2	<1	1,140	2.04	<1	9.52
MBMG	2006Q0120		<30	<1	<1	159.0	<1	<2	2.4	<2	110	<10	<2	<2	<1	1,252	<1	<0.5	45.2
MBMG	2006Q0436		<10	<1	1.27	167.0	<1	<2	6.27	<2	103	<10	<2	<2	2.7	1,167	<1	<.5	30.4
	Mean	#DIV/0!	48.4	#DIV/0!	1.17	167.0	#DIV/0!	#DIV/0!	3.59	#DIV/0!	105.5	#DIV/0!	7.1	#DIV/0!	2.70	1,193	2.04	#DIV/0!	28.4
	Maximum	0.0	48.4	0.00	1.27	175.0	0.00	0.00	6.27	0.00	110.0	0.0	9.6	0.0	2.70	1,252	2.04	0.00	45.2
	Minimum	0.0	48.4	0.00	1.09	159.0	0.00	0.00	2.10	0.00	103.0	0.0	4.7	0.0	2.70	1,140	2.04	0.00	9.5
	Number	0	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4
Well 5C	Sunburst																		
MBMG	2006Q0119		103.0	<1	<1	69.6	<1	<2	2.12	<2	37.3	<10	<2	<2	2.74	599	1.94	5.0	38.5
MBMG	2006Q0437		<10	<1	<1	61.7	<1	<2	7.36	<2	46	<10	<2	<2	3.81	539	<1	3.44	26.5
MBMG	2010Q0400		2346.0	<0.1	0.834	51.4	<0.3	3.87	6.44	8.64	32.3	0.614	6.36	3.47	1.98	518	<0.1	3.49	7.68
	Mean	#DIV/0!	1224.5	#DIV/0!	0.8	60.9	#DIV/0!	3.9	5.3	8.6	38.5	0.6	6.4	3.5	2.84	552	1.9	4.0	24.2
	Maximum	0.0	2346.0	0.0	0.8	69.6	0.0	3.9	7.4	8.6	46.0	0.6	6.4	3.5	3.81	599	1.9	5.0	38.5
	Minimum	0.0	103.0	0.0	0.8	51.4	0.0	3.9	2.1	8.6	32.3	0.6	6.4	3.5	1.98	518	1.9	3.4	7.7
	Number	0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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Water Quality Results
(All concentrations are dissolved, unless otherwise noted)

					PHYSICAL PARAMETERS									Water Type				
					FIELD	FIELD	FIELD	FIELD	FIELD	LAB	LAB			PERCENT MEQ/L				
Analy. Lab	Lab No.	DATE (mm/dd/yy)	TIME (HRS)	SWL (ft)	pH	SC (uMHOS)	Temp (C)	ORP (MV)	DO (mg/l)	pH	SC (uMHOS)	Hardness (mg/l)	Alkalinity (mg/l)	Ca	Mg	Na	Fe	HCO3
Well 8B	**Coal**	**M:223945**																
MBMG	2006Q0455	11/16/05	15:00	45.38	7.43	456	11.9	169		7.43	456	299	298	42.0	51.6	5.3	0.2	89.2
MBMG	2007Q0345	08/24/06	18:50	43.35	7.16	565	13.1	130		7.16	575	306	313	38.9	54.3	5.6	0.3	89.0
	Mean			44.37	7.30	510	12.5	150	#DIV/0!	7.30	515	303	305	40.4	52.9	5.4	0.3	89.1
	Maximum			45.38	7.43	565	13.1	169	0	7.43	575	306	313	42.0	54.3	5.6	0.3	89.2
	Minimum			43.35	7.16	456	11.9	130	0	7.16	456	299	298	38.9	51.6	5.3	0.2	89.0
	Number			2	2	2	2	2	0	2	2	2	2	2	2	2	2	2
Well 8C	Sunburst	**M:223948**																
MBMG	2006Q0452	11/16/05	11:40	45.38	7.39	461	10.1	144		7.67	570	299	308	40.9	52.5	5.4	0.0	89.2
MBMG	2007Q0344	08/24/06	16:40	42.8	7.09	570	14.4	135		7.13	610	319	317	38.4	54.7	5.7	0.3	89.0
	Mean			44.09	7.24	515	12.3	140	#DIV/0!	7.40	590	309	313	39.6	53.6	5.6	0.2	89.1
	Maximum			45.38	7.39	570	14.4	144	0	7.67	610	319	317	40.9	54.7	5.7	0.3	89.2
	Minimum			42.80	7.09	461	10.1	135	0	7.13	570	299	308	38.4	52.5	5.4	0.0	89.0
	Number			2	2	2	2	2	0	2	2	2	2	2	2	2	2	2
Well 9C	**Sunburst**	**M:223947**																
MBMG	2006Q0453	11/17/05	16:47	60.17	7.68	610	9.5	179		7.79	710	370	365	36.9	51.4	10.4	0.0	83.9
MBMG	2007Q0346	08/22/06	11:45	56.58	7.37	690	19.0	243	2.3	7.34	690	369	371	32.7	55.9	10.0	0.0	82.3
	Mean			58.38	7.53	650	14.3	211	2.3	7.57	700	369	368	34.8	53.7	10.2	0.0	83.1
	Maximum			60.17	7.68	690	19.0	243	2.3	7.79	710	370	371	36.9	55.9	10.4	0.0	83.9
	Minimum			56.58	7.37	610	9.5	179	2.3	7.34	690	369	365	32.7	51.4	10.0	0.0	82.3
	Number			2	2	2	2	2	1	2	2	2	2	2	2	2	2	2

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(All concentrations are dissolved,

Analy. Lab	Lab No.	SO4	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	Fe (mg/l)	Mn (mg/l)	SiO2 (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3-N (mg/l)	NO2-N (mg/l)	F (mg/l)	Oxygen 18O	Deuterium 2H	Tritium TU
Well 8B	**Coal**																		
MBMG	2006Q0455	9.0	53.8	40.1	7.8	1.7	0.26	0.102	6.2	363	0.0	2.1	28.7	<.05		1.2			
MBMG	2007Q0345	9.5	51.1	43.3	8.4	1.8	0.37	0.081	6.5	381	0.0	1.7	31.9	<0.05	<0.05	1.2			
	Mean	9.2	52.5	41.7	8.1	1.8	0.32	0.092	6.4	372	0.0	1.9	30.3	#DIV/0!	#DIV/0!	1.2	#DIV/0!	#DIV/0!	#DIV/0!
	Maximum	9.5	53.8	43.3	8.4	1.8	0.37	0.102	6.5	381	0.0	2.1	31.9	0.0	0.0	1.2	0.00	0.00	0.00
	Minimum	9.0	51.1	40.1	7.8	1.7	0.26	0.081	6.2	363	0.0	1.7	28.7	0.0	0.0	1.2	0.00	0.00	0.00
	Number	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	0	0	0
Well 8C	Sunburst																		
MBMG	2006Q0452	9.7	52.5	40.9	7.99	1.64	0.37	0.087	6.0	376	0.0	1.91	30.3	<.05	1.17	<.05			
MBMG	2007Q0344	9.5	52.6	45.5	9	1.74	0.40	0.08	6.5	387	0.0	1.69	32.3	<0.05	<0.05	1.16			
	Mean	9.6	52.6	43.2	8.5	1.7	0.39	0.084	6.2	381	0.0	1.8	31.3	#DIV/0!	1.2	1.2	#DIV/0!	#DIV/0!	#DIV/0!
	Maximum	9.7	52.6	45.5	9.0	1.7	0.40	0.087	6.5	387	0.0	1.9	32.3	0.0	1.2	1.2	0.00	0.00	0.00
	Minimum	9.5	52.5	40.9	8.0	1.6	0.37	0.080	6.0	376	0.0	1.7	30.3	0.0	1.2	1.2	0.00	0.00	0.00
	Number	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0
Well 9C	**Sunburst**																		
MBMG	2006Q0453	12.6	61.8	52.3	19.9	3.34	0.03	0.109	7.1	445	0.0	7.9	52.6	0.39		1.05			
MBMG	2007Q0346	13.7	54.5	56.5	19.2	3.28	0.04	0.111	6.8	452	0.0	10.1	59.2	0.26	<0.05	1.07			
	Mean	13.1	58.2	54.4	19.6	3.3	0.04	0.110	7.0	449	0.0	9.0	55.9	0.3	#DIV/0!	1.1	#DIV/0!	#DIV/0!	#DIV/0!
	Maximum	13.7	61.8	56.5	19.9	3.3	0.04	0.111	7.1	452	0.0	10.1	59.2	0.4	0.0	1.1	0.00	0.00	0.00
	Minimum	12.6	54.5	52.3	19.2	3.3	0.03	0.109	6.8	445	0.0	7.9	52.6	0.3	0.0	1.1	0.00	0.00	0.00
	Number	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	0	0	0

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DISSOLVED CONCENTRATION

Analy. Lab	Lab No.	Tritium Pico curies/L	Al (ug/l)	Ag (ug/l)	As (ug/l)	B (ug/l)	Cd (ug/l)	Co (ug/l)	Cr (ug/l)	Cu (ug/l)	Li (ug/l)	Mo (ug/l)	Ni (ug/l)	Pb (ug/l)	Se (ug/l)	Sr (ug/l)	Ti (ug/l)	U (ug/l)	Zn (ug/l)
Well 8B	**Coal**																		
MBMG	2006Q0455		<10	<1	2.3	37.6	<1	<2	5.1	<2	28.0	<10	<2	<2	1.89	445	<1	2.3	16.0
MBMG	2007Q0345		<10	<1	1.2	39.7	<1	<2	<2	<2	31.7	<10	<2	<2	<1	440	<1	2.0	3.9
	Mean	#DIV/0!	#DIV/0!	#DIV/0!	1.8	38.7	#DIV/0!	#DIV/0!	5.1	#DIV/0!	29.9	#DIV/0!	#DIV/0!	#DIV/0!	1.9	443	#DIV/0!	2.2	9.9
	Maximum	0.00	0.0	0.0	2.3	39.7	0.0	0.0	5.1	0.0	31.7	0.0	0.0	0.0	1.9	445	0.0	2.3	16.0
	Minimum	0.00	0.0	0.0	1.2	37.6	0.0	0.0	5.1	0.0	28.0	0.0	0.0	0.0	1.9	440	0.0	2.0	3.9
	Number	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Well 8C	Sunburst																		
MBMG	2006Q0452		<10	<1	1.99	39.4	<1	<2	<1	<2	28.1	<10	<2	<2	1.33	429	<1	2.6	14.5
MBMG	2007Q0344		<10	<1	1.3	40.1	<1	<2	<2	<2	33.3	<10	<2	<2	<1	445	<1	2.1	6.0
	Mean	#DIV/0!	#DIV/0!	#DIV/0!	1.6	39.8	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	30.7	#DIV/0!	#DIV/0!	#DIV/0!	1.3	437	#DIV/0!	2.3	10.3
	Maximum	0.00	0.0	0.0	2.0	40.1	0.0	0.0	0.0	0.0	33.3	0.0	0.0	0.0	1.3	445	0.0	2.6	14.5
	Minimum	0.00	0.0	0.0	1.3	39.4	0.0	0.0	0.0	0.0	28.1	0.0	0.0	0.0	1.3	429	0.0	2.1	6.0
	Number	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Well 9C	**Sunburst**																		
MBMG	2006Q0453		<10	<1	1.67	72.1	<1	<2	4.84	<2	28.6	<10	<2	<2	4.08	534	<1	6.4	14.8
MBMG	2007Q0346		21.0	<1	<1	65.6	<1	<2	2.06	<2	32.4	<10	5.7	<2	1.88	522	<1	7.9	2.69
	Mean	#DIV/0!	21.0	#DIV/0!	1.7	68.9	#DIV/0!	#DIV/0!	3.5	#DIV/0!	30.5	#DIV/0!	5.7	#DIV/0!	3.0	528	#DIV/0!	7.2	8.7
	Maximum	0.00	21.0	0.0	1.7	72.1	0.0	0.0	4.8	0.0	32.4	0.0	5.7	0.0	4.1	534	0.0	7.9	14.8
	Minimum	0.00	21.0	0.0	1.7	65.6	0.0	0.0	2.1	0.0	28.6	0.0	5.7	0.0	1.9	522	0.0	6.4	2.7
	Number	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

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Belt, MT Project
Water Quality Results
(All concentrations are dissolved, unless otherwise noted)

					PHYSICAL PARAMETERS									Water Type				
					FIELD	FIELD	FIELD	FIELD	FIELD	LAB	LAB			PERCENT MEQ/L				
Analy. Lab	Lab No.	DATE (mm/dd/yy)	TIME (HRS)	SWL (ft)	pH	SC (uMHOS)	Temp (C)	ORP (MV)	DO (mg/l)	pH	SC (uMHOS)	Hardness (mg/l)	Alkalinity (mg/l)	Ca	Mg	Na	Fe	HCO3
Well 14B	**Coal**	**M:223946**																
MBMG	2006Q0454	11/17/05	16:30	226.5	7.59	570	7.7	295		7.60	695	343	267	55.3	34.9	7.8	0.0	64.2
MBMG	2007Q0066	07/12/06	13:20	225.23	6.98	545	16.0	229		6.80	620	289	242	58.0	33.5	6.4	0.1	70.3
MBMG	2010Q0401	10/07/09	14:41	228.18	7.12	522	10.3	182	1.72	7.63	528	260	226	58.4				
	Mean			226.64	7.23	546	11.3	235	2	7.34	614	298	245	57.2	34.2	7.1	0.1	67.3
	Maximum			228.18	7.59	570	16.0	295	2	7.63	695	343	267	58.4	34.9	7.8	0.1	70.3
	Minimum			225.23	6.98	522	7.7	182	2	6.80	528	260	226	55.3	33.5	6.4	0.0	64.2
	Number			3	3	3	3	3	1	3	3	3	3	3	2	2	2	2
Well 15B	**Coal**	**M:223943**																
MBMG	2006Q0451	11/17/05	10:25	175.11	7.24	393	9.58	270		7.42	488	250	228	56.5	37.2	5.0	0.0	79.5
MBMG	2007Q0343	08/23/06	12:00	175.51	6.84	475	10.7	235		7.02	640	253	234	52.9	41.6	4.6	0.0	80.8
MBMG	2010Q0390	10/08/09	9:38	178.81	7.36	453	9.35	266	0.47	7.38	498	229	214	56.8	36.7	5.3	0.0	80.5
	Mean			176.48	7.15	440	9.9	257	0	7.27	542	244	225	55.4	38.5	5.0	0.0	80.2
	Maximum			178.81	7.36	475	10.7	270	0	7.42	640	253	234	56.8	41.6	5.3	0.0	80.8
	Minimum			175.11	6.84	393	9.4	235	0	7.02	488	229	214	52.9	36.7	4.6	0.0	79.5
	Number			3	3	3	3	3	1	3	3	3	3	3	3	3	3	3
Well 15 C	**Sunburst**	**M:223944**																
MGMG	2006Q0456	11/17/05	0:00	106.54	7.90	465	7.4	366		7.75	564	294	245	48.3	33.3	3.4	0.0	76.5
MGMG	2007Q0348	08/23/06	13:00	106.61	7.60	585	19.4	272		7.46	600	321	288	45.7	50.0	3.2	0.0	81.3
MGMG	2010Q0393	10/08/09	10:15	112.95	7.95	559	11.05	275	4.52	7.83	580	312	249	45.0	47.3	3.0	1.5	76.4
	Mean			108.7	7.82	536	12.617	304.33	4.52	7.68	581.33333	309	261	46.34	43.55	3.19	0.50	78.08
	Maximum			112.95	7.95	585	19.4	366	4.52	7.83	600	321	288	48.30	50.04	3.41	1.49	81.34
	Minimum			106.54	7.60	465	7.4	272	4.52	7.46	564	294	245	45.00	33.30	2.97	0.00	76.41
	Number			3	3	3	3	3	1	3	3	3	3	3	3	3	3	3

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Analy. Lab	Lab No.	SO4	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	Fe (mg/l)	Mn (mg/l)	SiO2 (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3-N (mg/l)	NO2-N (mg/l)	F (mg/l)	Oxygen 18O	Deuterium 2H	Tritium TU
Well 14B	**Coal**																		
MBMG	2006Q0454	33.1	84.3	32.3	13.7	4.63	0.01	0.004	7.6	326	0.0	3.97	132	0.65		1.38			
MBMG	2007Q00066	27.9	73.3	25.7	9.32	3.24	0.17	0.133	6.3	295	0.0	2.14	92	<0.05	<0.05	1.13			
MBMG	2010Q0401																		
	Mean	30.5	78.8	29.0	11.5	3.9	0.09	0.069	6.9	310	0.0	3.1	112.0	0.7	#DIV/0!	1.3	#DIV/0!	#DIV/0!	#DIV/0!
	Maximum	33.1	84.3	32.3	13.7	4.6	0.17	0.133	7.6	326	0.0	4.0	132.0	0.7	0.0	1.4	0.00	0.00	0.00
	Minimum	27.9	73.3	25.7	9.3	3.2	0.01	0.004	6.3	295	0.0	2.1	92.0	0.7	0.0	1.1	0.00	0.00	0.00
	Number	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	0	0	0
Well 15B	**Coal**																		
MBMG	2006Q0451	18.3	60.3	24.1	6.17	1.93	0.02	0.038	6.1	279	0.0	2.42	50.5	<.05		0.76			
MBMG	2007Q0343	17.4	56.7	27	5.61	1.64	0.02	0.026	6.8	285	0.0	2.27	48.5	0.06	<0.05	0.66			
MBMG	2010Q0390	17.7	55.6	21.8	5.94	1.84	0.01	0.024	6.4	261	0.0	2.31	45.22	<0.05	<0.005	0.59			
	Mean	17.8	57.5	24.3	5.9	1.8	0.02	0.029	6.4	275	0.0	2.3	48.1	0.1	#DIV/0!	0.7	#DIV/0!	#DIV/0!	#DIV/0!
	Maximum	18.3	60.3	27.0	6.2	1.9	0.02	0.038	6.8	285	0.0	2.4	50.5	0.1	0.0	0.8	0.00	0.00	0.00
	Minimum	17.4	55.6	21.8	5.6	1.6	0.01	0.024	6.1	261	0.0	2.3	45.2	0.1	0.0	0.6	0.00	0.00	0.00
	Number	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	0	0	0
Well 15 C	**Sunburst**																		
MGMG	2006Q0456	9.0	59.6	35.3	4.83	2.1	0.01	0.014	7.0	299	0.0	2.17	27.7	11.50		0.85			
MGMG	2007Q0348	11.6	61.4	40.8	4.91	2.26	<0.005	0.022	8.3	352	0.0	1.94	39.4	5.56	0.13	0.93			
MGMG	2010Q0393	11.8	61	38.9	4.61	2.39	1.88	0.085	11.5	303	0.0	<5.0	36.68	9.85		1.21			
	Mean	10.79	60.667	38.333	4.7833	2.25	0.95	0.0403	8.9	318	0.0	2.055	34.593	8.97	0.13	1.00	#DIV/0!	#DIV/0!	#DIV/0!
	Maximum	11.77	61.4	40.8	4.91	2.39	1.88	0.085	11.5	352	0.0	2.17	39.4	11.50	0.13	1.21	0	0	0.0
	Minimum	9.02	59.6	35.3	4.61	2.1	0.01	0.014	7.0	299	0.0	1.94	27.7	5.56	0.13	0.85	0	0	0.0
	Number	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	0	0	0

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DISSOLVED CONCENTRATION

Analy. Lab	Lab No.	Tritium Pico curies/L	Al (ug/l)	Ag (ug/l)	As (ug/l)	B (ug/l)	Cd (ug/l)	Co (ug/l)	Cr (ug/l)	Cu (ug/l)	Li (ug/l)	Mo (ug/l)	Ni (ug/l)	Pb (ug/l)	Se (ug/l)	Sr (ug/l)	Ti (ug/l)	U (ug/l)	Zn (ug/l)
Well 14B	**Coal**																		
MBMG	2006Q0454		15.9	<1	1.37	67.0	<1	<2	3.11	<2	45.5	<10	3.3	<2	2.42	983	<1	3.6	11.7
MBMG	2007Q0066		16.0	<1	<1	45.8	<1	<2	2.30	<2	36.2	<10	<2	<2	<1	880	<1	<1	35.6
MBMG	2010Q0401																		
	Mean	#DIV/0!	16.0	#DIV/0!	1.4	56.4	#DIV/0!	#DIV/0!	2.7	#DIV/0!	40.9	#DIV/0!	3.3	#DIV/0!	2.4	932	#DIV/0!	3.6	23.7
	Maximum	0.00	16.0	0.0	1.4	67.0	0.0	0.0	3.1	0.0	45.5	0.0	3.3	0.0	2.4	983	0.0	3.6	35.6
	Minimum	0.00	15.9	0.0	1.4	45.8	0.0	0.0	2.3	0.0	36.2	0.0	3.3	0.0	2.4	880	0.0	3.6	11.7
	Number	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Well 15B	**Coal**																		
MBMG	2006Q0451		17.3	<2	1.1	53.0	<2	<2	3.45	<2	19.6	<10	2.89	<1	1.79	374	<1	1.0	38.8
MBMG	2007Q0343		<10	<1	<1	<30	<1	<2	<2	<2	18.9	<10	3.11	<2	1.24	332	<1	1.2	21.6
MBMG	2010Q0390		<7.6	<0.1	0.217	30.8	<0.1	1.92	0.212	<0.4	16.4	1.15	3.65	<0.4	0.473	327	0.569	0.7	22.3
	Mean	#DIV/0!	17.3	#DIV/0!	0.7	41.9	#DIV/0!	1.9	1.8	#DIV/0!	18.3	1.2	3.2	#DIV/0!	1.2	344	0.6	0.9	27.6
	Maximum	0.00	17.3	0.0	1.1	53.0	0.0	1.9	3.5	0.0	19.6	1.2	3.7	0.0	1.8	374	0.6	1.2	38.8
	Minimum	0.00	17.3	0.0	0.2	30.8	0.0	1.9	0.2	0.0	16.4	1.2	2.9	0.0	0.5	327	0.6	0.7	21.6
	Number	0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Well 15 C	**Sunburst**																		
MGMG	2006Q0456		<10	<1	1.17	33.9	<1	<2	4.5	<2	16.7	<10	<2	<2	10.3	401	<1	3.9	16.5
MGMG	2007Q0348		<10	<1	<1	39.2	<1	<2	8.7	<2	18.2	<10	3.2	<2	5.7	481	<1	4.9	<2
MGMG	2010Q0393		1276.0	<0.1	1.38	30.7	<0.1	1.57	9.8	7.66	16.3	0.525	5.0	3.34	4.6	374	18.2	3.9	8.18
	Mean	#DIV/0!	1276.0	#DIV/0!	1.275	34.6	#DIV/0!	1.57	7.7	7.66	17.067	0.525	4.1	3.34	6.8	419	18.2	4.2	12.34
	Maximum	0.0	1276.0	0	1.38	39.2	0	1.57	9.8	7.66	18.2	0.525	5.0	3.34	10.3	481	18.2	4.9	16.5
	Minimum	0.0	1276.0	0	1.17	30.7	0	1.57	4.5	7.66	16.3	0.525	3.2	3.34	4.6	374	18.2	3.9	8.18
	Number	0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Appendix D

Belt, MT Project
Water Quality Results
(All concentrations are dissolved, unless otherwise noted)

Surface Water and Springs
Inorganic Water Quality Data

Analy. Lab	Lab No.	DATE (mm/dd/yy)	TIME (HRS)	Flow (gpm)	PHYSICAL PARAMETERS FIELD pH	FIELD SC (uMHOS)	FIELD Temp (C)	FIELD ORP (MV)	FIELD DO (mg/l)	LAB pH	LAB SC (uMHOS)	Hardness (mg/l)	Alkalinity (mg/l)	Water Type PERCENT MEQ/L Ca	Mg	Na	Fe	HCO3	SO4
Anaconda Mine Drain		**M: 200616**																	
MBMG	2003Q0848	01/30/03	11:30	220	2.99	2,290	9.8	627	2.91	3.01	2,285	652	0	22.0	16.8	1.3	26.5	0.0	100.0
Total Rec	2003Q0849	01/30/03	11:30									677		23.0	16.7	1.4	27.3		
MBMG	2003Q0866	03/15/03	11:15	155	3.01	2,220	10.7	626	2.75	2.97	2,280	699	0	23.2	16.4	1.3	26.3	0.0	99.4
MBMG	2003Q1018	04/22/03	15:45	140	2.89	2,260	7.5	639	2.60	2.95	2,265	669	0	23.7	17.8	1.5	25.0	0.0	100.0
Total Rec	2003Q1019	04/22/03	15:45									633	0	23.6	17.1	1.4	25.7		
MBMG	2003Q1079	05/28/03	18:30	140	2.84	2,350	11.3	623	1.80	3.03	2,120	627	0	22.5	17.9	1.5	24.8	0.0	99.0
Total Rec	2003Q1080	05/28/03	18:30									621	0	22.7	17.4	1.4	25.6		
MBMG	2003Q1163	06/18/03	11:50	148	2.88	1,425	9.9	631	2.51	2.88	2,080	688	0	22.1	16.9	1.3	25.6	0.0	99.5
MBMG	2004Q0029	07/17/03	17:45	140	--	--	--	--	--	2.79	2,090	706	0	23.0	17.2	1.3	23.7	0.0	99.7
Total Rec	2004Q0030	07/17/03	17:45									684		34.6	25.4	1.9	37.0		
MBMG	2004Q0103	08/19/03	16:30	155	2.58	2,355	9.9	607	2.10	2.80	2,290	671	0	21.2	16.8	1.3	25.7	0.0	98.9
Total Rec	2004Q0104	08/19/03	16:30									1,365		33.6	26.5	2.1	36.7		
MBMG	2004Q0147	09/18/03	18:45	155	2.70	2,390	9.9	623	1.54	2.93	2,350	672	0	21.3	15.7	1.2	25.7	0.0	99.7
Total Rec	2004Q0148	09/18/03	18:45									683		32.6	25.3	2.0	39.4		
MBMG	2004Q0241	10/23/03	16:20	140	2.99	2,300	9.9	264	1.83	3.01	2,290	713	0	23.3	15.5	1.2	25.8	0.0	99.8
Total Rec	2004Q0242	10/23/03	16:20									701		34.5	24.5	1.9	38.1		
MBMG	2004Q0470	04/24/04	15:20	163	2.80	2,275	9.8	460	3.78	3.19	2,280	710	0	23.0	17.1	1.4	18.2	0.0	99.4
Total Rec	2004Q0471	04/24/04	15:20									725		34.0	26.2	2.0	36.9		
MBMG	2004Q0574	06/24/04	16:50	103						3.34	2,230	682	0	25.5	19.8	1.5	14.8	0.0	99.1
Total Rec	2004Q0575	06/24/04	16:50									678		41.1	32.3	2.6	22.7		
MBMG	2005Q0075	08/12/04	14:30	140	2.68	2,465	9.9	630	1.61	2.80	2,280	705	0	25.9	19.0	1.5	17.7	0.0	100.0
MBMG	2005Q0358	02/03/05	16:25	141						3.13	2,340	716	0	23.1	16.6	1.3	25.9	0.0	100.0
MBMG	2005Q0359	02/03/05	16:25									716		23.4	16.5	1.3	25.6		
MBMG	2005Q0419	04/08/05	12:45	138	2.73	2,300	10.4	521	2.37	3.16	2,220	689	0	23.2	17.6	1.3	26.0	0.0	100.0
Total Rec	2005Q0420	04/08/05	12:45									699							
MBMG	2007Q0010	06/30/06	8:55	155	2.57	2,490	10.0	635	2.29	2.67	2,290	724	0	22.5	16.8	1.3	23.3	0.0	99.1
Total Rec	2007Q0011	06/30/06	8:55									712		33.3	25.7	2.0	38.0		
MBMG-TR	2008Q0175	09/18/07	14:10		2.65	2,210													
MBMG	2008Q0573	06/24/08								3.01	3,490	1,003	0.0	15.7	13.4	0.7	26.9	0.0	99
MBMG-TR	2009Q0041	07/01/08	11:00	280															
MBMG	2010Q0391	10/06/09	11:16		2.18	2,748	9.9	636	1.63	2.31	2,776	734	0	23.0	16.1	1.0	23.2	0.0	99.3
MBMG	2011Q0489	09/09/10																	
		Mean		157	2.75	2,291	9.9	579	2.29	2.94	2,350	723	0.0	25.7	19.3	1.5	27.1	0.0	99.5
		Maximum		280	3.01	2,748	11.3	639	3.78	3.34	3,490	1365	0.0	41.1	32.3	2.6	39.4	0.0	100.0
		Minimum		103	2.18	1,425	7.5	264	1.54	2.31	2,080	621	0.0	15.7	13.4	0.7	14.8	0.0	98.9
		Number		16	15	15	14	14	14	17	17	29	19	28	28	28	28	17	17

Belt, MT Project
Water Quality Results
(All concentrations are dissolved, unless o

Appendix D
Surface Water and Springs
Inorganic Water Quality Data

Analy. Lab	Lab No.	DATE (mm/dd/yy)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	Fe (mg/l)	Mn (mg/l)	SiO2 (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3-N (mg/l)	NO2-N (mg/l)	F (mg/l)	Oxygen 18O	Deuterium 2H	Tritium TU	Tritium Pico curies/L
Anaconda Mine Drain		**M: 200616**																		
MBMG	2003Q0848	01/30/03	148	68.6	10.3	3.2	166	0.403	52.6	0.0	0.0	<10	1,920	<1.0	<1.0	<1.0			14.2	44.7
Total Rec	2003Q0849	01/30/03	157	69.2	10.5	3.3	173	0.400												
MBMG	2003Q0866	03/15/03	164	70.4	10.5	3.3	173	0.500	52.5	0.0	0.0	5.8	1,934	<0.5	<0.5	1.83				
MBMG	2003Q1018	04/22/03	153	69.7	10.9	2.8	150	0.363	49.9	0.0	0.0	<10	1,900	<1.0	<1.0	<1.0				
Total Rec	2003Q1019	04/22/03	147	64.6	10.0	2.9	149	0.371												
MBMG	2003Q1079	05/28/03	140	67.5	10.8	2.8	143	0.375	52.5	0.0	0.0	7.5	1,523	<0.5	<0.5	1.87	-18.04		16.0	50.4
Total Rec	2003Q1080	05/28/03	141	65.3	10.2	2.6	148	0.376												
MBMG	2003Q1163	06/18/03	156	72.5	10.7	2.9	168	0.426	53.2	0.0	0.0	4.7	1,606	<0.25	<0.25	0.55				
MBMG	2004Q0029	07/17/03	162	73.3	10.5	3.0	155	0.426	53.0	0.0	0.0	<12.5	1,610	<1.25	<1.25	2.18	-18.22		16.0	50.4
Total Rec	2004Q0030	07/17/03	158	70.4	10.2	2.9	157	0.428												
MBMG	2004Q0103	08/19/03	150	72.0	10.5	3.2	169	0.435	53.8	0.0	0.0	8.6	1,851	<0.5	<0.5	3.71				
Total Rec	2004Q0104	08/19/03	306	146.0	22.3	6.4	310	0.824												
MBMG	2004Q0147	09/18/03	155	69.3	10.2	3.2	174	0.412	57.3	0.0	0.0	<5	1,905	<0.5	<0.5	2.15				
Total Rec	2004Q0148	09/18/03	154	72.5	10.9	3.2	173	0.423												
MBMG	2004Q0241	10/23/03	168	71.2	9.9	3.1	173	0.411	58.5	0.0	0.0	<5	2,025	<0.5	<0.5	1.78	-18.46	-146.49	12.9	40.6
Total Rec	2004Q0242	10/23/03	164	70.7	10.3	3.2	168	0.416												
MBMG	2004Q0470	04/24/04	163	73.5	11.0	2.9	120	0.406	54.9	0.0	0.0	<10	1,916	<10	<1.0	4.23	-17.77	-146.49	14.7	46.3
Total Rec	2004Q0471	04/24/04	164	76.7	10.8	2.8	165	0.401												
MBMG	2004Q0574	06/24/04	154	72.3	10.5	2.9	83.1	0.406	56.3	0.0	0.0	6.7	1,510	<2.5	<0.5	1.9				
Total Rec	2004Q0575	06/24/04	152	72.5	11.2	2.8	77.8	0.387	57.0											
MBMG	2005Q0075	08/12/04	163	72.3	11.0	3.3	103	0.428	58.5	0.0	0.0	<5	1,580	<0.25	<0.25	<0.25				
MBMG	2005Q0358	02/03/05	167	72.6	10.8	3.1	174	0.440	56.9	0.0	0.0	<50	1,921	<5.0	<5.0	<5.0				
MBMG	2005Q0359	02/03/05	168	72.0	10.9	3.1	171	0.433												
MBMG	2005Q0419	04/08/05	157	72.2	10.1	2.9	164	0.395	54.0	0.0	0.0	<10	1,897	<1	<1	<1				
Total Rec	2005Q0420	04/08/05	160	72.7	10.7	3.1	165	0.421												
MBMG	2007Q0010	06/30/06	166	75.3	11.3	2.5	160	0.470	62.1	0.0	0.0	10.9	2,278	<0.5	<0.5	2.46				
Total Rec	2007Q0011	06/30/06	161	75.4	11.1	2.3	171	0.474												
MBMG-TR	2008Q0175	09/18/07	168	75.3	12.8	2.5	178	0.515												
MBMG	2008Q0573	06/24/08	217	112	11.3	6.9	345	1.040	77.10	0.0	0.0	9.6	3,650	0.6	<0.5	3.3				
MBMG-TR	2009Q0041	07/01/08	154	100	10.4	3.7	218	<0.001												
MBMG	2010Q0391	10/06/09	173	73.3	8.9	1.9	162	0.616	65.0	0.0	0.0	<10	2,166	<1.0	<1.0	5.66				
MBMG	2011Q0489	09/09/10																		
		Mean	165	76.2	11	3.18	168	0.461	57.0	0.0	0.0	7.67	1,952	1	#DIV/0!	2.64	-18.12	-146.49	14.8	46.5
		Maximum	306	146.0	22	6.90	345	1.040	77.1	0.0	0.0	10.90	3,650	1	0	5.66	-17.77	-146.49	16.0	50.4
		Minimum	140	64.6	9	1.87	78	0.363	49.9	0.0	0.0	4.65	1,510	1	0	0.55	-18.46	-146.49	12.9	40.6
		Number	31	31	31	31	31	31	18	17	17	17	17	17	17	17	4	2	5	5

Belt, MT Project
Water Quality Results
(All concentrations are dissolved, unless o

Appendix D
Surface Water and Springs
Inorganic Water Quality Data

DISSOLVED CONCENTRATION

Analy. Lab	Lab No.	DATE (mm/dd/yy)	Al (ug/l)	Ag (ug/l)	As (ug/l)	B (ug/l)	Cd (ug/l)	Co (ug/l)	Cr (ug/l)	Cu (ug/l)	Li (ug/l)	Mo (ug/l)	Ni (ug/l)	Pb (ug/l)	Se (ug/l)	Sr (ug/l)	Ti (ug/l)	U (ug/l)	Zn (ug/l)
Anaconda Mine Drain		**M: 200616**																	
MBMG	2003Q0848	01/30/03	99,000	<5	<5	<150	6.59	265	28.3	<50	208	<10	618	<10	<5	1,630	1.84	2.79	3,280
Total Rec	2003Q0849	01/30/03	94,100	<10	<10		4.90	320	27.8	<20	213	<100	744	<20	<10	1,810	2.60	<5	3,500
MBMG	2003Q0866	03/15/03	102,000	<10	<10	111	<10	292	31.5	15.7	219	<10	777	<20	<10	1,780	<5	--	2,800
MBMG	2003Q1018	04/22/03	90,700	<5	<5	118	3.96	222	23.3	<10	192	<50	398	<10	<5	1,510	<1	<2.5	2,790
Total Rec	2003Q1019	04/22/03	88,500	<5	<5		4.08	222	24.0	<10	187	<50	667	<10	<5	1,560	1.13	2.53	2,970
MBMG	2003Q1079	05/28/03	90,850	<5	<5	95	3.52	245	27.0	11.4	190	<50	416	<10	<5	1,598	<1	2.94	2,817
Total Rec	2003Q1080	05/28/03	89,233	<5	<5		3.78	259	28.2	17.2	178	<10	443	<10	<5	1,528	<1	2.99	2,671
MBMG	2003Q1163	06/18/03	106,252	<5	<2	102	26.00	250	27.7	10.9	206	<10	450	<10	<5	1,930	<1	3.01	3,121
MBMG	2004Q0029	07/17/03	107,767	<5	<5	97	4.13	255	27.7	<10	210	<10	438	<10	<5	1,700	<1	2.73	3,171
Total Rec	2004Q0030	07/17/03		<5	7.59		27.30	254	27.7	<10	207	<50	772	<10	8.12	1,709	1.86	2.77	3,096
MBMG	2004Q0103	08/19/03	108,575	<5	<5	105	4.68	264	30.0	<10	212	<10	485	<10	<5	1,876	<1	2.74	3,249
Total Rec	2004Q0104	08/19/03		<5	<5		28.30	262	28.7	<10	459	<50	462	<10	<5	3,417	<10	2.73	3,090
MBMG	2004Q0147	09/18/03	116,063	<5	<5	109	5.33	260	38.4	<10	217	<10	454	<10	<5	1,806	<1	2.90	3,283
Total Rec	2004Q0148	09/18/03		<5	<5		32.00	291	28.2	<10	230	<50	436	<10	<5	1,882	<5	2.80	3,618
MBMG	2004Q0241	10/23/03	105,949	<5	<5	<150	4.39	265	29.5	<10	217	<10	430	<10	<5	1,873	<1	2.64	3,229
Total Rec	2004Q0242	10/23/03		<5	<5		4.37	262	29.1	<10	220	<10	459	<10	<5	1,904	<1	2.74	3,276
MBMG	2004Q0470	04/24/04	126,252	<10	<5	83	5.57	254	24.1	<10	198	<10	456	<10	<5	1,864	<1	2.67	3,100
Total Rec	2004Q0471	04/24/04		<10	<10		5.66	282	27.9	<20	200	<10	546	<20	<10	1,866	<1	2.71	3,083
MBMG	2004Q0574	06/24/04	101,577	<5	<5	102	3.97	247	22.3	10.9	210	<10	452	<10	<5	1,773	<1	3.13	3,261
Total Rec	2004Q0575	06/24/04		<5	<5		3.41	243	22.0	10.8	207	<10	452	<10	<5	1,792	<1	2.95	3,298
MBMG	2005Q0075	08/12/04	98,934	<5	<5	116	5.05	253	27.8	<10	218	<10	487	<10	<5	1,743	1.50	3.46	3,339
MBMG	2005Q0358	02/03/05	105,027	<5	<5	<150	6.25	239	26.3	<10	212	<10	445	<10	<5	1,832	2.08	<3.0	3,333
MBMG	2005Q0359	02/03/05	104,445	<5	<5		6.21	256	26.3	<10	212	<10	478	<10	<5	1,842	2.19	2.57	3,266
MBMG	2005Q0419	04/08/05	95,278	<5	<5	109	5.80	240	18.2	<10	207	<10	473	<10	<5	1,633	<1	<3	2,715
Total Rec	2005Q0420	04/08/05		<5	<5		6.06	253	17.7	<10	215	<10	487	<10	<5	1,734	1.26	<3	2,879
MBMG	2007Q0010	06/30/06	117,193	<5	<5	107	9.94	445	50.9	75.4	220	<10	1,001	<10	<5	1,689	1.19	4.94	4,197
Total Rec	2007Q0011	06/30/06		<5	<5		9.16	445	50.3	57.9	219	<10	998	<10	<5	1,672	1.28	4.95	4,091
MBMG-TR	2008Q0175	09/18/07	118,000	<1	1.68		9.58	404	12.0	17.8	229	<1	946	1.4	1.1	1,861	2.71	3.85	4,026
MBMG	2008Q0573	06/24/08	265,750	1.72	16.7	42	8.48	208	26.6	119.0	122	<0.5	352	<0.5	<0.5	1,525	<0.5	15.00	2,556
MBMG-TR	2009Q0041	07/01/08	127,745	5.41	<10		10.20	113	12.3	18.5	24	<0.1	174	15.4	<0.1	1,143	<0.5	7.56	4,365
MBMG	2010Q0391	10/06/09	121,337	<0.5	1.00	91	13.10	292	30.4	55.6	93	<0.5	696	2.15	0.69	1,685	0.86	5.53	4,109
MBMG	2011Q0489	09/09/10																	
		Mean	112,197	3.6	6.7	99	9.1	270	27.5	35.1	205	#DIV/0!	545	6.30	3.32	1,780	1.71	3.83	3,277
		Maximum	265,750	5.4	16.7	118	32.0	445	50.9	119.0	459	0.00	1,001	15.40	8.12	3,417	2.71	15.00	4,365
		Minimum	88,500	1.7	1.0	42	3.4	113	12.0	10.8	24	0.00	174	1.36	0.69	1,143	0.86	2.53	2,556
		Number	23	31	31	17	31	31	31	31	31	31	31	31	31	31	31	31	31

Belt, MT Project
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Appendix D
Surface Water and Springs
Inorganic Water Quality Data

Analy. Lab	Lab No.	DATE (mm/dd/yy)	TIME (HRS)	Flow (gpm)	PHYSICAL PARAMETERS FIELD pH	FIELD SC (uMHOS)	FIELD Temp (C)	FIELD ORP (MV)	FIELD DO (mg/l)	LAB pH	LAB SC (uMHOS)	Hardness (mg/l)	Alkalinity (mg/l)	Water Type PERCENT MEQ/L Ca	Mg	Na	Fe	HCO3	SO4
French Coulee Drain	**M: 200615**																		
MBMG	2003Q0846	01/29/03	14:00	8.0	2.70	5,620	7.0	628	4.73	2.75	5,625	1,158	0.0	9.9	7.0	0.4	41.3	0.0	100.0
Total Rec	2003Q0847	01/29/03	14:00									1,112		9.6	6.9	0.4	43.1		
MBMG	2003Q0865	03/15/03	10:45	7.7	2.68	5,030	7.2	650	3.75	2.71	5,150	1,211	0.0	10.9	7.7	0.4	40.7	0.0	100.0
MBMG	2003Q1020	04/22/03	14:55	9.0	2.68	4,660	9.7	659	3.12	2.70	4,800	1,071	0.0	11.1	8.3	0.5	39.3	0.0	100.0
Total Rec	2003Q1021	04/22/03	14:55									1,062		11.3	8.4	0.6	38.5		
MBMG	2003Q1081	05/28/03	18:00	11.0	2.62	4,410	12.2	655	3.54	2.78	3,960	943	0.0	11.6	9.5	0.9	39.9	0.0	99.2
Total Rec	2003Q1082	05/28/03	18:00									925		11.6	9.4	0.9	39.5		
MBMG	2003Q1164	06/18/03	11:20	8.6	2.63	2,820	12.2	653	4.42	2.66	4,030	1,071	0.0	11.5	9.0	0.7	39.2	0.0	100.0
MBMG	2004Q0031	07/17/03	17:10	10.0	--	--	--	--	--	2.40	4,400	1,205	0.0	11.8	8.9	0.5	38.0	0.0	99.8
Total Rec	2004Q0032	07/17/03	17:10									1,211		19.8	15.0	0.9	63.8		
MBMG	2004Q0095	08/19/03	16:00	8.5	2.36	5,180	14.3	639	3.15	2.54	4,810	1,194	0.0	11.3	8.2	0.5	37.1	0.0	99.1
Total Rec.	2004Q0096	08/19/03										1,128		20.5	15.9	0.9	55.9		
MBMG	2004Q0149	09/18/03	19:05	8.1	2.41	5,690	11.3	636	5.97	2.76	5,080	1,215	0.0	10.9	8.1	0.4	39.1	0.0	99.8
Total Rec	2004Q0150	09/18/03	19:05									1,224		19.0	14.3	0.8	65.4		
MBMG	2004Q00235	10/23/03	15:50	8.5	2.73	5,800	10.3	288	3.72	2.71	5,600	1,254	0.0	9.4	6.7	0.3	40.9	0.0	99.8
Total Rec	2004Q0236	10/23/03	15:50									1,266		16.7	11.9	0.5	70.5		
MBMG	2004Q0472	04/24/04	15:45	11.0	2.57	4,080	10.2	573	6.63	2.95	4,070	939	0.0	11.0	9.9	0.9	40.3	0.0	100.0
Total Rec	2004Q0473	04/24/04	15:45									932		35.5	31.8	3.5	28.4		
MBMG	2004Q0572	06/24/04	16:00	15.3						3.14	5,510	1,817	0.0	14.0	9.4	0.4	32.9	0.0	100.0
Total Rec	2004Q0573	06/24/04	16:00									1,820		24.7	16.5	0.6	57.7		
MBMG	2005Q0077	08/12/04	15:15	10.4	3.99	6,230	12.2	626	8.80	4.10	5,180	1,185	0.0	9.4	7.6	0.5	41.7	0.0	99.5
Total Rec	2005Q0078	08/12/04	15:15									1,191		15.3	13.2	0.8	70.2		
MBMG	2005Q0356	02/03/05	16:45	5.5						2.90	5,760	1,297	0.0	9.5	7.4	0.1	41.1	0.0	99.6
Total Rec.	2005Q0357	02/03/05	16:45									1,473		10.2	7.9	0.4	38.5		
MBMG	2005Q0417	04/08/05	15:15	6.5	2.32	6,315	9.0	489	1.66	2.84	5,400	1,230	0.0	8.8	7.2	0.4	42.9	0.0	100.0
Total Rec	2005Q0418	04/08/05	15:15									1,475							
MBMG	2010Q0392	10/06/09	17:55	15.4	2.24	4,745	10.9	622	2.36	2.75	4,810	850	0.0	9.9	8.2	11.0	40.5	0.0	98.6
	Mean			9.6	2.66	5,048	10.5	593	4.32	2.85	4,946	1,202	0.0	13.7	10.6	1.1	44.9	0.0	99.7
	Maximum			15.4	3.99	6,315	14.3	659	8.80	4.10	5,760	1,820	0.0	35.5	31.8	11.0	70.5	0.0	100.0
	Minimum			5.5	2.24	2,820	7.0	288	1.66	2.40	3,960	850	0.0	8.8	6.7	0.1	28.4	0.0	98.6
	Number			15	13	13	13	13	13	15	15	27	15	26	26	26	26	15	15

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Appendix D
Surface Water and Springs
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Analy. Lab	Lab No.	DATE (mm/dd/yy)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	Fe (mg/l)	Mn (mg/l)	SiO2 (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3-N (mg/l)	NO2-N (mg/l)	F (mg/l)	Oxygen 18O	Deuterium 2H	Tritium TU	Tritium Pico curies/L
French Coulee Drain		**M: 200615**																		
MBMG	2003Q0846	01/29/03	271	117	11.7	5.4	1,050	0.960	101.0	0.0	0.0	<50	7,990	<5.0	<5.0	<5.0			15.3	48.2
Total Rec	2003Q0847	01/29/03	259	113	12.0	5.3	1,080	0.900												
MBMG	2003Q0865	03/15/03	284	122	12.2	5.4	989	0.988	97.6	0.0	0.0	<50	6,975	<5.0	<5.0	<5.0				
MBMG	2003Q1020	04/22/03	246	111	13.5	4.2	808	0.703	90.0	0.0	0.0	<125	6,198	<12.5	<12.5	<12.5				
Total Rec	2003Q1021	04/22/03	244	110	14.0	4.2	771	0.694												
MBMG	2003Q1081	05/28/03	208	103	17.6	3.4	665	0.531	85.2	0.0	0.0	16.3	4,400	<1	<1	5.84	-17.98		19.5	61.4
Total Rec	2003Q1082	05/28/03	204	101	18.0	3.3	647	0.535												
MBMG	2003Q1164	06/18/03	241	114	16.6	3.3	761	0.650	89.8	0.0	0.0	<50	5,226	<5	<0.25	<5				
MBMG	2004Q0031	07/17/03	275	126	14.4	2.8	821	0.833	103.0	0.0	0.0	<25	5,750	<2.5	<2.5	3.46	-18.04		17.2	54.2
Total Rec	2004Q0032	07/17/03	276	127	14.9	3.2	828	0.830												
MBMG	2004Q0095	08/19/03	277	122	13.8	4.2	843	0.888	106.0	0.0	0.0	29.6	6,891	<2.5		9.91				
Total Rec.	2004Q0096	08/19/03	254	120	13.5	3.3	717	0.838												
MBMG	2004Q0149	09/18/03	279	126	13.2	<5	929	0.902	105.4	0.0	0.0	<25	7,133	<2.5	<2.5	6.79				
Total Rec	2004Q0150	09/18/03	279	128	13.7	3.6	894	0.921												
MBMG	2004Q00235	10/23/03	293	127	10.8	3.7	1,185	1.030	109.0	0.0	0.0	<25	8,152	<2.5	<2.5	7.94	-18.28	-143.92	16.0	50.4
Total Rec	2004Q0236	10/23/03	296	128	10.9	3.5	1,164	1.060												
MBMG	2004Q0472	04/24/04	198	108	19.3	3.3	673	0.528	83.2	0.0	0.0	<63	4,799	<6.3	<6.3	<6.3	-17.76	-143.61	17.4	54.8
Total Rec	2004Q0473	04/24/04	197	107	22.0	3.7		0.549												
MBMG	2004Q0572	06/24/04	436	177	12.9	<0.5	950	1.520	160.0	0.0	0.0	<25	7,350	<2.5	<2.5	<2.5				
Total Rec	2004Q0573	06/24/04	437	177	12.9	<0.5	948	1.470												
MBMG	2005Q0077	08/12/04	262	129	14.7	3.8	1,078	0.959	108.0	0.0	0.0	17.3	6,244	<1.25	<1.25	2.57				
Total Rec	2005Q0078	08/12/04	256	134	14.9	3.9	1,088	0.920												
MBMG	2005Q0356	02/03/05	292	138	12.5	4.5	1,169	1.080	117.0	0.0	0.0	<12.5	7,878	<12.5	<12.5	13.30				
Total Rec.	2005Q0357	02/03/05	331	157	14.8	4.5	1,166	1.250												
MBMG	2005Q0417	04/08/05	270	135	12.6	5.6	1,227	1.020	105.0	0.0	0.0	<25	7,760	<2.5	<2.5	<2.5				
Total Rec	2005Q0418	04/08/05	340	152	12.9	3.7	1,131	1.170												
MBMG	2010Q0392	10/06/09	186	94	10.3	3.8	706	0.759	86.1	0.0	0.0	26.8	4,887	<2.5	<2.5	13.15				
		Mean	274	126	14.1	4.0	934	0.91	103.1	0.00	0.00	22.50	6,509	#DIV/0!	#DIV/0!	7.87	-18.02	-143.77	17.1	53.8
		Maximum	437	177	22.0	5.6	1,227	1.52	160.0	0.00	0.00	29.60	8,152	0.00	0.00	13.30	-17.76	-143.61	19.5	61.4
		Minimum	186	94	10.3	2.8	647	0.53	83.2	0.00	0.00	16.30	4,400	0.00	0.00	2.57	-18.28	-143.92	15.3	48.2
		Number	27	27	27	27	26	27	15	15	15	15	15	15	14	15	4	2	5	5

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DISSOLVED CONCENTRATION

Analy. Lab	Lab No.	DATE (mm/dd/yy)	Al (ug/l)	Ag (ug/l)	As (ug/l)	B (ug/l)	Cd (ug/l)	Co (ug/l)	Cr (ug/l)	Cu (ug/l)	Li (ug/l)	Mo (ug/l)	Ni (ug/l)	Pb (ug/l)	Se (ug/l)	Sr (ug/l)	Ti (ug/l)	U (ug/l)	Zn (ug/l)
French Coulee Drain		**M: 200615**																	
MBMG	2003Q0846	01/29/03	505,000	<10	65.6	<300	16.80	368	131.0	<200	684	<100	974	<20	<10	2,720	<10	16.00	5,120
Total Rec	2003Q0847	01/29/03	481,000	<10	61.6		6.90	470	123.0	46.8	697	<100	927	<20	<10	2,860	2.90	15.80	5,210
MBMG	2003Q0865	03/15/03	470,000	<10	51.8	178	10.70	363	130.0	97.5	659	<50	1,080	<20	<10	2,880	<25	--	4,090
MBMG	2003Q1020	04/22/03	402,000	<10	29.5	<300	<10	287	95.4	93.9	547	<100	819	<20	<10	2,520	<10	12.20	3,820
Total Rec	2003Q1021	04/22/03	397,000	<10	29.6		<10	267	92.2	86.0	540	<100	830	<20	<10	2,500	<10	12.10	3,860
MBMG	2003Q1081	05/28/03	305,844	<10	24.1	<300	<10	240	80.3	42.9	415	<100	356	<20	<10	2,119	<10	14.00	2,845
Total Rec	2003Q1082	05/28/03	304,070	<10	25.0		25.80	257	85.3	45.9	419	<100	406	<20	<10	2,030	<10	14.80	2,679
MBMG	2003Q1164	06/18/03	368,398	<5	27.5	<150	33.70	227	80.7	31.3	488	<50	778	<10	<5	2,592	<5	15.50	3,446
MBMG	2004Q0031	07/17/03	422,685	<10	28.3	<300	<10	240	92.0	31.0	589	<100	344	<20	<10	2,974	<10	16.30	4,245
Total Rec	2004Q0032	07/17/03		<5	29.5		<10	249	93.3	30.0	598	<50	345	<10	<5	2,954	<10	16.80	4,404
MBMG	2004Q0095	08/19/03	467,327	<10	31.7	<300	54.50	330	123.0	41.6	640	<100	1,074	<20	<10	3,035	<10	15.90	4,819
Total Rec.	2004Q0096	08/19/03		78.30	31.7		50.40	320	121.0	41.4	654	<100	546	<20	<10	2,756	<10	15.80	4,246
MBMG	2004Q0149	09/18/03	473,245	<10	27.7	<300	55.00	339	125.0	41.2	667	<100	539	<20	<10	3,154	<100	16.40	5,082
Total Rec	2004Q0150	09/18/03		<10	26.8		58.60	402	122.0	38.5	696	<100	551	<20	<10	3,116	<10	16.00	5,182
MBMG	2004Q00235	10/23/03	595,625	<10	45.1	<300	<10	406	152.0	26.7	714	<100	556	<20	<10	3,410	<10	19.50	5,787
Total Rec	2004Q0236	10/23/03		<10	44.0		<10	399	152.0	39.6	758	<100	577	<20	<10	3,312	<100	18.10	5,723
MBMG	2004Q0472	04/24/04	304,001	<10	<10	<300	<10	239	47.7	38.8	436	<100	399	<20	<10	1,962	<10	16.00	1,835
Total Rec	2004Q0473	04/24/04		<10	<10		13.60	235	51.1	50.4	430	<100	385	<20	<10	1,945	<10	13.40	1,846
MBMG	2004Q0572	06/24/04	600,602	<10	<10	<300	<100	401	182.0	85.3	967	<100	781	<20	<10	5,420	<10	26.60	8,401
Total Rec	2004Q0573	06/24/04		<10	<10		<100	397	178.0	81.9	914	<100	756	<20	<10	5,529	<10	25.90	8,224
MBMG	2005Q0077	08/12/04	506,913	<10	35.9	<300	<10	337	128.0	38.8	692	<100	589	<20	<10	2,926	<10	21.10	5,275
Total Rec	2005Q0078	08/12/04		<10	37.0		<10	332	125.0	38.6	691	<100	611	<20	11.30	2,926	<50	21.70	5,273
MBMG	2005Q0356	02/03/05	566,482	<10	46.1	<300	11.80	339	132.0	35.4	796	<100	588	<20	<10	3,600	<10	15.60	5,982
Total Rec.	2005Q0357	02/03/05	625,201	<10	47.2		13.40	363	138.0	40.6	953	<100	622	<20	<10	4,251	<10	17.10	6,903
MBMG	2005Q0417	04/08/05	560,947	<10	48.5	<300	10.00	362	118.0	24.6	751	<100	600	<20	<20	3,058	<10	<50	4,568
Total Rec	2005Q0418	04/08/05		<10	34.2		14.90	377	129.0	40.9	817	<100	649	<20	<10	3,953	<10	17.70	5,419
MBMG	2010Q0392	10/06/09	342,394	<1.0	22.1	92	6.85	226	106.0	30.7	233	<1.0	533	5.39	<1.0	1,897	29.20	8.78	3,329
		Mean	457,828	78.3	37.0	135	25.5	325	116.0	47.7	646	#DIV/0!	638	5.39	11.30	3,052	16.05	16.76	4,726
		Maximum	625,201	78.3	65.6	178	58.6	470	182.0	97.5	967	0.00	1,080	5.39	11.30	5,529	29.20	26.60	8,401
		Minimum	304,001	78.3	22.1	92	6.9	226	47.7	24.6	233	0.00	344	5.39	11.30	1,897	2.90	8.78	1,835
		Number	19	27	27	15	27	27	27	27	27	27	27	27	27	27	27	27	27

Belt, MT Project
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Appendix D
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					PHYSICAL PARAMETERS									Water Type					
					FIELD	FIELD	FIELD	FIELD	FIELD	LAB	LAB			PERCENT MEQ/L					
Analy. Lab	Lab No.	DATE (mm/dd/yy)	TIME (HRS)	Flow (gpm)	pH	SC (uMHOS)	Temp (C)	ORP (MV)	DO (mg/l)	pH	SC (uMHOS)	Hardness (mg/l)	Alkalinity (mg/l)	Ca	Mg	Na	Fe	HCO3	SO4
Highway Drain		**M:200617**																	
MBMG	2003Q0850	01/30/03	14:10		7.79	610	3.5	82	11.09	7.93	659	327	283	46.3	46.4	6.0	0.3	74.8	20.0
Total Rec	2003Q0851	01/30/03	14:10									326		46.7	44.6	5.9	1.4		
MBMG	2003Q0863	03/15/03	13:15		8.17	440	4.1	144	10.9	7.88	494	254	212	48.7	43.3	5.7	0.6	82.1	15.9
MBMG	2003Q1024	04/22/03	14:00		7.78	605	8.6	114	10.8	7.82	607	307	265	46.6	46.2	6.0	0.1	75.4	19.3
Total Rec	2003Q1025	04/22/03	14:00									324		46.0	46.0	5.9	0.9		
MBMG	2003Q1083	05/28/03	17:25		8.13	740	13.6	50	9.05	7.71	784	376	292	45.7	47.2	5.9	0.0	70.0	26.2
Total Rec	2003Q1084	05/28/03	17:25									397		45.7	46.7	5.4	1.0		
MBMG	2003Q1165	06/17/03	17:45		8.07	460	15.1	42	11.05	7.78	700	416	311	44.2	49.2	5.4	0.0	70.8	25.7
MBMG	2004Q0027	07/17/03	14:50	1.8	--	--	--	--	--	7.80	1,410	803	338	44.7	50.0	4.2	0.2	40.2	56.7
Total Rec	2004Q0028	07/17/03	14:50									791		42.9	49.6	4.0	2.7		
MBMG	2004Q0099	08/19/03	17:45	0.6	7.66	790	10.6	304	9.6	7.69	1,510	1,004	288	42.5	51.9	4.1	0.5	26.9	68.8
Total Rec	2004Q0100	08/19/03										927		42.7	50.5	4.4	1.4		
MBMG	2004Q0151	09/19/03	10:05	5.8	7.74	860	9.3	116	9.57	8.13	1,020	498	323	43.4	50.2	5.6	0.0	59.3	37.9
Total Rec	2004Q0152	09/19/03	10:05									453		43.9	43.2	6.0	1.1		
MBMG	2004Q0474	04/24/04	18:00	17	8.16	620	8.3	322	12.1	8.30	620	390	286	42.8	49.9	6.2	0.0	71.9	23.9
Total Rec	2004Q0475	04/24/04	18:00									229		6.3	82.3	10.2	0.1		
MBMG	2004Q0570	06/24/04	15:00	32						8.20	620	380	260	47.3	47.3	4.3	0.0	66.8	18.2
Total Rec	2004Q0571	06/24/04	15:00									365		47.5	47.2	4.4	0.1		
MBMG	2005Q0079	08/12/04	16:00	19	9.72	765	12.0	214	10.4	7.78	920	417	214	47.8	46.6	4.6	0.0	65.3	20.3
Total Rec	2005Q0080	08/12/04	16:00									427		47.3	47.2	4.5	0.2		
MBMG	2005Q0354	02/04/05	9:55	12						8.06	655	372	277	46.8	44.8	5.0	1.7	72.9	22.2
MBMG	2005Q0415	04/08/05	15:40	26	6.85	595	7.6	330	5.61	8.27	640	334	280	46.1	47.4	5.4	0.1	77.8	17.1
Total Rec	2005Q0416	04/08/05	15:40									350							
MBMG	2010Q0396	10/06/09	18:40		7.61	608	7.4	170	10.14	8.02	617	351	272	43.1	50.2	5.7	0.0	76.5	14.3
		Mean		14.3	7.97	645	9.1	172	10.03	7.96	804	451	279	43.7	49.0	5.4	0.5	66.5	27.6
		Maximum		32.0	9.72	860	15.1	330	12.10	8.30	1,510	1004	338	48.7	82.3	10.2	2.7	82.1	68.8
		Minimum		0.6	6.85	440	3.5	42	5.61	7.69	494	229	212	6.3	43.2	4.0	0.0	26.9	14.3
		Number		8	12	12	12	12	12	14	14	24	14	23	23	23	23	14	14
HWD-Seep		**M:204710**																	
MBMG	2004Q0025	07/17/03	14:15	0.3	--	--	--	--	--	7.05	3,340	2,609	274	40.8	55.1	3.3	0.1	10.6	84.9
Total Rec	2004Q0026	07/17/03	14:15									2,628		41.0	55.2	3.5	0.0		
MBMG	2004Q0090	08/19/03	18:10	0.2	--	--	--	--	--	7.62	3,350	2,518	405	40.6	55.0	3.6	0.1	15.0	81.1
Total Rec	2004Q0213	08/19/03										2,567		39.2	56.2	3.9	0.1		
MBMG	2004Q0153	09/19/03	10:30	0.2	7.40	3,510	10.4	210	9.11	7.68	3,520	2,563	334	41.3	54.5	3.5	0.0	12.5	82.3
Total Rec	2004Q0154	09/18/03	10:30									2,557		40.9	54.6	3.7	0.1		
		Mean		0.2	7.40	3,510	10.4	210	9.11	7.45	3,403	2,574	338	40.7	55.1	3.6	0.0	12.7	82.8
		Maximum		0.3	7.40	3,510	10.4	210	9.11	7.68	3,520	2,628	405	41.3	56.2	3.9	0.1	15.0	84.9
		Minimum		0.2	7.40	3,510	10.4	210	9.11	7.05	3,340	2,518	274	39.2	54.5	3.3	0.0	10.6	81.1
		Number		3	3	3	3	3	3	3	3	6	3	6	6	6	6	3	3
PVC-Spring		**M:213598**																	
MBMG	2005Q0081	08/12/04	18:40	14.7	9.71	650	12.8	381	9.36	8.36	670	324	236	34.7	59.0	5.3	0.6	64.6	5.8
Total Rec	2005Q0082	08/12/04	18:40									332		34.8	58.9	5.1	0.3		
MBMG	2005Q0352	02/04/05	13:10	4.5						8.36	640	315	264	32.7	60.3	6.0	0.0	83.8	9.0
Total Rec	2005Q0353	02/04/05	13:10									318		32.6	60.1	6.0	0.1		
MBMG	2010Q0394	10/06/09	15:55	5.41	7.85	648	8.4	327	10.8	8.12	633	364	264	33.2	60.2	5.7	0.0	71.1	0.0
		Mean		8.2	8.78	649	10.60	354	10.08	8.28	648	331	255	33.61	59.73	5.62	0.20	73.16	4.94
		Maximum		14.7	9.71	650	12.80	381	10.80	8.36	670	364	264	35	60.33	6.00	0.58	83.76	9.05
		Minimum		4.5	7.85	648	8.40	327	9.36	8.12	633	315	236	33	58.93	5.13	0.00	64.63	0.00
		Number		3	2	2	2	2	2	3	3	5	3	5	5	5	5	3	3

Belt, MT Project
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(All concentrations are dissolved, unless o

Appendix D
Surface Water and Springs
Inorganic Water Quality Data

Analy. Lab	Lab No.	DATE (mm/dd/yy)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	Fe (mg/l)	Mn (mg/l)	SiO2 (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3-N (mg/l)	NO2-N (mg/l)	F (mg/l)	Oxygen 18O	Deuterium 2H	Tritium TU	Tritium Pico curies/L
Highway Drain		**M:200617**																		
MBMG	2003Q0850	01/30/03	65.3	39.8	9.7	1.7	0.38	0.068	9.0	345	0.0	2.5	73	4.09	<0.05	0.52			26.0	81.9
Total Rec	2003Q0851	01/30/03	66.7	38.7	9.6	1.7	1.90	0.100												
MBMG	2003Q0863	03/15/03	53.8	29.0	7.2	2.7	0.65	0.040	8.6	259	0.0	2.6	40	3.78	<0.05	0.56				
MBMG	2003Q1024	04/22/03	61.7	37.1	9.1	1.8	0.16	0.066	8.2	323	0.0	2.5	65	3.70	<0.05	0.67				
Total Rec	2003Q1025	04/22/03	64.8	39.3	9.5	1.8	1.15	0.064												
MBMG	2003Q1083	05/28/03	74.1	46.4	11.0	2.4	0.05	0.083	9.6	356	0.0	4.0	105	2.41	<0.05	0.63	-16.52		23.6	74.3
Total Rec	2003Q1084	05/28/03	78.6	48.7	10.6	2.3	1.59	0.083												
MBMG	2003Q1165	06/17/03	78.8	53.2	11.0	3.0	0.04	0.093	10.6	379	0.0	4.8	108	1.88	<0.05	0.61				
MBMG	2004Q0027	07/17/03	152.0	103.0	16.5	4.6	0.70	0.147	13.3	412	0.0	14.8	457	1.22	<0.25	0.52				
Total Rec	2004Q0028	07/17/03	147.0	103.0	15.8	4.4	8.45	0.212												
MBMG	2004Q0099	08/19/03	181.0	134.0	20.1	5.8	2.12	0.196	12.4	351	0.0	26.1	706	1.04		1.87				
Total Rec	2004Q0100	08/19/03	170.0	122.0	20.2	5.8	5.26	0.203												
MBMG	2004Q0151	09/19/03	92.5	64.8	13.6	2.3	0.04	0.108	12.4	393	0.0	7.1	198	1.16	<0.1	0.45				
Total Rec	2004Q0152	09/19/03	86.3	57.6	13.6	2.2	1.97	0.118												
MBMG	2004Q0474	04/24/04	72.0	51.0	12.0	2.3	0.03	0.067	9.8	349	0.0	3.3	91	2.94	<0.10	0.58	-16.62	-136.83	20.9	65.8
Total Rec	2004Q0475	04/24/04	6.6	51.7	12.1	2.2	0.06	0.003												
MBMG	2004Q0570	06/24/04	76.1	46.2	7.9	2.6	0.02	0.034	10.7	317	0.0	4.6	68	14.10	<0.05	0.53				
Total Rec	2004Q0571	06/24/04	73.3	44.2	7.8	2.1	0.09	0.009												
MBMG	2005Q0079	08/12/04	84.6	50.0	9.4	2.4	0.01	0.041	12.8	351	0.0	4.4	86	15.60	<0.05	0.49				
Total Rec	2005Q0080	08/12/04	85.7	51.8	9.3	2.3	0.38	0.045												
MBMG	2005Q0354	02/04/05	76.1	44.2	9.3	2.2	2.59	0.066	12.1	338	0.0	3.1	81	3.64	<0.05	0.42				
MBMG	2005Q0415	04/08/05	65.9	41.1	8.9	1.8	0.18	0.027	9.0	342	0.0	2.7	59	3.74	<0.05	0.46				
Total Rec	2005Q0416	04/08/05	68.4	43.5	9.5	1.9	0.84	0.029												
MBMG	2010Q0396	10/06/09	65.1	45.9	9.9	2.0	0.03	0.027	9.9	332	0.0	<5.0	49	8.55		0.86				
		Mean	85.3	57.8	11.4	2.7	1.20	0.08	10.6	346	0.0	6.3	156	4.85	#DIV/0!	0.65	-16.57	-136.83	23.5	74.0
		Maximum	181.0	134.0	20.2	5.8	8.45	0.21	13.3	412	0.0	26.1	706	15.60	0.00	1.87	-16.52	-136.83	26.0	81.9
		Minimum	6.6	29.0	7.2	1.7	0.01	0.00	8.2	259	0.0	2.5	40	1.04	0.00	0.42	-16.62	-136.83	20.9	65.8
		Number	24	24	24	24	24	24	14	14	14	14	14	14	12	14	2	1	3	3
HWD-Seep		**M:204710**																		
MBMG	2004Q0025	07/17/03	445.0	364.0	41.7	11.0	0.89	0.035	10.9	334	0.0	79.2	2,116	1.91	<0.25	<0.25	-17.36		31.9	100.5
Total Rec	2004Q0026	07/17/03	451.0	365.0	43.6	11.6	1.20	0.039												
MBMG	2004Q0090	08/19/03	428.0	352.0	43.9	11.5	0.53	0.033	10.7	494	0.0	74.8	2,105	--	--	--				
Total Rec	2004Q0213	08/19/03	423.0	367.0	47.7	12.0	0.54	0.035												
MBMG	2004Q0153	09/19/03	443.0	354.0	43.2	11.2	0.44	0.042	10.0	408	0.0	83.8	2,105	1.95	<0.5	4.63				
Total Rec	2004Q0154	09/18/03	439.0	355.0	45.9	12.7	0.55	0.043												
		Mean	438.2	359.5	44.3	11.7	0.69	0.038	10.5	412	0.0	79.3	2,109	1.93	#DIV/0!	4.63	-17.4	#DIV/0!	31.9	100.5
		Maximum	451.0	367.0	47.7	12.7	1.20	0.043	10.9	494	0.0	83.8	2,116	1.95	0	4.63	-17.4	0.0	31.9	100.5
		Minimum	423.0	352.0	41.7	11.0	0.44	0.033	10.0	334	0.0	74.8	2,105	1.91	0	4.63	-17.4	0.0	31.9	100.5
		Number	6	6	6	6	6	6	3	3	3	3	3	3	3	3	1	0	1	1
PVC-Spring		**M:213598**																		
MBMG	2005Q0081	08/12/04	48.1	49.6	8.4	1.6	0.01	<0.001	8.1	285	0.9	7.3	20	25.60	<0.05	1.25				
Total Rec	2005Q0082	08/12/04	49.4	50.7	8.3	1.6	0.41	0.016												
MBMG	2005Q0352	02/04/05	44.3	46.9	9.3	1.9	0.01	0.002	7.6	310	6.0	2.9	26	<0.05	<0.05	0.57				
Total Rec	2005Q0353	02/04/05	44.8	50.1	9.4	1.9	0.15	0.009												
MBMG	2010Q0394	10/06/09	51.8	56.9	10.2	1.9	0.01	0.002	8.0	322	0.0	6.3	<25	26.84		0.91				
		Mean	47.7	50.8	9.1	1.8	0.12	0.007	7.9	306	2.3	5.5	23.2	26.22	#DIV/0!	0.91	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
		Maximum	51.8	56.9	10.2	1.9	0.41	0.016	8.1	322	6.0	7.3	26.3	26.84	0.00	1.25	0.00	0.00	0.00	0.0
		Minimum	44.3	46.9	8.3	1.6	0.01	0.002	7.6	285	0.0	2.9	20.0	25.60	0.00	0.57	0.00	0.00	0.00	0.0
		Number	5	5	5	5	5	5	3	3	3	3	3	3	2	3	0	0	0	0

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DISSOLVED CONCENTRATION

Analy. Lab	Lab No.	DATE (mm/dd/yy)	Al (ug/l)	Ag (ug/l)	As (ug/l)	B (ug/l)	Cd (ug/l)	Co (ug/l)	Cr (ug/l)	Cu (ug/l)	Li (ug/l)	Mo (ug/l)	Ni (ug/l)	Pb (ug/l)	Se (ug/l)	Sr (ug/l)	Ti (ug/l)	U (ug/l)	Zn (ug/l)
Highway Drain		**M:200617**																	
MBMG	2003Q0850	01/30/03	68	<1	<1	31.5	1.2	<2	<2	<2	21	<10	3.7	<2	2.43	442	<1	4.57	3.7
Total Rec	2003Q0851	01/30/03	363	<1	<1		<1	<2	<2	<2	20	<10	<2	<2	1.70	503	3.60	4.66	19.3
MBMG	2003Q0863	03/15/03	136	<1	<1	<30	<1	<2	<2	<2	18	<10	2.8	<2	2.02	342	<5	--	5.3
MBMG	2003Q1024	04/22/03	87	<1	<1	<30	<1	<2	<2	<2	19	<10	2.3	<2	1.82	436	<1	4.06	2.3
Total Rec	2003Q1025	04/22/03	167	<1	<1		<1	<2	<2	<2	20	<10	2.5	<2	1.63	452	<1	4.21	18.1
MBMG	2003Q1083	05/28/03	113	<1	<1	<30	<1	<2	2.0	<2	25	<10	3.2	<2	1.25	547	<1	4.81	3.9
Total Rec	2003Q1084	05/28/03	240	<1	<1		<1	<2	<2	<2	23	<10	3.1	<2	1.44	532	<1	5.29	24.7
MBMG	2003Q1165	06/17/03	137	<1	<1	45.3	<1	<2	<2	<2	27	<10	3.4	<2	1.35	586	<1	4.86	3.5
MBMG	2004Q0027	07/17/03	<30	<5	<5	33.4	<1	<2	<10	<5	40	<10	4.1	<10	<5	852	<1	6.21	33.7
Total Rec	2004Q0028	07/17/03		<5	<5		<5	<10	<10	<10	38	<50	<10	<10	<5	858	5.93	5.99	88.8
MBMG	2004Q0099	08/19/03	<30	<1	<1	59.5	<1	3.2	<2	<2	47	<10	10.4	<2	3.80	1,041	<1	8.44	65.7
Total Rec	2004Q0100	08/19/03		6.56	<1		<1	3.5	<2	<2	49	<10	10.5	<2	3.40	1,045	4.19	8.80	106.3
MBMG	2004Q0151	09/19/03	46	<1	<1	51.7	<1	<2	<2	<2	30	<10	4.7	<2	2.10	621	<1	5.45	4.8
Total Rec	2004Q0152	09/19/03		<1	1.24		<1	<2	<2	<2	30	<10	7.6	<2	2.43	594	1.42	5.44	21.3
MBMG	2004Q0474	04/24/04	101	<1	<1	51.0	<1	<2	<2	<2	28	<10	3.4	<2	1.93	522	2.06	6.31	<2
Total Rec	2004Q0475	04/24/04		<1	<1		<1	<2	6.6	<2	27	<10	<2	<2	1.84	67	<1	<1	5.9
MBMG	2004Q0570	06/24/04	11	<1	<1	52.8	<1	4.1	5.4	3.3	28	<10	4.4	<2	1.28	638	<1	5.67	19.9
Total Rec	2004Q0571	06/24/04		<1	<1		<1	<2	<2	<2	23	<10	3.1	<2	1.25	523	<1	3.99	4.0
MBMG	2005Q0079	08/12/04	52	<1	<1	60.5	<1	<2	3.1	<2	27	<10	9.6	<2	1.84	572	1.10	7.06	<2
Total Rec	2005Q0080	08/12/04		<1	<1		<1	<2	<2	<2	26	<10	9.8	<2	1.58	584	1.22	7.53	17.3
MBMG	2005Q0354	02/04/05	631	<1	<1	<30	<1	<2	<2	<2	26	<10	7.9	<2	2.69	599	<1	4.80	11.7
MBMG	2005Q0415	04/08/05	127	<1	<1	<30	<1	<2	<2	<2	20	<10	3.1	<2	2.33	470	<1	4.64	2.3
Total Rec	2005Q0416	04/08/05		<1	<1		<1	<2	<2	<2	21	<10	2.9	<2	2.28	504	1.01	5.01	31.7
MBMG	2010Q0396	10/06/09	68	<0.1	0.36	36.0	<0.1	0.7	<0.1	0.7	18	1.44	0.8	<0.4	1.03	470	0.66	3.53	1.9
		Mean	156	7	0.80	46.9	1.2	2.9	4.3	2.0	27	1.4	4.9	#DIV/0!	1.97	575	2.35	5.52	22.6
		Maximum	631	7	1.24	60.5	1.2	4.1	6.6	3.3	49	1.4	10.5	0	3.80	1045	5.93	8.80	106.3
		Minimum	11	7	0.36	31.5	1.2	0.7	2.0	0.7	18	1.4	0.8	0	1.03	67	0.66	3.53	1.9
		Number	17	24	24	14	24	24	24	24	24	24	24	24	24	24	24	24	24
HWD-Seep		**M:204710**																	
MBMG	2004Q0025	07/17/03	<150	<5	<5	<150	<5	<10	<10	<10	69	<50	<10	<10	<5	2,224	<5	22.00	254
Total Rec	2004Q0026	07/17/03		<5	<5		<5	<10	<10	<10	72	<50	13.0	<10	<5	2,391	<10	21.80	255
MBMG	2004Q0090	08/19/03	322		<50	<150	<5	<10	<50	<25	80	<50	<10	<50	<75	2,174	<5	--	337
Total Rec	2004Q0213	08/19/03		<5	<5		<5	<10	<10	<10	97	<50	13.2	<10	<5	2,232	<10	21.70	284
MBMG	2004Q0153	09/19/03	<300	<10	<10	<300	<10	<20	<20	<20	73	<100	<20	<20	<10	2,355	<10	23.30	161
Total Rec	2004Q0154	09/18/03		<10	<10		<10	<20	<20	<20	84	<100	29.9	<20	<10	2,384	<10	23.10	160
		Mean	322	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	79	#DIV/0!	18.7	#DIV/0!	#DIV/0!	2,293	#DIV/0!	22.38	242
		Maximum	322	0	0.00	0	0.0	0.0	0.0	0.0	97	0	29.9	0	0	2,391	0.00	23.30	337
		Minimum	322	0	0.00	0	0.0	0.0	0.0	0.0	69	0	13.0	0	0	2,174	0.00	21.70	160
		Number	3	5	6	3	6	6	6	6	6	6	6	6	6	6	6	6	6
PVC-Spring		**M:213598**																	
MBMG	2005Q0081	08/12/04	52	<1	<1	84	<1	<2	2.2	<2	25	<10	5.8	<2	2.31	581	<1	4.77	<2
Total Rec	2005Q0082	08/12/04		<1	<1		<1	<2	<2	<2	25	<10	5.8	<2	1.48	608	7.34	4.58	21
MBMG	2005Q0352	02/04/05	<30	<1	<1	47	<1	<2	<2	<2	28	<10	3.8	<2	2.54	577	<1	3.64	<2
Total Rec	2005Q0353	02/04/05	148	<1	<1		<1	<2	<2	<2	28	<10	9.2	<2	2.30	581	4.34	3.78	13
MBMG	2010Q0394	10/06/09	<7.6	<0.1	0.36	42	<0.1	0.083	0.2	<0.4	20	1.74	<0.1	<0.4	2.39	549	0.336	3.01	<0.9
		Mean	100	#DIV/0!	0.36	58	#DIV/0!	0.1	1.2	#DIV/0!	25	2	6.2	#DIV/0!	2.2	579	4.0	4.0	17
		Maximum	148	0	0.36	84	0.0	0.1	2.2	0.0	28	2	9.2	0.0	2.5	608	7.3	4.8	21
		Minimum	52	0	0.36	42	0.0	0.1	0.2	0.0	20	2	3.8	0.0	1.5	549	0.3	3.0	13
		Number	4	5	5	3	5	5	5	5	5	5	5	5	5	5	5	5	5

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Analy. Lab	Lab No.	DATE (mm/dd/yy)	TIME (HRS)	Flow (gpm)	PHYSICAL PARAMETERS FIELD pH	FIELD SC (uMHOS)	FIELD Temp (C)	FIELD ORP (MV)	FIELD DO (mg/l)	LAB pH	LAB SC (uMHOS)	Hardness (mg/l)	Alkalinity (mg/l)	Water Type PERCENT MEQ/L Ca	Mg	Na	Fe	HCO3	SO4
Box Elder Creek, Harris Ranch			**M:200614**																
MBMG	2003Q0844	01/29/03	16:15	300	7.89	615	0.4	267	15.20	8.10	685	341	316	48.8	44.7	5.8	0.0	80.9	12.3
Total Rec	2003Q0845	01/29/03	16:15									332		49.6	43.7	5.8	0.1		
MBMG	2003Q0864	03/15/03	12:00	600	8.15	585	3.5	365	10.10	8.06	595	339	289	53.8	38.0	5.4	0.1	77.9	15.4
MBMG	2003Q1022	04/22/03	16:41		8.69	670	18.6	306	11.74	8.29	665	350	318	49.6	43.0	6.3	0.0	80.5	14.1
Total Rec	2003Q1023	04/22/03	16:41									336		49.4	43.0	6.4	0.1		
MBMG	2010Q0395	10/06/09	16:48		7.89	589	8.6	335	10.93	8.21	592	339	264	47.2	46.2	5.4	0.0	74.8	8.4
		Mean		450	8.16	615	7.8	318	11.99	8.17	634	340	297	49.7	43.1	5.9	0.1	78.5	12.5
		Maximum		600	8.69	670	18.6	365	15.20	8.29	685	350	318	53.8	46.2	6.4	0.1	80.9	15.4
		Minimum		300	7.89	585	0.4	267	10.10	8.06	592	332	264	47.2	38.0	5.4	0.0	74.8	8.4
		Number		2	4	4	4	4	4	4	4	6	4	6	6	6	6	4	4
Upper Box Elder Creek, Larson Ranch				**M:203450**															
MBMG	2003Q1085	05/28/03	15:50	103	8.10	675	19.0	240	7.32	8.13	680	336	287	53.5	38.6	6.7	0.0	77.6	16.6
Total Rec	2003Q1086	05/28/03	15:50									339		53.3	38.6	6.6	0.2		
MBMG	2003Q1166	06/17/03	17:15	72	7.89	400	18.2	299	7.81					53.2	39.6	6.2	0.6		
MBMG	2004Q0033	07/17/03	12:20	6						6.44	835	322	236	48.5	43.1	7.4	0.0	73.4	17.4
Total Rec	2004Q0034	07/17/03	12:20									361		49.6	37.6	6.6	1.0		
MBMG	2004Q0097	08/19/03	11:20	8	7.85	620	15.6	253	7.93	8.09	625	322	271	49.3	43.4	6.2	0.0	80.4	12.6
Total Rec	2004Q0098	08/19/03	11:20									320		49.6	42.2	6.2	0.9		
MBMG	2004Q0155	09/18/03	18:05	14	7.58	620	8.7	245	9.13	7.88	700	328	270	49.5	43.4	6.0	0.0	82.3	12.9
Total Rec	2004Q0156	09/18/03	18:05									317		48.2	43.4	6.3	0.9		
MBMG	2004Q0237	10/23/03	11:15	14	7.71	660	9.3	66	6.95	7.89	730	356	293	51.2	41.9	5.9	0.0	74.4	13.5
Total Rec	2004Q0238	10/23/03	11:15									360		51.0	41.7	5.9	0.5		
MBMG	2004Q0476	04/25/04	14:40	56	8.48	635	13.0	296	12.80	8.19	640	409	320	48.0	43.6	7.1	0.0	76.5	16.7
Total Rec	2004Q0477	04/25/04	14:40									295		18.8	68.5	10.9	0.0		
MBMG	2005Q0350	02/04/05	13:35	25						8.15	685	354	329	50.7	41.6	6.5	0.0	80.2	12.7
MBMG	2005Q0413	04/08/05	11:50	56	8.02	655	8.1	458	5.47	8.13	660	314	275	50.4	42.2	6.4	0.0	76.4	14.4
Total Rec	2005Q0414	04/08/05	11:50									353							
MBMG	2010Q0402	10/06/09	13:25	46.15	7.36	598	6.9	344	9.32	8.13	604	328	290	53.0	40.2	5.7	0.0	79.7	9.2
		Mean		40	7.87	608	12.4	275	8.34	7.89	684	338	285	48.6	43.1	6.7	0.3	77.9	14.0
		Maximum		103	8.48	675	19.0	458	12.80	8.19	835	409	329	53.5	68.5	10.9	1.0	82.3	17.4
		Minimum		6	7.36	400	6.9	66	5.47	6.44	604	295	236	18.8	37.6	5.7	0.0	73.4	9.2
		Number		10	8	8	8	8	8	9	9	16	9	16	16	16	16	9	9
Lower Box Elder Creek			**M:203451**																
MBMG	2003Q1087	05/28/03	16:45	112	8.20	680	24.5	236	5.73	8.02	645	342	291	50.7	42.0	6.1	0.0	81.6	14.4
Total Rec	2003Q1088	05/28/03	16:45									342		50.4	42.6	5.9	0.1		
MBMG	2003Q1162	06/17/03	16:05	22	8.15	395	23.3	286	7.88	8.21	590	357	294	49.2	47.8	5.7	0.0	83.0	13.4
MBMG	2004Q0478	04/25/04	14:10	78	8.67	570	17.0	288	14.30	8.26	560	327	258	46.9	45.2	6.5	0.0	77.2	17.6
Total Rec	2004Q0479	04/25/04	14:10									226		20.1	67.9	10.6	0.0		
MBMG	2005Q0411	04/08/05	11:15	192	7.78	655	8.3	453	5.69	8.14	670	356	304	50.1	43.7	5.6	0.0	79.2	12.0
Total Rec	2005Q0412	04/08/05	11:15									358							
MBMG	2007Q0008	06/29/06	13:30		7.80	595	19.4	258	4.60										
Total Rec	2007Q0009	06/29/06	13:30									330		52.8	40.0	5.2	0.7		
MBMG	2010Q0395	10/06/09	16:35	72.7	7.89	589	8.6	335	10.93	8.21	590	339	264	47.2	46.2	5.4	0.0	74.8	8.4
		Mean		95	8.08	581	16.9	309	8.19	8.17	611	331	282	45.9	46.9	6.4	0.1	79.2	13.2
		Maximum		192	8.67	680	24.5	453	14.30	8.26	670	358	304	52.8	67.9	10.6	0.7	83.0	17.6
		Minimum		22	7.78	395	8.3	236	4.60	8.02	560	226	258	20.1	40.0	5.2	0.0	74.8	8.4
		Number		5	6	6	6	6	6	5	5	9	5	8	8	8	8	5	5

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Analy. Lab	Lab No.	DATE (mm/dd/yy)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	Fe (mg/l)	Mn (mg/l)	SiO2 (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3-N (mg/l)	NO2-N (mg/l)	F (mg/l)	Oxygen 18O	Deuterium 2H	Tritium TU	Tritium Pico curies/L
Box Elder Creek, Harris Ranch																				
MBMG	2003Q0844	01/29/03	71.3	39.7	9.7	1.7	0.04	0.003	9.8	386	0.0	6.1	46	4.83	<0.05	0.37			18.6	58.6
Total Rec	2003Q0845	01/29/03	70.8	37.8	9.5	1.6	0.10	0.005												
MBMG	2003Q0864	03/15/03	79.4	34.1	9.3	6.8	0.10	0.066	10.3	353	0.0	9.6	55	3.06	<0.05	0.33				
MBMG	2003Q1022	04/22/03	75.1	39.5	11.0	2.9	0.04	0.012	4.4	388	0.0	8.3	53	2.41	--	0.48				
Total Rec	2003Q1023	04/22/03	71.9	38.0	10.7	2.8	0.08	0.015												
MBMG	2010Q0395	10/06/09	68.6	40.7	9.1	2.8	0.01	0.006	9.6	322	0.0	5.8	29	13.78		0.65				
		Mean	72.9	38.3	9.9	3.1	0.06	0.018	8.5	362	0.0	7.4	46	6.02	#DIV/0!	0.46			18.6	58.6
		Maximum	79.4	40.7	11.0	6.8	0.10	0.066	10.3	388	0.0	9.6	55	13.78	0.00	0.65			18.6	58.6
		Minimum	68.6	34.1	9.1	1.6	0.01	0.003	4.4	322	0.0	5.8	29	2.41	0.00	0.33			18.6	58.6
		Number	6	6	6	6	6	6	4	4	4	4	4	4	3	4			1	1
Upper Box Elder Creek, Larson Ranch																				
MBMG	2003Q1085	05/28/03	78.2	34.2	11.2	2.9	0.04	0.052	9.2	351	0.0	7.9	59	2.51	<0.05	0.40	-17.11		20.2	63.6
Total Rec	2003Q1086	05/28/03	78.7	34.5	11.1	2.9	0.34	0.074												
MBMG	2003Q1166	06/17/03	84.4	38.1	11.3	2.6	0.05	0.032	12.8											
MBMG	2004Q0033	07/17/03	68.2	36.8	11.9	2.4	0.03	0.024	11.8	287	0.0	8.8	54	4.59	0.11	0.37				
Total Rec	2004Q0034	07/17/03	78.4	40.1	11.9	2.5	1.47	0.199												
MBMG	2004Q0097	08/19/03	68.6	36.6	9.9	2.2	0.04	0.023	12.1	330	0.0	7.1	41	3.41	--	0.51			19.8	62.4
Total Rec	2004Q0098	08/19/03	69.3	35.7	10.0	2.4	1.16	0.106												
MBMG	2004Q0155	09/18/03	69.9	37.2	9.7	2.5	0.03	0.046	11.7	329	0.0	7.0	40	1.33	<0.05	0.43				
Total Rec	2004Q0156	09/18/03	66.9	36.5	10.0	2.7	1.18	0.100												
MBMG	2004Q0237	10/23/03	78.4	38.9	10.3	2.3	0.03	0.042	11.8	358	0.0	7.1	51	9.98	<0.05	0.58	-16.88	-135.16	23.2	73.1
Total Rec	2004Q0238	10/23/03	79.3	39.3	10.5	2.4	0.68	0.080												
MBMG	2004Q0476	04/25/04	85.9	47.3	14.6	4.1	0.02	0.019	6.1	390	0.0	9.9	67	3.48	<0.10	0.39	-16.99	-138.92	17.7	55.7
Total Rec	2004Q0477	04/25/04	25.4	56.2	16.9	4.4	0.03	<0.001												
MBMG	2005Q0350	02/04/05	77.8	38.7	11.5	2.9	0.03	0.023	11.8	401	0.0	8.2	50	4.75	<0.05	0.26				
MBMG	2005Q0413	04/08/05	68.5	34.8	10.0	2.2	0.02	0.027	10.0	336	0.0	8.0	50	5.81	<0.05	0.33				
Total Rec	2005Q0414	04/08/05	77.9	38.6	11.8	2.7	0.25	0.043												
MBMG	2010Q0402	10/06/09	74.7	34.3	9.2	2.7	0.02	0.015	11.5	353	0.0	5.5	32	8.68		0.57				
		Mean	72.4	38.7	11.3	2.7	0.32	0.06	10.9	348	0.0	7.71	49	4.95	0.11	0.43	-16.99	-137.04	20.2	63.7
		Maximum	85.9	56.2	16.9	4.4	1.47	0.20	12.8	401	0.0	9.85	67	9.98	0.11	0.58	-16.88	-135.16	23.2	73.1
		Minimum	25.4	34.2	9.2	2.2	0.02	0.02	6.1	287	0.0	5.49	32	1.33	0.11	0.26	-17.11	-138.92	17.7	55.7
		Number	17	17	17	17	17	17	10	9	9	9	9	9	8	9	3	2	4	4
Lower Box Elder Creek																				
MBMG	2003Q1087	05/28/03	74.8	37.6	10.4	2.7	0.06	0.065	12.8	355	0.0	6.1	49	1.22	0.07	0.46	-16.74		20.3	63.9
Total Rec	2003Q1088	05/28/03	74.3	38.1	10.0	2.5	0.14	0.061												
MBMG	2003Q1162	06/17/03	75.7	40.9	10.1	2.3	0.04	0.035	16.7	359	0.0	5.5	46	0.99	<0.05	0.46				
MBMG	2004Q0478	04/25/04	66.7	39.0	10.7	3.1	0.04	0.008	3.1	315	0.0	6.8	57	1.81	<0.10	0.43	-16.55	-135.73	18.2	57.3
Total Rec	2004Q0479	04/25/04	20.7	42.4	12.5	2.6	0.02	<0.001	13.6											
MBMG	2005Q0411	04/08/05	76.6	40.1	9.9	2.4	0.01	0.022	8.5	370	0.0	5.8	44	6.95	<0.05	0.35				
Total Rec	2005Q0412	04/08/05	76.6	40.6	10.1	2.3	0.06	0.025												
MBMG	2007Q0008	06/29/06																		
Total Rec	2007Q0009	06/29/06	75.2	34.6	8.4	3.3	0.89	0.087												
MBMG	2010Q0395	10/06/09	68.6	40.7	9.1	2.8	0.01	0.006	9.6	322	0.0	5.8	29	13.78	<0.5	0.65				
		Mean	67.7	39.3	10.1	2.7	0.14	0.039	10.7	344	0.0	6.00	45	4.95	0.07	0.47	-16.6	-135.7	19.3	60.6
		Maximum	76.6	42.4	12.5	3.3	0.89	0.087	16.7	370	0.0	6.80	57	13.78	0.07	0.65	-16.6	-135.7	20.3	63.9
		Minimum	20.7	34.6	8.4	2.3	0.01	0.006	3.1	315	0.0	5.50	29	0.99	0.07	0.35	-16.7	-135.7	18.2	57.3
		Number	9	9	9	9	9	9	6	5	5	5	5	5	5	5	2	1	2	2

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DISSOLVED CONCENTRATION

Analy. Lab	Lab No.	DATE (mm/dd/yy)	Al (ug/l)	Ag (ug/l)	As (ug/l)	B (ug/l)	Cd (ug/l)	Co (ug/l)	Cr (ug/l)	Cu (ug/l)	Li (ug/l)	Mo (ug/l)	Ni (ug/l)	Pb (ug/l)	Se (ug/l)	Sr (ug/l)	Ti (ug/l)	U (ug/l)	Zn (ug/l)
Box Elder Creek, Harris Ranch																			
MBMG	2003Q0844	01/29/03	<30	<1	<1	<30	1.1	<2	<2	<2	19	<10	3.0	<2	1.10	390	1.16	3.52	<2
Total Rec	2003Q0845	01/29/03	64	<1	<1		<1	<2	<2	<2	17	<10	<2	<2	<1	430	2.10	3.24	17.0
MBMG	2003Q0864	03/15/03	<30	<1	1.31	<30	<1	<2	2.0	<2	18	<10	3.1	<2	1.35	379	<5	--	<2
MBMG	2003Q1022	04/22/03	<30	<1	<1	<30	<1	<2	<2	<2	17	<10	<2	<2	<1	412	<1	2.98	<2
Total Rec	2003Q1023	04/22/03	<30	<1	<1		<1	<2	<2	<2	16	<10	2.3	<2	<1	401	1.12	2.92	8.1
MBMG	2010Q0395	10/06/09	<7.6	<0.1	0.84	33	<0.1	0.6	<0.1	0.6	15	1.28	0.1	<0.4	0.95	390	<0.1	2.70	<0.9
		Mean	64	#DIV/0!	1.08	33.3	1.1	0.6	2.0	0.6	17	1.3	2.1	#DIV/0!	1.13	400	1.46	3.07	12.6
		Maximum	64	0.0	1.31	33.3	1.1	0.6	2.0	0.6	19	1.3	3.1	0.00	1.35	430	2.10	3.52	17.0
		Minimum	64	0.0	0.84	33.3	1.1	0.6	2.0	0.6	15	1.3	0.1	0.00	0.95	379	1.12	2.70	8.1
		Number	6	6	6	4	6	6	6	6	6	6	6	6	6	6	6	6	6
Upper Box Elder Creek, Larson Ranch																			
MBMG	2003Q1085	05/28/03	<30	<1	1.04	<30	<1	<2	2.8	<2	15	<10	2.1	<2	<1	394	<1	2.19	<2
Total Rec	2003Q1086	05/28/03	80	<1	1.22		<1	<2	<2	<2	15	<10	2.1	<2	<1	383	2.20	2.35	7.7
MBMG	2003Q1166	06/17/03	32	<1	1.08	<30	<1	<2	<2	<2	16	<10	<2	<2	<1	453	<1	2.29	<2
MBMG	2004Q0033	07/17/03	<30	<1	<1	<30	<1	<2	<2	<2	17	<10	<2	<2	<1	438	<1	2.62	<2
Total Rec	2004Q0034	07/17/03		<1	1.16		<1	<2	<2	<2	17	<10	2.6	<2	<1	449	8.30	2.63	6.0
MBMG	2004Q0097	08/19/03	<30	<1	<1	40	<1	<2	<2	<2	18	<10	<2	<2	1.14	442	<1	2.71	2.6
Total Rec	2004Q0098	08/19/03		<1	1.08		<1	<2	<2	<2	19	<10	2.5	<2	<1	453	36.80	2.77	16.1
MBMG	2004Q0155	09/18/03	<30	<1	<1	36	<1	<2	<2	<2	18	<10	2.5	<2	1.40	450	<1	3.01	<2
Total Rec	2004Q0156	09/18/03		<1	1.36		<1	<2	<2	<2	19	<10	6.0	<2	1.23	440	19.00	3.17	13.6
MBMG	2004Q0237	10/23/03	35	<1	<1	<30	<1	<2	<2	<2	20	<10	4.7	<2	<1	470	<1	3.84	10.6
Total Rec	2004Q0238	10/23/03		<1	<1		<1	<2	<2	<2	20	<10	2.5	<2	<1	478	6.87	3.84	9.6
MBMG	2004Q0476	04/25/04	<30	<1	<1	42	<1	<2	<2	<2	22	<10	3.7	<2	1.01	533	<1	5.48	<2
Total Rec	2004Q0477	04/25/04		<1	2.07		1.6	<2	4.9	<2	23	<10	<2	<2	1.77	333	<1	<1	5.7
MBMG	2005Q0350	02/04/05	<30	<1	<1	<30	<1	<2	<2	<2	18	<10	6.6	<2	1.08	432	1.57	3.02	<2
MBMG	2005Q0413	04/08/05	32	<1	<1	<30	<1	<2	<2	<2	15	<10	2.5	<2	<1	354	<1	2.53	<2
Total Rec	2005Q0414	04/08/05		<1	<1		<1	<2	<2	<2	17	<10	2.8	<2	1.27	424	3.34	2.77	23.4
MBMG	2010Q0402	10/06/09	<7.6	<0.1	0.53	29	<0.1	0.2	0.2	0.6	12	0.864	<0.1	<0.4	0.69	344	<0.1	2.56	<0.9
		Mean	45	#DIV/0!	1.2	36.6	1.6	0.2	2.6	0.6	18	0.9	3.4	#DIV/0!	1.20	428	11.15	2.99	10.6
		Maximum	80	0.0	2.1	42.0	1.6	0.2	4.9	0.6	23	0.9	6.6	0.00	1.77	533	36.80	5.48	23.4
		Minimum	32	0.0	0.5	29.0	1.6	0.2	0.2	0.6	12	0.9	2.1	0.00	0.69	333	1.57	2.19	2.6
		Number	11	17	17	10	17	17	17	17	17	17	17	17	17	17	17	17	17
Lower Box Elder Creek																			
MBMG	2003Q1087	05/28/03	40	<1	1.86	<30	<1	<2	3.2	3.3	17	<10	2.1	<2	<1	436	<1	2.56	12.0
Total Rec	2003Q1088	05/28/03	35	<1	1.81		<1	<2	<2	<2	17	<10	2.5	<2	<1	410	1.19	2.55	11.7
MBMG	2003Q1162	06/17/03	39	<1	2.07	38	<1	<2	<2	<2	18	<10	2.0	<2	<1	444	<1	2.74	2.1
MBMG	2004Q0478	04/25/04	<30	<1	<1	41	1.4	<2	<2	<2	25	<10	3.4	<2	1.04	555	<1	3.67	7.8
Total Rec	2004Q0479	04/25/04		<1	<1		<1	<2	3.4	<2	21	<10	<2	<2	<1	303	<1	<1	4.6
MBMG	2005Q0411	04/08/05	<30	<1	<1	<30	<1	<2	<2	<2	17	<10	2.8	<2	<1	430	<1	3.06	<2
Total Rec	2005Q0412	04/08/05		<1	<1		<1	<2	<2	<2	18	<10	3.0	<2	1.05	447	1.95	3.05	28.6
MBMG	2007Q0008	06/29/06																	
Total Rec	2007Q0009	06/29/06		<1	2.16		<1	2.9	3.3	8.4	16	<10	2.3	<2	<1	432	12.7	3.45	17.8
MBMG	2010Q0395	10/06/09	<7.6	<0.1	0.84	33	<0.1	0.6	<0.1	0.6	15	1.28	0.1	<0.4	0.95	390	0.493	2.70	<0.9
		Mean	38	#DIV/0!	1.75	37.2	1.4	1.7	3.3	4.1	18.1	1.3	2.3	#DIV/0!	1.0	427	4.08	2.97	12.1
		Maximum	40	0.0	2.16	40.7	1.4	2.9	3.4	8.4	25.3	1.3	3.4	0.00	1.1	555	12.70	3.67	28.6
		Minimum	35	0.0	0.84	33.3	1.4	0.6	3.2	0.6	14.5	1.3	0.1	0.00	0.9	303	0.49	2.55	2.1
		Number	6	9	9	5	9	9	9	9	9	9	9	9	9	9	9	9	9