ACTION MEMORANDUM

FOR THE

RECLAMATION OF THE BROKEN HILL MINE SITE SANDERS COUNTY, MONTANA

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ATTACHMENTS

1.0 PURPOSE

The purpose of this Action Memorandum is to document the approval of Reclamation that will address the environmental impacts of historic mining activities at the Broken Hill Mine site (BHMS), Sanders County, Montana. This Reclamation is described herein. Specifically, this Reclamation will limit human and ecological exposure to mine-related contaminants and reduce the mobility of those contaminants through associated solid media and surface water exposure pathways. This memorandum will describe the justification for implementing Reclamation at the BHMS, identify the preferred reclamation alternative, explain the rationale for selection of the preferred alternative, and document approval of this Reclamation.

This Reclamation will be executed by following the non-time-critical removal action process as defined by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP; 40 CFR Part 300). Response actions, as defined in the USEPA's *Guidance on Conductions Non-Time-Critical Removal Actions Under CERCLA,* are implemented to respond to "the cleanup of removal of released hazardous substances from the environment … as may be necessary to prevent, minimize, or mitigate damage to the public health or welfare or the environment…" (EPA 1993).

2.0 SITE CONDITIONS AND BACKGROUND

2.1 SITE DESCRIPTION

The BHMS is located in Sanders County, Montana approximately four miles north of Heron, Montana. The surrounding area consists of moderately steep to steep mountain slopes and hillsides. The BHMS topography is characterized by steep mountainous terrain rising from a narrow valley floor draining the East Fork of Blue Creek. Features at the BHMS include two waste rock dumps totaling approximately 4,100 cubic yards, two collapsed adits (and a associated seasonal/intermittent lower adit discharge), and roadways. These features comprise approximately 1.5 acres of historic metal mining impacted land. A location map and topographic/site features map are shown in Attachment 2.

2.1.1 Removal Site Evaluation

The BHMS investigation, characterization, and repository investigation activities occurred in 2009 and 2010 to support the Expanded Engineering Evaluation/Cost Analysis (EEE/CA), prepared for the State of Montana Department of Environmental Quality/Mine Waste Cleanup Bureau (DEQ/MWCB). The results of these investigations are presented in the *Reclamation Investigation Report for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2010a), the *Repository Investigation Report for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2010b), and the *Final Expanded Engineering Evaluation/Cost Analysis for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2011).

2.1.2 Physical Location

The BHMS is located at an elevation of about 4,200 feet above sea level, in Section 10, Township 27 North, Range 34 West of the Montana Principal Meridian. The latitude and longitude of the BHMS are North 48° 07' 15" and West 115° 58' 06" (Attachment 2, Figure 1). The BHMS is accessed by traveling north on Forest Service Road (FR) #409 (Blue Creek Road) for approximately 2.5 miles to the junction of FR #409 and FR #2290 and continuing up FR # 2290 for another approximately 2.5 miles. The BHMS encompasses an area of approximately 1.5 acres of mining impacted land. The community of Heron, Montana and Montana Highway 200 are located approximately four miles south of the BHMS.

2.1.3 Site Characteristics

The BHMS includes lands located on private land and on the Kootenai National Forest. The BHMS land ownership is divided into two parcels (RTI 2002). The upper adit and waste rock dump are located on the patented Broken Hill claim (Mineral Survey #10572.) The Broken Hill claim is currently owned by a private company, Sanders Mtn. Development, LLC of Kalispell, Montana. The lower adit and the majority of the lower waste rock dump are located on the unpatented Tuesday Lode (Mineral Survey #10572.) The Tuesday Lode and surrounding lands are administered by the Kootenai National Forest.

The BHMS consists of two waste rock dumps totaling approximately 4,100 cubic yards (approximately 500 cubic yards in the upper dump and 3,600 cubic yards in the lower dump), two collapsed adits (and associated season/intermittent lower adit discharge), and roadways. These features comprise approximately 1.5 acres of historic metal mining impacted land. The lower waste rock dump is located on private and Kootenai National Forest lands. Of the estimated 3,600 total cubic yards in the lower waste rock dump, approximately 3,000 cubic yards is on federal land and 600 cubic yards is on private land.

Waste rock material contains levels of arsenic and lead that are above DEQ/MWCB Risk Based Cleanup Guidelines (RBCG) (DEQ 1996). Other metals including antimony, cadmium, copper, iron, mercury, and zinc are present at greater than three times background concentrations. Adit discharge water exceeds the human health drinking water standard for arsenic and lead and exceeds aquatic life standards for cadmium, lead, and zinc. This data is summarized in the *Reclamation Investigation Report for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2010a), and the *Final Expanded Engineering Evaluation and Cost Analysis for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2011).

2.1.4 Mining History

The BHMS is part of the Blue Creek Mining District. The early history of the Broken Hill Mine includes conflicting accounts. Early mine inspector reports state the first period of significance for the Broken Hill Mine was in 1906, when there was intermittent small-scale production. However, later sources put the development of the mine in the early 1920s, which is consistent with the original patent filing in 1920 (FHC 2002). The mine was worked by varying owners and operators until 1930, when it became inactive.

The 1920 patent survey recorded two tunnels, seven drifts, two crosscuts, and a raise. The mine was worked through the series of tunnels and drifts. The ore was oxide of iron carrying as much as 80% excess iron, which made it desirable for fluxing. The Montana Bureau of Mines and Geology reports that the Federal Bureau of Mining production records indicate 273 tons of ore were produced from 1925 to 1927, from which 942 oz of silver, 53,057 lb of lead, and 176,632 lb of zinc were extracted. The Federal Bureau of Mining reported two adits: one adit tunnel being 350 ft long and another 108 ft long with a raise connecting the two tunnels (MBMG 1963).

The mine remained closed until 1965, when other owners and operators had renewed interest in mining at the Broken Hill Mine. Approximately 94 tons of ore were mined in 1966. Road improvements, tunnel repair, and ore removal were performed; however, in 1973, the mine was inactive again and remains so today. Fewer than 400 tons of ore were recorded as being shipped from the Broken Hill Mine since its original discovery (RTI 2002). The cultural resource inventory for the BHMS, indicates that all ore was shipped off site for processing and no milling or amalgamating equipment was noted at the BHMS (FHC 2002).

2.1.4.1 Land Use and Population

The BHMS is located on private land and on the Kootenai National Forest. The primary land use in the vicinity of the site is commercial (logging) and recreational. The population in Sanders County is 11,096 people, with approximately four persons per square mile (USCB 2009).

2.1.4.2 Land Ownership

The BHMS land ownership is divided into two parcels (RTI 2002). The upper adit and waste rock dump are located on the patented Broken Hill claim (Mineral Survey #10572.) The Broken Hill claim is currently owned by a private company, Sanders Mtn. Development, LLC of Kalispell, Montana. The lower adit and the majority of the lower waste rock dump are located on the unpatented Tuesday Lode (Mineral Survey #10572.) The Tuesday Lode and surrounding lands are administered by the Kootenai National Forest.

2.1.4.3 Project History

Investigation activities performed by Pioneer Technical Services, Inc. (Pioneer), for the DEQ/MWCB in 1993 indicated elevated arsenic, cadmium, copper, iron, mercury, lead, antimony, and zinc in onsite waste rock and elevated arsenic and lead in the adit discharge. In July 2009, at the request of the DEQ/MWCB, Portage, Inc. (Portage) performed a reclamation investigation (RI) to further characterize the nature and extent of contamination at the BHMS. The *Reclamation Investigation Report for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2010a) was completed in January of 2010. During the RI, samples were collected to support site characterization and risk assessment. The sampling included material from the upper and lower waste rock dumps, background soil sampling, and sampling of lower waste rock dump adit discharge water. A recreational user scenario risk assessment of the data indicated both potential human exposure and ecological impacts exceeds what the Environmental Protection Agency (EPA) establishes as healthy benchmarks. Also at the request of the DEQ/MWCB, the *Repository Investigation Report for the Broken Hill Mine Site, Sanders County, Montana*

(Portage 2010b) was completed in September of 2010. In May of 2010, Portage investigated four potential repository sites located on Kootenai National Forest land near the BHMS. The sites were located in cooperation with the DEQ/MWCB and Kootenai National Forest staff as potential environmentally and geographically suitable sites.

The *Reclamation Investigation Report for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2010a) completed in January of 2010, identified general categories of response actions for reclamation at the BHMS and recommended that reclamation alternatives be evaluated through an alternative screening process under the framework of an EEE/CA. Portage performed the completion of data review, analysis, and alternatives evaluation sufficient to prepare an EEE/CA report during the summer and fall of 2010, and the draft EEE/CA report was finalized for public comment in December of 2010.

2.1.5 Release or Threatened Release into the Environment of a Hazardous Substance

2.1.5.1 Hazardous Substances

Hazardous substances found at the BHMS, as defined in section 101(14) of CERCLA, include, but are not necessarily limited to, antimony, arsenic, cadmium, copper, iron, lead, mercury, silver, and zinc. Mining related wastes located at the BHMS are the source of metal particulates that can be mobile in surface water and cause releases of hazardous substances into the environment. Concentrations and distribution of hazardous substances in waste rock, soil, and surface water at the BHMS are documented in the *Reclamation Investigation Report for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2010a) and the *Final Expanded Engineering Evaluation/Cost Analysis for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2011).

2.1.5.2 Sampling and Analytical Data

Background soil, waste rock, soil, and surface water samples were collected in 2009 during the RI. Solid media laboratory analytical results showed the following metals present at three times the background concentration: antimony, arsenic, cadmium, copper, iron, lead, mercury, silver, and zinc. Solid media sample results also showed that concentrations of arsenic and lead exceed the DEQ/MWCB RBCG (Portage 2010a). Surface water sample results from the lower discharging adit exceed human health drinking water standards for arsenic and lead and exceed aquatic life standards for cadmium, lead, and zinc (DEQ 2010). This data is summarized in the *Reclamation Investigation Report for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2010a), and the *Final Expanded Engineering Evaluation and Cost Analysis for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2011).

2.1.5.3 Mechanism for Past, Present, or Future Release

The principal mechanisms of transport of contaminants associated with the wastes at the BHMS are the following:

- Physical erosion, transport, and deposition of particulates by runoff into surface water;
- Release of contaminants into soils and groundwater through the leaching of waste via precipitation and other surface water infiltration.

Physical erosion of materials occurs at the waste rock dumps where mine wastes are exposed at the surface. Contaminants are being released to underlying soils and groundwater via infiltrating surface water (discharging adit water) and precipitation through the waste rock at the site.

2.1.5.4 Events or Features that Could Spread or Accelerate Releases

Large runoff events, particularly during spring runoff, present conditions for increasing erosion of the waste rock piles. These runoff events could further erode the waste rock and spread the contaminated materials throughout the area. Additionally, large precipitation events could increase the volume of water currently being discharge from the lower adit resulting in increased erosion of the lower waste rock pile.

2.1.6 National Priority List Status

The BHMS is not on the National Priority List (NPL). This Reclamation under the NCP is in accordance with Montana's Abandoned Mines Reclamation Authority.

2.1.7 Map, Pictures and Other Graphic Representations

A location map and topographic/site features map are shown in Attachment 2. Additional location maps and photographs of the waste and repository site are included in the *Repository Investigation Report for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2010b) and the *Final Expanded Engineering Evaluation and Cost Analysis for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2011).

2.2 OTHER ACTIONS TO DATE

2.2.1 Previous Actions

Investigation activities conducted by Pioneer for the DEQ/MWCB in 1993 indicated elevated arsenic, cadmium, copper, iron, mercury, lead, antimony, and zinc in onsite waste rock and elevated arsenic and lead in the adit discharge. In July 2009, at the request of the DEQ/MWCB, Portage performed a RI to further characterize the nature and extent of contamination at the BHMS. The *Reclamation Investigation Report for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2010a) was completed in January of 2010. During the RI, samples were collected to support site characterization and risk assessment. The sampling included material from the upper and lower waste rock dumps, background soil sampling, and sampling of adit discharge water. A recreational user scenario risk assessment of the data indicated both potential human exposure and ecological impacts exceeding what the EPA establishes as healthy benchmarks. Also at the request of the DEQ/MWCB, the *Repository Investigation Report for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2010b) was completed in September

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There has been no previous action to remove or contain the waste rock at the BHMS.

2.2.2 Current Actions

At the request of the DEQ/MWCB, Portage completed and analyzed reclamation alternatives for the BHMS (Portage 2011). The draft version of the EEE/CA was completed in December 2010. In January 2011, the DEQ/MWCB developed a Community Relations Plan for this project. The Community Relations Plan (DEQ 2011) identified ways that information would be conveyed about the project to the public and for gaining public input. These methods included generating a legal notice in a local newspaper of general circulation. A public notice appeared in the Sanders County Ledger newspaper on January 27th, February 3rd, and February 10th, 2011. The notice announced that the draft EEE/CA and other project documents were available for public review, and listed the time and location for the public meeting. The DEQ/MWCB, Portage, and the Kootenai National Forest conducted a public meeting on February 16, 2011, in Heron, Montana, to present the reclamation alternatives and receive public comment on the preferred alternative. A thirty day comment period was established and ended on March 18, 2011. Project reports were made available on the DEQ website and at the Trout Creek Ranger Station during the public review and comment period.

Comments concerning the EEE/CA were received from the BHMS landowner and adjacent land owners concerning the repository location, access to mine features, and surface water quality. A copy of the comments and DEQ/MWCB responses are included in Attachment 3 of this Action Memorandum.

The DEQ/MWCB has reached an agreement with the National Forest Service (NFS) to work together to cleanup the BHMS. The majority of the waste on the site is located on land administered by the Kootenai National Forest. The DEQ/MWCB and the NFS have agreed that the DEQ/MWCB will take primary responsibility for implementing all reclamation activities at the BHMS, including the excavation of mine wastes on both private land and NFS lands, and the design and construction of the repository located on NFS land. The DEQ/MWCB will also be responsible for all costs associated with all reclamation activities at the BHMS. The NFS will supply a repository location located on NFS land in which all BHMS wastes located on both

private and NFS lands will be disposed. A copy of the Memorandum of Understanding and Repository Agreement are included as Attachment 4.

Reclamation at the BHMS, in accordance with the preferred alternative discussed in the EEE/CA (Portage 2011), is scheduled to begin the design phase in spring 2011, with reclamation to occur in summer 2011. This alternative is for the total removal of waste rock located on both private and NFS lands and disposal of the waste rock in a repository locted on NFS land.

2.3 STATE AND LOCAL AUTHORITIES' ROLE

2.3.1 State and Local Actions to Date

Since BHMS waste rock is located on both private and public lands, the DEQ/MWCB has entered into a Memorandum of Understanding and Repository Agreement with the NFS to work together on this project.

In accordance with the DEQ/MWCB's State of Montana Reclamation Plan, the DEQ/MWCB consulted with the US Fish and Wildlife Service and Montana State Historic Preservation Office to receive comments on the proposed reclamation at the BHMS. Copies of consultation letters and concurrences can be found in Attachment 5.

The DEQ/MWCB also sent copies of the Draft EEE/CA to the NFS Regional Office located in Missoula, Montana, the Kootenai National Forest, and the BHMS landowner for review and comment. The NFS Regional Office and the Kootenai National Forest did not express concerns over the preferred alternative. Landowner comments are summarized in Section 2.2.2 of this Action Memorandum.

2.3.2 Potential for Continued State/Local Response

The DEQ/MWCB will be responsible for carrying out all reclamation activities at the BHMS. This will include all procurement for construction contracted and engineering design and oversight services, financial responsibility for reclamation construction and engineering services, and maintenance of the reclamation for a period of three years following completion of reclamation construction activities.

3.0 THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

The EEE/CA establishes there has been a release of hazardous substances and there is a substantial threat of release into the environment of pollutants and contaminants which may present an imminent and substantial threat to public health or welfare, or the environment, as set forth by the criteria identified in the National Contingency Plan (NCP) at 40 CFR 300.415(b)(2). Briefly, this threat is the release and risk of continued releases of heavy metals to surrounding lands, surface water, and groundwater.

Due to the concentrations of metals in mine waste sources (Portage 2010a and 2011), conditions

at the BHMS meet the criteria for initiating an action under 40 CFR 300.415(b)(2) of the NCP. The following factors form the basis for the DEQ/MWCB's determination of the threat present and the appropriate action to be taken:

(i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;

(ii) High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface that may migrate;

(iii) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released; and

(iv) The unavailability of other appropriate federal or state response mechanisms to respond to the release.

3.1 ACTUAL OR POTENTIAL EXPOSURE TO NEARBY HUMAN POPULATIONS, ANIMALS, OR THE FOOD CHAIN FROM HAZARDOUS SUBSTANCES OR POLLUTANTS OR CONTAMINANTS

Heavy metals associated with wastes within the site can affect human health through inhalation of dust or ingestion of solids or surface water. Based on a recreational use scenario, hazard quotients from the risk assessment are greater than 1.0 for two metals: arsenic and lead, and the cancer threshold of 1×10^{-6} is exceeded for arsenic, which poses unacceptable risks to humans. The site is relatively remote and is used primarily for recreational purposes. There is potential for contact with mine wastes, contaminated soils, and contaminated surface water by these users, including gold panner/rock hounds, hunters, prospectors, hikers, and other general recreational users.

3.2 ACTUAL OR POTENTIAL CONTAMINATION OF DRINKING WATER SUPPLIES OR SENSITIVE ECOSYSTEMS

Surface water analysis (lower adit discharge) has identified water quality exceedances for both human health and aquatic standards. The human health standard for arsenic and lead were exceeded while cadmium, copper, lead, and zinc all exceed aquatic life standards from the "Montana Numeric Water Quality Standards" (DEQ 2010). The site is potentially home to numerous species of wildlife which may use the adit discharge as a source of drinking water including grizzly bears.

3.3 HIGH LEVELS OF HAZARDOUS SUBSTANCES OR POLLUTANTS OR CONTAMINANTS IN SOILS LARGELY AT OR NEAR THE SURFACE THAT MAY MIGRATE;

Sampling of mine waste rock and surrounding soils indicates that metals have been and will continue to be mobilized to surrounding soils. Transport mechanisms include erosion of contaminated waste rock and transport of contaminants by surface water flow and leaching.

Metals present in site soils at levels greater than three times background include: antimony, arsenic, cadmium, copper, iron, lead, mercury, and zinc.

3.4 WEATHER CONDITIONS THAT MAY CAUSE HAZARDOUS SUBSTANCES OR POLLUTANTS OR CONTAMINANTS TO MIGRATE OR BE RELEASED;

Heavy snowpack, associated snowmelt runoff, and high intensity precipitation events will erode or leach the mine waste rock leading to contaminant release and migration.

3.5 THE UNAVAILABILITY OF OTHER APPROPRIATE FEDERAL OR STATE RESPONSE MECHANISMS TO RESPOND TO THE RELEASE.

The DEQ/MWCB has the authority delegated by the U.S Office of Surface Mining, Reclamation and Enforcement, to administer the Abandoned Mine Land (AML) Reclamation program in accordance with the State of Montana's Reclamation Plan. The DEQ/MWCB AML program is funded by federal grants derived from a tax on coal under Title IV of the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The DEQ/MWCB will use AML funds to pay for reclamation at the BHMS.

The BHMS was abandoned and left in an inadequate reclamation status prior to 1977. DEQ/MWCB determined that no party had continuing reclamation responsibilities, and no private party funds or responsible party were identified to pay for cleanup. The BHMS was therefore determined to be eligible for the expenditure of AML fundsSince the majority of the waste at the BHMS is located on land administered by the Kootenai National Forest, the DEQ/MWCB has reached an agreement with the National Forest Service (NFS) to work together to cleanup the BHMS. The DEQ/MWCB and the NFS have agreed that the DEQ/MWCB will take primary responsibility for implementing all reclamation activities at the BHMS, completing the design and construction of the repository located on NFS land, and be responsible for all costs associated with all reclamation activities at the BHMS. The NFS will supply a repository location located on NFS land in which all BHMS wastes located on both private and NFS lands will be disposed. A copy of the Memorandum of Understanding and Repository Agreement are included as Attachment 4.

4.0 ENDANGERMENT DETERMINATION

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the Reclamation Action selected in this Action Memorandum, may present an imminent and substantial endangerment to human health and the environment at the BHMS.

5.0 PROPOSED ACTIONS AND ESTIMATED COSTS

5.1 PROPOSED ACTIONS

5.1.1 Proposed Action Description

The preferred alternative for reclamation of the BHMS is Alternative 5b. Reclamation at the BHMS will consists of complete removal and disposal of the two waste rock dumps in an

engineering repository located an NFS land; closure of one adit with a bat friendly closure; elimination of the intermittent surface water seep at the lower waste rock dump adit; site regrading and contouring; and site revegetation. The actions stated above differ slightly from Alternative 5b as outlined in the EEE/CA. In the EEE/CA, Alternative 5b called for closure of two adits. Based on landowner public comments received during the public comment period, the landowner requested that the upper adit not be backfilled and graded (Attachment 3). Since this adit is currently completely collapsed and does not pose a safety hazard, the upper adit will remain "as is" during reclamation.

These actions are designed to achieve the reclamation objective of limiting human and ecological exposure to mine-related contaminants and reducing the mobility of those contaminants through associated solid media and surface water exposure pathways by:

- Achieving risk-based cleanup goals for metals in site waste rock and surface water.
- Eliminating the arsenic and lead ingestion and dermal contact contamination pathways to the recreational site user and wildlife through contact with site waste rock and surface water.
- Eliminating the contaminant transport pathways associated with site waste rock erosion and leaching and surface water transport.

Alternative 5b, disposal in a constructed repository on NFS land at Road Bench Site #2, is protective of human health and the environment and the most cost effective of all repository alternatives analyzed. Alternative 5b is the lowest cost because of the short haul distance from the BHMS and also offers environmental protection advantages over other sites analyzed. Because it offers the shortest haul distance from the BHMS, construction activities will generate less fugitive dust than other alternatives. Road Bench Site #2 is the highest elevation site and is potentially the most hydrologically isolated. The local topography of the site will allow for shaping the repository into the slope of the bench, creating a more naturally appearing landform. Road Bench Site #2 is also one of the least publicly accessible sites, because motor vehicle travel is limited to individuals authorized by the NFS.

The BHMS waste repository will consist of a below grade, balanced, cut-and-fill impoundment with a multilayer low-permeability cap and soil cover. The BHMS reclamation work that will be performed under Alternative 5b is summarized as:

- Construct site stormwater best management practices and controls.
- Repository site clearing, grubbing, excavation, and preparation.
- Load and haul waste to the constructed repository.
- Place, compact, and shape waste in the constructed repository.

- Construct multilayer cap and soil cover to isolate the wastes from the environment and to limit surface water infiltration.
- Construct final grading to control precipitation run-on and run-off.
- Fill, shape, and regrade HMOs and waste rock excavation areas.
- Construct subsurface infiltration trench for adit discharge.
- Close open adit with bat-friendly closure.
- Reseed and mulch final reclaimed areas.
- Install temporary fencing around repository perimeter (four strand wire and t-posts).

5.1.1.1 Address Identified Human Health and Environmental Threats

Alternatives 5b is protective of human health and the environment. This alternative effectively isolates site waste rock and associated contaminated soils from environmental receptors in an engineered repository with a multilayer low-permeability cap. The repository would have no bottom liner or leachate collection sump, but contaminant mobility would likely be completely eliminated, because the repository cap would prevent surface water infiltration through the waste rock and subsequent leaching of contaminants into the subsurface. Exposure of humans, terrestrial, and aquatic wildlife to contaminants in the adit discharge would also be mitigated through implementation of this alternative. Alternative 5b satisfies all risk-based cleanup criteria identified in the *Final Expanded Engineering Evaluation and Cost Analysis for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2011).

5.1.1.2 Justification for Proposed Alternative

The DEQ/MWCB has selected Alternative 5b because this alternative provides the best combination of remedy effectiveness, implementability, and cost effectiveness of the alternatives evaluated. Alternative 5b is the most cost-effective alternative considered for the site that would achieve all risk-based reclamation goals. Alternative 5b is readily implemented with standard construction techniques and proven technologies applicable to contaminated mine wastes in remote locations.

5.1.1.3 Technical Feasibility and Probable Effectiveness

This alternative is both technically and administratively feasible. The alternative is also implementable in a single mid-summer construction season. The excavation, hauling, compacting, grading, capping, and revegetation steps required are considered conventional construction practices; and, materials and construction methods are readily available. Design methods and requirements are well documented and well understood. Suitable earthen materials for construction are located onsite, helping to minimize construction expense.

Road Bench Site #2 provides topographic contours which facilitate repository design parameters to withstand a seismic event that would produce a horizontal ground acceleration of 0.25g. Any potential surface water leaching, erosion, and associated contaminant mobility would be remote. Resultant direct contact risks to humans, terrestrial wildlife, and aquatic wildlife from unacceptably high concentrations of site contaminants would also be remote. Contaminant toxicity would not be reduced; however, the waste would be rendered immobile and protected from surface water infiltration and other environmental transport mechanisms. Post-reclamation monitoring and maintenance would be established to ensure continued effectiveness of the Reclamation. The effectiveness of the un-lined repository with a multi-layered cap to protect human health and the environment against contamination associated with mine wastes has been proven at sites similar to the BHMS.

5.1.1.4 Short-Term Impacts

Probable short term impacts from the implementation of Alternative 5b include construction related fugitive dust and stormwater impacts. These impacts could be effectively mitigated by using water spray for dust suppression during construction activities and by constructing BMPs for stormwater control. BMPs applicable to Alternative 5b include installing silt fencing; temporary ditch and sedimentation pond construction; utilizing straw bales; installing erosion control matting; construction of berms and other surface water run-on/run-off controls; minimizing reclamation slopes; and revegetation of disturbed areas. Noise levels in the immediate vicinity of the construction area may be elevated by heavy construction equipment operation.

Short-term impacts to the nearby community of Heron may include a slight increase in demand for food, lodging, and other local services. Nearby forest campgrounds and other local communities (Trout Creek and Noxon) may also experience increased short term demand for services. Increases in local traffic are expected to be minor because the majority of the construction equipment (i.e. excavator, dozer, dumptruck) will remain onsite. FS #2290 may experience additional vehicle trips during the period of construction. These trips are expected to be limited by the relatively small crew required to complete the reclamation. FS #2290 will remain closed to the general public throughout the duration of the project.

5.1.2 Contribution to Reclamation Performance

The Reclamation described herein will address the risks to human health and wildlife from uncontrolled site contaminants associated with mine waste rock and adit discharge. Arsenic and Lead found at unacceptable levels at the BHMS are the primary contributors to human health risk while lead is the primary contributor to ecological risk. Reclamation will effectively reduce or eliminate these risks.

5.1.3 Description of Alternative Technologies

Alternative reclamation technologies were evaluated and screened pursuant to NCP procedures as described in Chapters 7 and 8 of the *Final Expanded Engineering Evaluation and Cost Analysis for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2011). A copy of the

Final EEE/CA is attached (Attachment 6).

5.1.4 Expanded Engineering Evaluation/Cost Analysis (EEE/CA)

The EEE/CA which details site characteristics and identifies and develops reclamation alternatives was prepared in 2010 and finalized in 2011 (Portage 2011). The reclamation alternatives were analyzed and evaluated in the EEE/CA and a preferred alternative was selected. The DEQ/MWCB received public comment on the preferred alternative during a 30 day public comment period (Attachment 3).

5.1.5 Applicable or Relevant and Appropriate Requirements (ARARs)

Section 300.415(i) of the National Contingency Plan (NCP) and guidance issued by the EPA require that removal actions attain Applicable or Relevant and Appropriate Requirements (ARARs) under federal or state environmental laws or facility siting laws, to the extent practicable considering the urgency of the situation and the scope of the removal (EPA 1993). ARARs were identified in Section 5 of the *Final Expanded Engineering Evaluation and Cost Analysis for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2011).

ARARs are either applicable or relevant and appropriate. Applicable requirements are those standards, requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, or contaminant found at a site and would apply in the absence of a cleanup action. Relevant and appropriate requirements are those standards, requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that are not applicable to a particular situation but apply to similar problems or situations, and therefore may be well suited requirements for a response action to address.

ARARs are divided into contaminant specific, location specific, and action specific requirements. Contaminant specific ARARs are listed according to specific media and govern the release to the environment of specific chemical compounds or materials possessing certain chemical or physical characteristics. Contaminant specific ARARs generally set health or risk based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment.

Location specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of cleanup activities because they are in specific locations. Location specific ARARs generally relate to the geographic location or physical characteristics or setting of the site, rather than to the nature of the site contaminants.

Action specific ARARs are usually technology or activity based requirements or limitations on actions taken with respect to hazardous substances.

Only the substantive portions of the requirements are ARARs. Administrative requirements are not ARARs and do not apply to actions conducted entirely onsite. Provisions of statutes or

regulations that contain general goals expressing legislative intent but are non-binding are not ARARs. In addition, in instances like the present case where the cleanup is proceeding in stages, a particular phase of the remedy may not comply with all ARARs, so long as the overall remedy does meet ARARs.

Only those State standards that are more stringent than any federal standard are considered to be an ARAR provided that these standards are identified by the State in a timely manner. To be an ARAR, a State standard must be "promulgated", which means that the standards are of general applicability and are legally enforceable. A complete list of the ARARs and their applicability to this action is found in Section 5 of the *Final Expanded Engineering Evaluation and Cost Analysis for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2011).

5.1.5.1 Surface Water ARARs

Surface water ARARs include established aquatic life and human health water quality standards which specify concentrations of a specific constituent deemed protective of human health and the environment. The more stringent of the applicable human health or aquatic water quality standards is taken to be the ARAR-based goal for surface water. Although the treatment of surface water is not addresses in the EEE/CA, the ARAR-based reclamation goals for surface water are listed, for informational purposes, in Table 23 in the *Final Expanded Engineering Evaluation and Cost Analysis for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2011).

5.1.5.2 Groundwater ARARs

Groundwater at the site is not currently used as a drinking water source, nor is it likely to be used as such in the future. Although the EEE/CA does not address treatment of groundwater, this Reclamation has the potential to improve groundwater quality through removal of potential sources of groundwater contamination. ARAR-based goals for groundwater are the State of Montana human health standards. The ARAR-based goals for groundwater are listed, for informational purposes, in Table 22 of the *Final Expanded Engineering Evaluation and Cost Analysis for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2011).

5.1.5.3 Soil ARARs

Currently, there are no promulgated standards for metal concentrations in soil that may be used as a chemical-specific reclamation-based ARAR. The DEQ/MWCB has developed a conservative set of RBCGs that are calculated for different contaminants using a recreational visitor exposure pathway scenario. The risk-based cleanup goals are listed in Table 24 of the *Final Expanded Engineering Evaluation and Cost Analysis for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2011).

5.1.6 Project Schedule

It is anticipated that construction activities related to the implementation of Alternative 5b would be completed over a single, mid-summer, season in 2011. Construction activities would begin

after July 4th, 2011 and are estimated to take no longer than six weeks to complete. It is anticipated that construction would be completed prior to September 1, 2011.

6.0 ESTIMATED COSTS

Estimated cost to implement Alternative 5b is $245,507. This includes the present value cost of reclamation construction and 30 years of monitoring and maintenance. A detailed cost breakdown for the selected Reclamation Action is included in the *Final Expanded Engineering Evaluation and Cost Analysis for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2011).

7.0 EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

If no action is taken to stabilize and isolate BHMS wastes from the public, site contaminants (i.e. arsenic and lead) will continue to be mobilized from site wastes through leaching, erosion, and other transport mechanisms. The surrounding environment will continue to be impacted and the site will continue to present an unacceptable risk to human and ecologic receptors.

8.0 OUTSTANDING POLICY ISSUES

There are no known outstanding policy issues regarding the planned BHMS reclamation detailed in the *Final Expanded Engineering Evaluation and Cost Analysis for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2011).

9.0 ENFORCEMENT

The DEQ/MWCB is exercising its authority delegated by the U.S Office of Surface Mining, Reclamation and Enforcement, to administer the Abandoned Mine Land (AML) Reclamation program in accordance with the State of Montana's Reclamation Plan. The DEQ/MWCB will be the lead agency for reclamation at the BHMS.

10.0 RECOMMENDATION

This decision document identifies, describes, and explains the preferred reclamation alternative for the removal and disposal of waste rock and associated contaminated soils at the BHMS. This document was developed in accordance with the NCP, and is not inconsistent with CERCLA, as amended. This decision is based on the administrative record for the site. Conditions at the site meet the NCP section 300.415(b)(2) criteria for a removal and I recommend approval of this Reclamation Action.

John Koerth, Supervisor
DEQ Abandoned Mine Section

5/11/2011
Date

Attachment 1

References

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RTI, 2002. Past and Present Landownership/Mine Operators Investigation Phase I, Renewable Technologies, Inc., August 2002.

Attachment 2

Figures

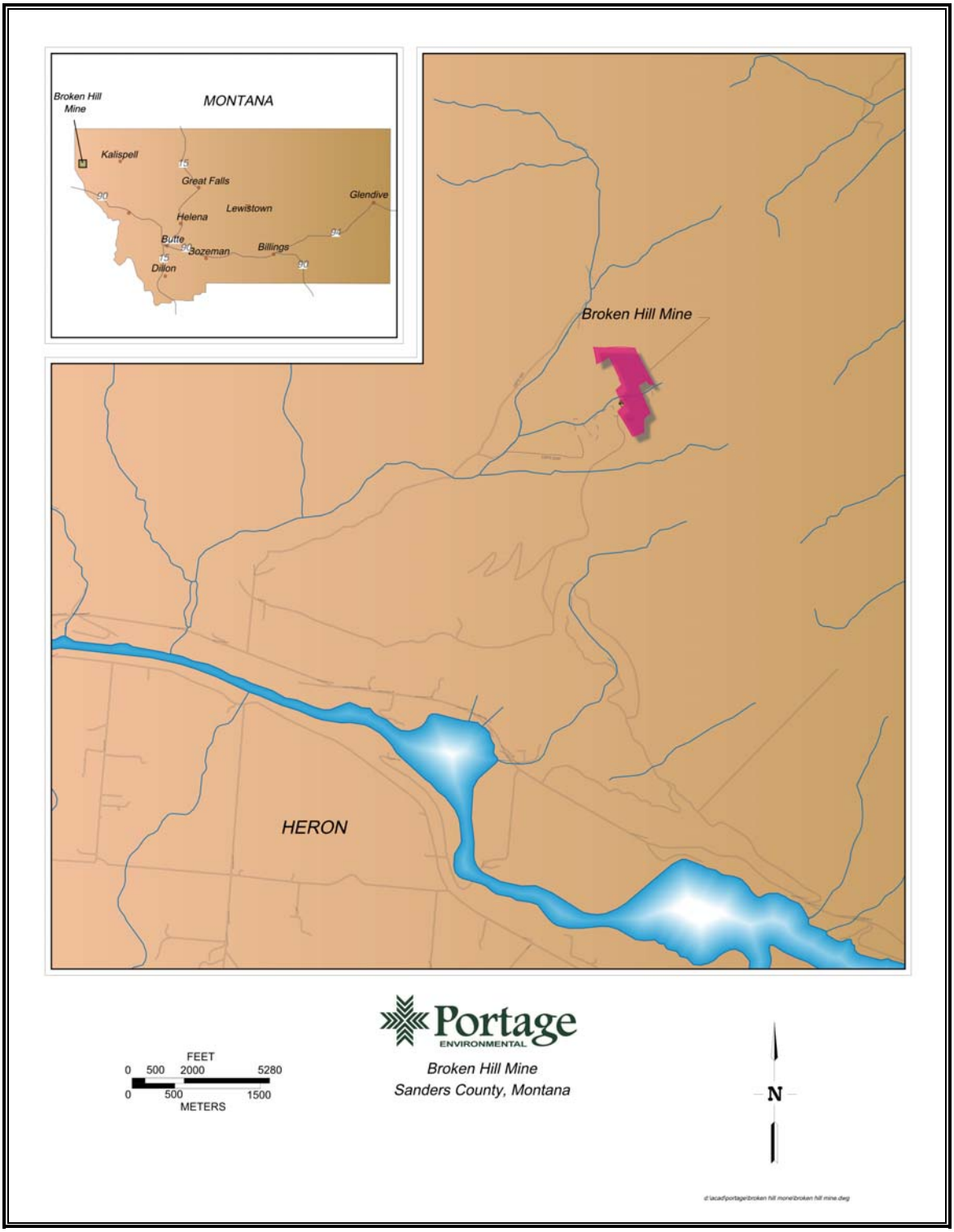


Figure 1. The BHMS within Montana

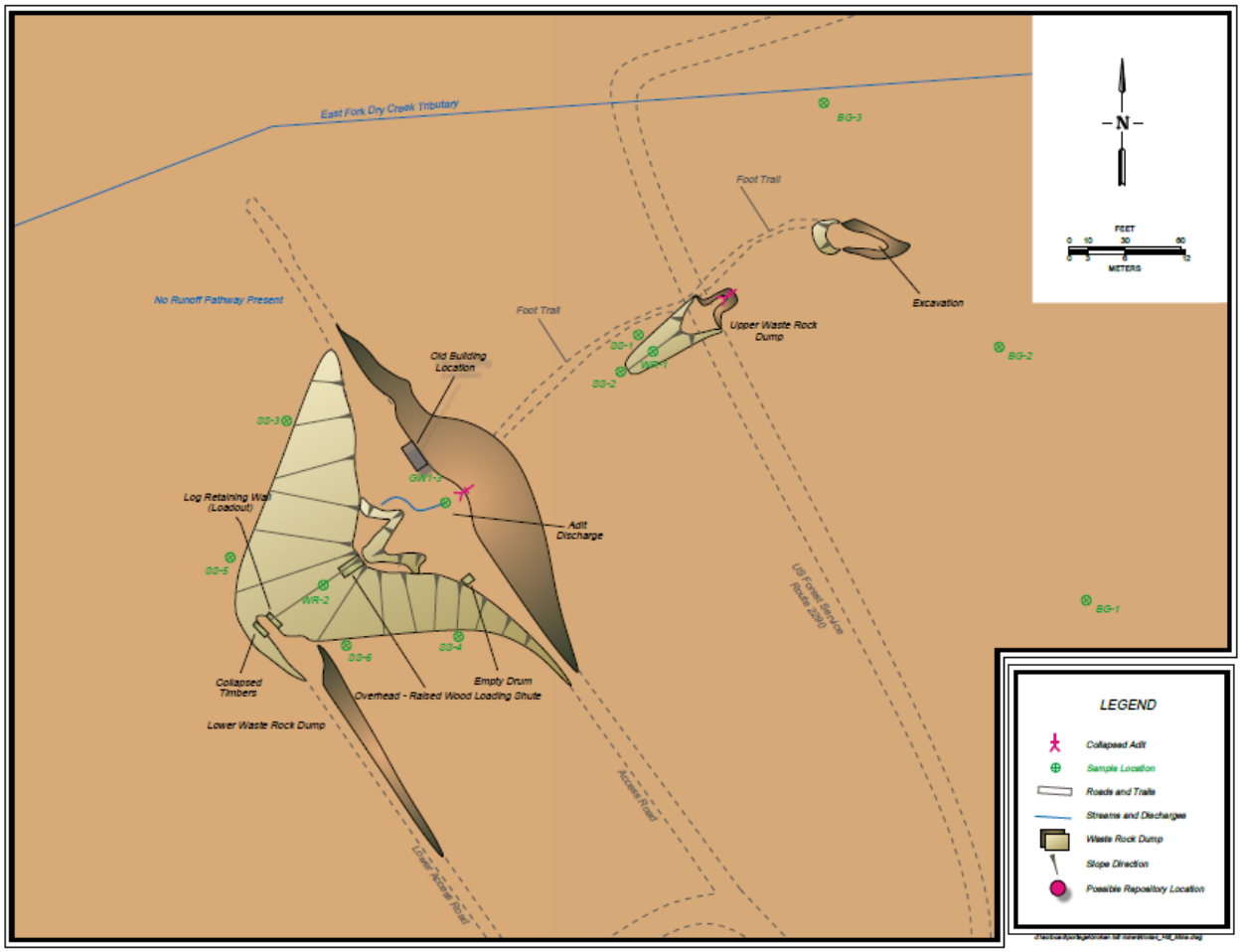


Figure 2. BHMS Site Features

Attachment 3

Public Comments and Response to Public Comments

Montana Department of
ENVIRONMENTAL QUALITY
Brian Schweitzer, Governor
P. O. Box 200901 Helena, MT 59620-0901 (406) 444-2544 Website: www.deq.mt.gov

March 29, 2011

Broken Hill Mine Reclamation Project
Sanders County, Montana

DEQ Response to Public Comments on the Expanded Engineering Evaluation and Cost Analysis (EEE/CA)

WRITTEN COMMENTS AND ANSWERS:

Comment 1, Mine Adit Openings: Our primary comments pertain to the adits that exist on the upper and lower excavation areas. Within the reclamation proposal document, MDEQ has the 2 existing adits scheduled to be closed during the restoration work. During the public meeting you indicated that the general plan was to place bat gates on the mine openings.

Our intention was to open the adits and utilize the mines for future storage and access on our property during the summer /fall of 2011. Currently, we cannot remove the waste rock from the entrance to the mine shafts until fall of 2011. We are sure MDEQ will agree that the waste rock from the mine entrance should be deposited in the lower repository. It is therefore our proposal that DEQ will provide for the excavation of the mine entrances during the reclamation process to ensure that all mine tailings will be removed from the clean up area. During this time the mine tailings in the adit entrance would be transported to the lower repository along with the other mine tailings.

As landowners, we strongly support the proposed action of placing bat gates onto each of the adit openings. We would of course request a key to the gates for our personal access.

Answer 1: The lower adit portal is located on Forest Service property and is currently open (Attachment 1, Photo 1). The upper adit is located on private lands and appears to be completely collapsed. When a bat survey has not been performed at an abandoned mine project site, it is Department of Environmental Quality Abandoned Mine Section (DEQ AMS) general practice to place bat friendly closures on open mine features that may provide bat habitat. This is done to eliminate human and ecological safety hazards while maintaining bat habitat. A bat friendly closure consists of a culvert with a bat friendly grate placed either in the culvert or on the end of the culvert (Attachment 1, Photo 2).

In the event the property owner wishes to have access to the mine working for future mining related purposes, a removable bar with a lock may be placed across the grate (Attachment 1, Photo 3). This culvert and grate is placed in the mine opening and the area around the culvert is backfilled and graded to match the surrounding topography. Attachment 2 shows a conceptual drawing of a typical bat friendly closure and access culvert. The actual design of the bat friendly closure will be completed during the Engineering Design and Bid Document Preparation phase of the project.

Excavation and grading of the lower adit portal will be limited to removing the waste rock from the environment and providing access for the bat friendly closure placement. The waste rock will be hauled and placed in the repository. Since one of the purposes of DEQ AMS reclamation projects is to reduce safety hazards associated with open mine portals, the lower adit portal will not be excavated, opened, and graded for the purposes of allowing mine rehabilitation and human access. Future property owner access to the mine working would be through the culvert by removing the bar and lock. A key to the lock would be provided to the landowner.

The upper adit portal is currently collapsed, does not provide bat habitat, and poses a limited safety risk. DEQ AMS projects are focused on closing portals to eliminate safety hazards. Since the upper adit portal is already collapsed, DEQ AMS will not open this portal and create a possible safety hazard liability. Waste rock around and near portal will be excavated and transported to the repository. DEQ AMS general practice is to leave the collapsed adits as is or backfill and grade the adits to match the surrounding topography. Per the preferred alternative outlined in the EEE/CA, the upper adit portal is planned to backfilled and graded to match the surrounding topography.

Comment 2, Repository Bench Sites: As landowners and residents of the nearest private property to the proposed repositories, we have major concerns on the placement of mine tailings into repository #2. . From our observations of the attached map, the proposed Bench site #2 is immediately adjacent to the Broken Hill Private properties and will provide risk of human exposure both short and long term to the residents of the private properties. We feel that repository #2 would be a more suitable for the following rationale:

1. Bench site #1 is further than bench site #2 from the private properties and would provide a lesser amount of risk to humans. Bench site #1 provides the best minimal exposure to human contact as it is farther from the private properties.
2. Bench site #1 is larger than bench site #2 and will therefore provide more of a suitable repository.
3. Bench site #1 is estimated to cost $250,078. Bench site #2 is estimated to cost $245,507. We feel that the small amount of cost difference is justified when considering the repository would be located the farthest distance possible from human exposure.

Answer 2: Road Bench Site #2 is located approximately 0.5 mile, via Forest Service (FS) 2290, closer to the BHMS than Road Bench Site #1. Both potential repository sites are located United States Forest Service (USFS) property. With increasing fuel costs, every extra bit of haul distance will make a difference in cost. Below is a general breakdown of hauling distance for Road Bench Site #2 vs. Road Bench Site #1. (Note: All distances were approximated using GIS software.)

Road Bench Site #2
4,100 cubic yards waste (cy) x 10 cy/truck trip to repository = 410 truck trips to repository

Broken Hill Mine to Road Bench Site #2 via FS 2290 = 0.9 miles/round trip

410 truck trips to repository x 0.9 miles/round trip = 377 miles

Road Bench Site #1
4,100 cubic yards waste (cy) x 10 cy/truck trip to repository = 410 truck trips to repository

Broken Hill Mine to Road Bench Site #2 via FS 2290 = 1.7 miles/round trip

410 truck trips to repository x 1.7 miles/round trip = 713 miles

Hauling to Road Bench Site #1 would be an additional 336 miles of haul distance throughout the duration of the project. Since Road Bench Site #1 is twice the roundtrip haul distance of Road Bench Site #2, assuming the same number of haul trucks are used, hauling the waste material to Road Bench Site #1 would take approximately twice as long as hauling to Road Bench Site #2. Hauling to Road Bench Site #1 would also require more roadwork and more switchbacks to navigate and upgrade which would add additional time to complete the project.

Additionally, a survey would need to be completed at the Road Bench #1 Site before an engineering design could be completed. We currently have survey data for Road Bench Site #2. This project is scheduled to be completed this summer while funding is available. DEQ AMS would not have sufficient time to complete a survey at the Road Bench #1 Site (which would cost additional money), complete an engineering design, complete the public bidding process, and complete construction of the project in summer 2011. Also, there is no guarantee that DEQ AMS funding will be available next year to complete this project. Funding is available this year. Since the preference (weather permitting) is to complete the project by September 1, 2011, Road Bench Site #2 is more economical and would allow the project to be completed this year in a much shorter time frame.

The results of the Repository Investigation that was performed in May 2010, concluded that "Each site has sufficient area for repository construction (at least ¾ acres)…" and that "Because no one site has an advantage over another based on geotechnical consideration, the choice of preferred repository site is based on factors which affect cost (haul distance), environmental concerns, visual impact, and other." Based on these findings, the difference in area between the different repository sites is not a factor for choosing the preferred repository location.

The purpose of placing the waste material in a lined, capped, engineered repository is to isolate the waste material from human contact and the environment thus eliminating short and long term exposure risks. The repository will consist of excavating a hole in the ground, placing the waste material in the hole, capping the repository with an approximate three foot thick multilayer cap, revegetating the repository with a native grass mix, and placing woody debris along the edge and on top of the repository. This will help discourage people from walking on the repository and help the vegetation become established more quickly. The basic design of the repository would be the same regardless of chosen repository location.

With proper repository design and construction, there should be no short or long term exposure risk. To ensure the repository is properly designed to encapsulate and isolate the waste material from human exposure and the environment, the design will be completed by a licensed professional engineer. To ensure the repository is constructed properly, DEQ AMS will contract with the design engineering firm to provide full time project oversight. Also, the waste material will be located under an approximate three foot multilayer cap, so there should be no short or long term exposure risk to the public or private property owners regardless of the repository location.

Public access to both repository locations is very limited as FS 2290 is closed to motorized vehicles above the Forest Service gate for grizzly bear habitat. This gate will remain closed to the public throughout the duration of the project. The privately owned cabin which is used for seasonal recreational use is the closest human recreational residence to the Road Bench Site #2 and is located approximately 0.5 miles away from Road Bench Site #2 via FS 2290.

After taking this comment into consideration, Road Bench Site #2 is still the preferred repository location based on reduced projects costs, ability to complete the project this year with the goal of finishing construction by September 1, 2011 (weather permitting), current funding availability, remoteness of the repository location, and repository site ability to meet project reclamation goals and objectives.

Comment 3, Water Off Cap Onto FS 2290: Is there a plan to place a culvert under FS 2290 after the waste repository is constructed? We feel that there may be a significant risk of erosion and wash out of FS 2290 if the synthetic liner is placed onto the waste

rock directly above FS 2290 as proposed. It seems that the water would was onto the road and provide a risk of wash out. Is it feasible for a ditch or catch basin to be constructed around the cap and possibly funneling into a culvert that would go under FS 2290? It appears that bench site #2 is directly above FS 2290. Is Bench Site #1 Directly above FS 2290 as well? This may be additional rationale for using bench site #1 vs. Bench site #2.

Answer 3: Because of the vegetative cap, final grades, and small disturbed acreage, future runoff from the cap and associated reclaimed acreage should be minimal. During construction, sediment control best management practices (BMPs, examples include drain dips, silt fence, straw wattles, other erosion control technologies) would be installed. These BMPs would remain in place until all disturbed areas are fully revegetated and stable. In additional, all disturbed areas will be revegetated with a native seed mixture. Site grading will be designed and constructed to minimize runon/runoff.

Road Bench Site #1 is generally located on the southern end of a FS 2290 switchback and Road Bench Site #2 is nestled in between the upper and lower ends of a switchback on FS 2290 (see Appendix D of the Repository Investigation Report for the Broken Hill Mine Site, Sanders County, Montana, September 2010, for maps showing the exact location of repository test pits and perimeter boundaries). A repository typically has a channel around the repository that serves to capture surface water and route and disperse the water around the repository. The actual repository design and runon/runoff control locations will be designed during the Engineering Design and Bid Document phase of the project.

With proper repository cap design and installation of BMPs, it is not anticipated that there will be an increase in stormwater water runoff above what is currently being delivered via snowmelt and precipitation runoff. Therefore, it is not anticipated that stormwater will need to be directed under the roadway. If during the Engineering Design and Bid Document Preparation phase of the project USFS hydrologic personnel determine that a culvert is necessary, the culvert would be sized and installed per USFS specifications.

Comment 4, Forest Road 2290 Road Preparation: Significant improvements will need to be made to FS 2290. We did not see a budget for this in the Analysis Report. Could you describe in more detail what will be done and what the expected cost will be? There are 2 locations on the road that may require the installation of culverts where small annual streams cross over the road. This would reduce erosion and ensure future use of the road after the BHMS restoration is complete.

Answer 4: Because of the small size of the job, limited construction equipment anticipated to complete the job, and limited heavy equipment and truck traffic on FS

2290, there will not be significant improvements to FS 2290. Minor road improvements anticipated include clearing downed trees, minor brushing to allow the passage of heavy equipment, and installing standard BMPs to reduce erosion and sediment. Limited quantities of road-base gravel may be placed in high traffic areas (i.e. the working pad for repository construction). Major earthmoving equipment will be mobilized to the jobsite (most likely unloaded toward the bottom of FS 2290 and walked in), remain at the jobsite during the duration of the project, and demobilized when the project is complete. Two to four light vehicle trips per work day are anticipated to be the only daily traffic up and down FS 2290. The FS gate on FS2290 will remain locked and closed to the public during the duration of the project. If during the Engineering Design and Bid Document Preparation phase of the project USFS hydrologic personnel determine that a culvert is necessary, the culvert would be sized and installed per USFS specifications.

At the BHMS, road improvements will need to be made to connect access from an old mining road at the lower waste rock dump to FR 2290 (see Attachment 3). Anticipated improvements include clearing trees and other obstacles on the old mining road to allow equipment access and minor excavation and grading to connect the two roads. At the repository site, a realignment of FR 2290 will also be required to provide access to the repository location and a working area for construction.

Comment 5, Retain possession of Ore Bin, Load Out, and any other structures indentified during Clean Up: We would like to retain the ore bin, and any other artifacts of cultural significance that are identified during the clean up process. Also pertaining to any artifacts / tools etc. that are identified in the mine shafts. We would like any cabins / load outs left intact if possible (possibly waste material can be removed around these structures?)

Answer 5: It is anticipated that waste material can reasonably be removed around these types of mining related structures without damaging their integrity. All historic artifacts found during site cleanup will be left at the site. In DEQ AMS construction contracts, there is a provision related to the protection of historical findings. The purpose of this provision is to protect historical findings and prevent their removal from the project site. This provision requires the construction contractor to stop operations and immediately report the discovery of historic artifacts, structures, remain, etc. to the project engineer. This provision also imposes a $500.00 per artifact penalty levied against the Contractor for disturbing or removing artifacts from the site without DEQ AMS approval.

Comment 6, Post Analysis of water in lower creek beneath BHMS: To our knowledge, there was no analysis done on the water in the creek that is located directly below the lower Mine Shaft. During the clean up process could MDEQ do an analysis on this spring to identify if we can use this water as a viable water source?

Answer 6: Based on the spring location on the map provided related to this comment, no analysis of this spring water was conducted during the Reclamation Investigation (RI). During the RI, the only water sample that was collected was from the discharging adit at the lower waste rock dump. This water exceeds the human health drinking water standard for arsenic and lead and exceeded aquatic life standards for cadmium, lead, and zinc. Sampling of surface waters outside of the BHMS project area is outside of the scope of this project. Costs associated with such sampling cannot be justified by DEQ AMS since determining a viable drinking water sources is not within the scope of this project.

Comment 7, Post Mine reclamation of the mine site: Could you describe how / what nutrients will be added to the mine site after the waste rock has been removed and what / if there is a plan to place native seeds / forage at the site for the rehabilitation?

Answer 7: All disturbed areas at the BHMS and the repository will be revegetated, fertilized, and mulched upon completion of construction activities. These areas will include waste rock removal areas, areas around excavation that have been disturbed by heavy equipment, haul roads, and all other areas where heavy equipment operation has disturbed the native ground. These areas will be revegetated using a native seed mix. This seed mix will likely include the following: tufted hairgrass (10 pure live seed (PLS)/acre), rough bentgrass (10 PLS/acre), Idaho fescue (10 PLS/acre), bluebunch wheatgrass (10 PLS/acre), and annual rye (20 PLS/acre). Depending on the application method used (hydroseed, broadcast, etc), these application rates may be required to be doubled. This is the seed mix and application rate that was approved and used by the USFS on the Scotchman Mine Reclamation Project which was completed in the Blue Creek drainage in 2010. Once the disturbed areas have been graded, and covered with topsoil, if necessary, native seed will be placed on all disturbed areas. Fertilizer will then be applied followed by mulch and other appropriate BMPs for erosion control. Based on laboratory analysis of soil in the vicinity of the BHMS, the following fertilizer rate was recommended: nitrogen (25 pounds (lbs)/acre), phosphorus (20 lbs/acre), potassium (30 lbs/acre), and zinc (2 lbs/acre). The actual seed mix, application rate, and fertilizer application rate will be determined during the Engineering Design and Bid Document preparation phase of this project.

Comment 8, Work Schedule: We are hoping that all work will be completed by August 15 and at the latest September 1. We will be hunting on the property during the month of September.

Answer 8: DEQ AMS anticipates that the project could reasonably be completed by September 1, 2011. However, the start of construction activities is very weather dependent as access to the site is required to begin the bidding process. At this time, DEQ AMS cannot predict when access to the site will be available, so an exact construction schedule cannot yet be determined. Since a September 1, 2011, completion date was requested by the BHMS landowner and by the Montana Fish Wildlife and Parks, DEQ AMS will make every reasonable attempt to complete this project by this date. Due to grizzly bear habitat, the project cannot begin before June 17, 2011. A 45 to 60 day construction contract is anticipated for this project. The exact number of contract days will be determined during the Engineering Design and Bid Document phase of this project.

Comment 9, Post Construction Weed Control on Forest Service Road 2290, Private Road and BHMS: We did not see any analysis to address significant disturbances to FS 2290 that will take place during the heavy use of the road and subsequent weed problems that will occur after the disturbances. We would like to request that MDEQ perform spraying / weed control as part of the post project work. Could you send us a plan that would address these issues?

Answer 9: As was stated in the response to Comment 4, significant disturbance to FS 2290 is not anticipated. DEQ AMS construction contracts and the USFS require the construction contractor to clean all equipment with a high-pressure washer prior to being mobilized to the project site to ensure no weeds are imported to the work area. This equipment is also inspected by the project engineer to ensure it has been cleaned prior to mobilization. The construction contractor is also required to submit a Weed Control Plan to DEQ AMS for review prior to beginning the project. DEQ AMS construction contracts also state that "If there is an abnormal growth of noxious weeds on the Project site after construction as determined by Engineer or local weed control authority, Contractor shall be responsible for weed control under Contractor's General Warranty and Guarantee, General Conditions, Paragraph 6.19.C."

During previous site visits, DEQ AMS observed a significant amount of knapweed on FS 2290. These observations show that noxious weeds are already present in proposed work areas. DEQ AMS conducts annual monitoring of reclaimed areas (this will include public and private lands involved with the project) for a period of three years following completion of construction activities. After this three year maintenance period, it is the private landowner's responsibility to maintain weed control on the private land, and the USFS's responsibility to maintain weed control USFS land. DEQ AMS annual monitoring generally includes spraying for weeds if a weed problem is

determined to be present. The USFS monitors forest service roads for weeds every two to three years and treats accordingly. For the BHMS project, the USFS plans to conduct annual monitoring for a few years to monitor for new populations of weeds on forest service land and treat accordingly.

Comment 10, Passing of Contact Info to Contractors: Feel free to pass on our contact info to Contractors who may be performing the work. We have a cabin located on the property that could be utilized for the contracting work and this reduction in travel expenses / lodging could result in a lower bid price to MDEQ for the project.

Answer 10: The BHMS and repository location are both located within Bear Management Unit 4 of the Cabinet-Yaak Grizzly Bear Recovery Zone. DEQ AMS is required to consult with wildlife officials on threatened or endangered species as part of the approval process to begin reclamation projects. During this consultation, comments were received from local wildlife officials that required that there be no camping at the jobsite and that all food and garbage be stored in a bear resistant manner.

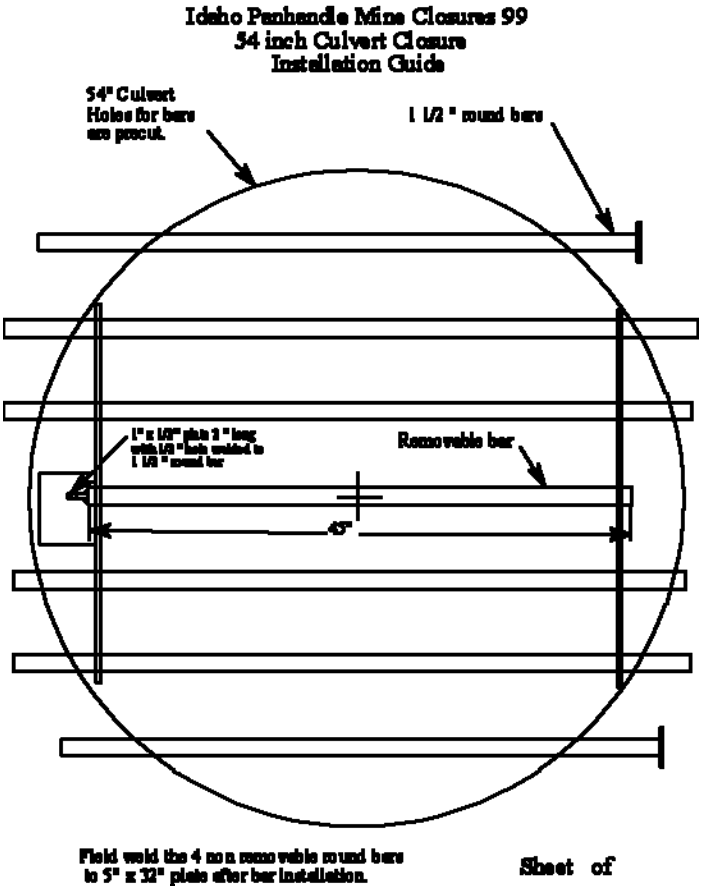
DEQ AMS requires a mandatory pre-bid walk through for all contractors wishing to bid on the project and any interested public. During this walk through the project areas are visited and the scope of work is discussed. This ensures that all bidders have actually seen the project site. As the landowner, you are welcome to attend this walk through and make your contact information available to bidding contractors. Any other member of the public is also welcome to attend the walk through to provide lodging information.

Attachment 1

Photo 1: Lower Adit Portal

Attachment 1 Cont.

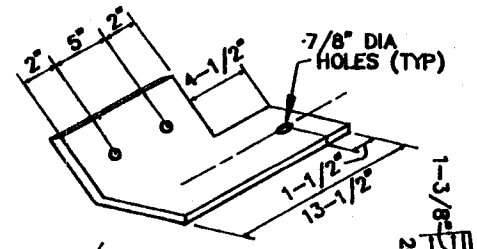
Photo 2: Example Bat Friendly Adit Closure with Access

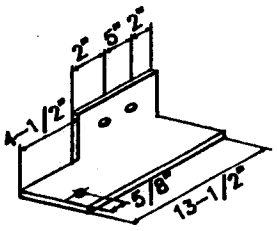


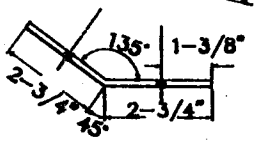
Attachement 1 Cont.

Photo 3: Example Bat Friendly Adit Closure with Access

NOTE: BRACKET AND GRATE DIM. VARY WITH CULVERT DIA. (DRAWING DIA. = 48") DIM. SHALL BE DETERMINED BY SUPPLIER AND INDICATED ON SUBMITTALS.







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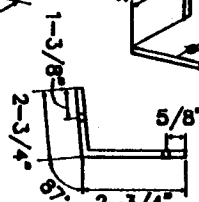

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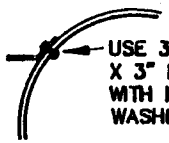

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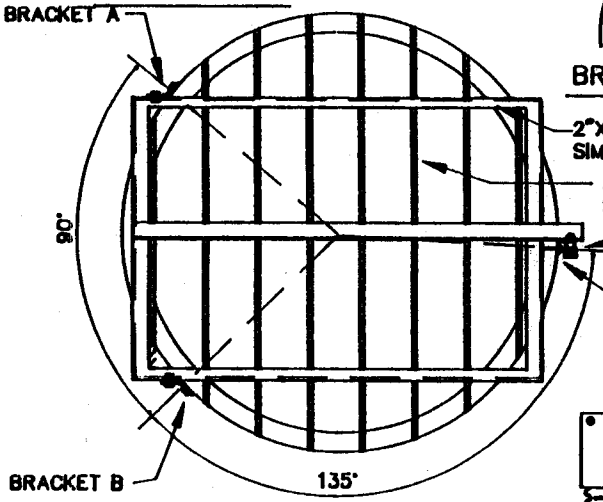
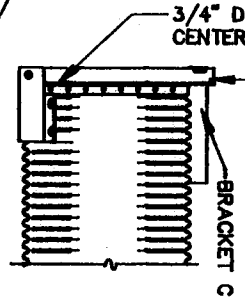
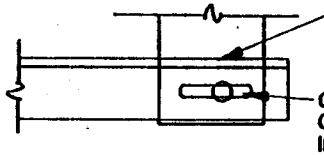


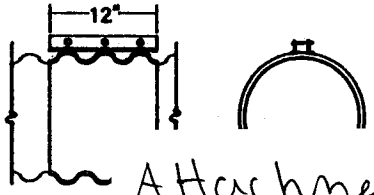
GATE FRAME DETAIL



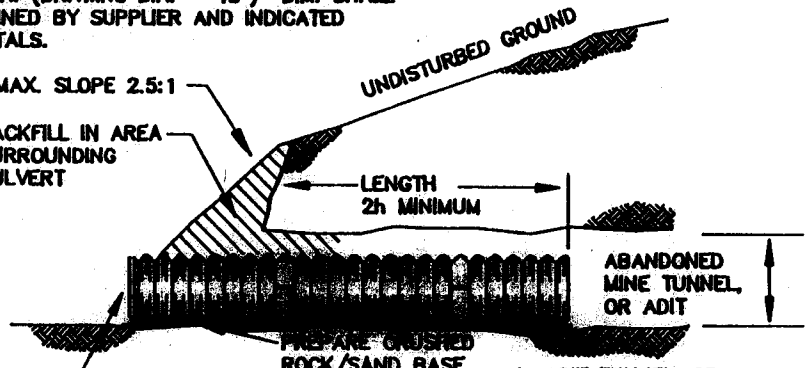


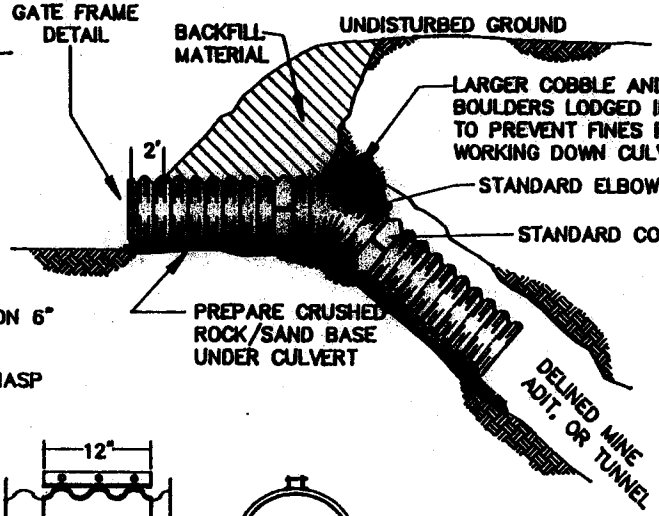
LOCK ASSEMBLY DETAIL

GATE FRAME–PLAN VIEW



PIPE





GENERAL NOTES

AFTER PIPE SECTIONS ARE PLACED THE SURROUNDING VOID WILL BE BACKFILLED.

SUFFICIENT BACKFILL MATERIAL IS NEEDED TO SECURE THE PIPE AND CLOSE THE ORIGINAL ADIT ENTRANCE.

UNLESS OTHERWISE SHOWN, ALL JOINTS OR CONNECTIONS ARE TO BE WELDED.

Attachment 2

NO SCALE

STATE OF MONTANA
DEPARTMENT OF STATE LANDS

ACCESS CULVERT INSTALLATION

DRAWING No. 413.01

Lower Waste Rock Pile

To upper Waste Rock Dump

ROAD 2

ROAD 3

ROAD 1

KOOTENAI NATIONAL FOREST

DJA BPC 5

DJA BPC 14

DJA BPC 13

DJA ALUM. CAP 21

BRASS CAP 10

BRASS CAP 11

N71°30'13"E 85.36'

LEGEND

- SET 5/8" X 18" REBAR WITH 2" ALUMINUM CAP, MK'D. DJ&A CP
- SET NAIL
- SET 3/8" X 18" REBAR WITH 3/4" BLUE PLASTIC CAP (BPC), MK'D DJ&A CP
- FOUND 3 1/2" BRASS CAP MK'D AS SHOWN
- SOIL TEST
- MINE ADIT
- DECIDUOUS TREE
- EVERGREEN TREE
- 3575 MAJOR CONTOUR
- MINOR CONTOUR
- PROPERTY LINE
- EDGE OF ROAD
- TOP OF BANK
- TOE OF BANK

BROKEN HILL
MS 10572

Road improvements required to connect Lower Waste Rock Dump access road with FS 8290.

BOBBY
MS 10572

KOOTENAI NATIONAL FOREST

FS 8290

ROAD 1

To repository

N

0 40 80

SCALE IN FEET

SEE SHEET 3

Attachment 3

BY	DATE	REVISION DESCRIPTION

Nov 04, 2010 – 11:36am F:\5759.29 – Broken Hill Repository-COPY\dwg\575929-BASE.dwg

DESIGN ____ PROJ. NO. 5759.29
DRAWN ML DATE 10/2010
CHECKED KL SURVEYED DJA

DJ&A, P.C.
CONSULTING ENGINEERS & LAND SURVEYORS
3203 Russell Street, Missoula, Montana 59801-8591
Phone 406/721-4325 Fax 406/549-6371

MONTANA
DEPT OF ENVIROMENTAL QUALITY
HERON, MONTANA

SITE & TOPOGRAPHIC MAP

SHEET 2 OF 8

Hello Pebbles,

Thank you for your timely responses to our comments for the Broken Hill Mine restoration project. Your responses provided us with answers to our questions.

We, the members of the Broken Hill private properties feel that the comments have been adequately addressed and understand the rationale behind your responses to the comments. We only have one issue that will need to be addressed regarding the project.

The issue pertains to the upper adit opening. We, the landowners have had several discussions regarding this issue and have agreed that we do not want the adit entrance backfilled as suggested in the response to our comments. We feel that the upper mine adit, although collapsed at the current time, provides significant financial value to the property in the form of future access and storage space for our residences. As outlined in our comment #1, our intention is to open the upper adit and utilize it for future storage and access on our property during fall of 2011.

Unfortunately, at the current time it does not appear we will be able to get an excavator to the site and open the adit until the fall of 2011. So this leaves us with an issue regarding opening the adit and what will be done with any waste rock that is removed from the mine entrance if the adit material is removed after DEQ has performs the clean up action in summer of 2011.

We feel it is in the best interest of all involved to arrange for the removal of the waste material and mine tailings in the upper adit opeing to be transported to the waste repository along with the other mine tailings that DEQ. For this to happen, the entrance to the upper adit would need to excavated prior to or during the scheduled DEQ clean up efforts.

As landowners of the Broken hill properties we propose the following:

1. DEQ will arrange for the DEQ selected contractor to coordinate with Broken Hill property owners for removal of the tailings and debris from the upper adit. Broken Hill private property owners will pay for the excavation of the tailings from the adit entrance (This would be a fair hourly rate charged by contractor we estimate for 4 – 6 hours no more than $1,000). These hazardous materials can then be transferred to the lower repository with the rest of the hazardous materials.

We feel that this is a very good faith compromise to the situation and are willing to pay for the contractor for their services. We feel that both DEQ project and private landowners would both benefit in regards to ensuring that hazardous / toxic materials which currently block the upper adit would be placed in the repository with the other hazardous materials and would not be exposed during future excavations of the adit.

At a bare minimum we will request that DEQ perform no backfill or grading on the upper adit during the project, and we will proceed with opening the upper adit during the fall of 2011. We do however, hope that DEQ will consider the rational approach outlined above and will be willing to work with the landowners to find a solution that will work for / benefit all parties.

Thank You,

Tyson Jerald and Broken Hill Property Owners

Montana Department of
ENVIRONMENTAL QUALITY
Brian Schweitzer, Governor
P. O. Box 200901 Helena, MT 59620-0901 (406) 444-2544 Website: www.deq.mt.gov

April 7, 2011

Tyson Jerald
211 San Remo Ln.
Chelan, WA 98816

Re: Response to Comment Submitted via Email on April 5, 2011, Regarding the Upper Adit at the Broken Hill Mine, Sanders County, Montana

Dear Mr. Jerald:

Thank you for your letter expressing the local private landowners' concerns about the plan to backfill and grade the upper mine adit at the Broken Hill Mine (site). This adit is currently completely collapsed and is considered a closed adit by DEQ. I understand that the Broken Hill property owners wish to have the upper mine adit left "as is" to facilitate their future plans for the site and not be backfilled and graded as proposed in the Expanded Engineering Evaluation and Cost Analysis (EEE/CA). Per this request, the currently closed upper mine adit will not be backfilled and graded during reclamation activities planned for summer 2011. It will be left in its current collapsed and closed state. If disturbance to this area is required to facilitate other construction activities, DEQ will work with the private landowners to leave this area in a state that does not compromise their future plans for the site.

DEQ would like to express concerns about your proposal to reopen the upper mine adit. In Montana, having an open mine adit on your property is a misdemeanor criminal offense. I have attached a copy of 45-8-113 Montana Code Annotated (MCA) for your records. Since it would be a violation of Montana statute 45-8-113(1)(b) MCA, DEQ cannot excavate and open this adit, nor can DEQ agree to perform this work for you.

I encourage the private landowners to meet with myself and the project engineer at the site before or during the initial stages of construction to ensure construction activities are meeting your needs to the extent we can under Montana law.

As always, please let me know if you have any questions concerning the project as we move forward. I can be reached at my office telephone (406) 841-5028 or through email at pclark2@mt.gov.

Sincerely,

Pebbles Clark

Pebbles Clark
Reclamation Specialist
Mine Waste Cleanup Bureau
Abandoned Mine Program

Enc: 45-8-113 MCA

45-8-113. Creating hazard. (1) A person commits the offense of creating a hazard if the person knowingly:

(a) discards in any place where it might attract children a container having a compartment of more than 1 1/2 cubic feet capacity and a door or lid that locks or fastens automatically when closed and cannot easily be opened from the inside and fails to remove the door, lid, or locking or fastening device;

(b) being the owner or otherwise having possession of property upon which there is a well, cistern, cesspool, mine shaft, or other hole of a depth of 4 feet or more and a top width of 12 inches or more, fails to cover or fence it with a suitable protective construction;

(c) tampers with an aircraft without the consent of the owner;

(d) being the owner or otherwise having possession of property upon which there is a steam engine or steam boiler, continues to use a steam engine or steam boiler that is in an unsafe condition;

(e) being a person in the act of game hunting, acts in a negligent manner or knowingly fails to give all reasonable assistance to any person whom the person has injured; or

(f) deposits any hard substance upon or between any railroad tracks that will tend to derail railroad cars or other vehicles.

(2) A person convicted of the offense of creating a hazard shall be fined not to exceed $500 or be imprisoned in the county jail for a term not to exceed 6 months, or both.

History: En. 94-8-108 by Sec. 1, Ch. 513, L. 1973; amd. Sec. 31, Ch. 359, L. 1977; R.C.M. 1947, 94-8-108; amd. Sec. 1699, Ch. 56, L. 2009.

Attachment 4

Memorandum of Understanding
And
Repository Agreement

FS Agreement No. 10-MU-11011400-032
Cooperator Agreement No.

MEMORANDUM OF UNDERSTANDING
Between The
MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
AND THE
U.S. FOREST SERVICE
KOOTENAI NATIONAL FOREST
Regarding
ABANDONED MINE RECLAMATION IN
SANDERS COUNTY, MONTANA

This MEMORANDUM OF UNDERSTANDING (MOU) is hereby made and entered into by and between the Montana Department of Environmental Quality, hereinafter referred to as DEQ and the U.S. Forest Service, Kootenai National Forest, hereinafter referred to as the Forest Service.

Background:

It has been shown that historic mine and mill sites ("Site" or "Sites") are located in various watersheds within Sanders County (County). Waste rock dumps and mill tailings impoundments associated with these historic sites contain heavy metal such as lead, arsenic, copper, and zinc and are located in or adjacent to streams or floodplains within theses drainages. These metals are in concentrations that pose a potential threat to human health and the environment and have the potential to create an economic impact to water and land resources.

Pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. §9601 et seq., the President has authority to respond to releases of pollutants, contaminant, and hazardous substances to protect the public health or welfare or the environment.

Pursuant to Executive Orders 12580 and 13016, the President delegated authority to conduct various activities under CERCLA, including investigations and response activities (42 U.S.C. §9604), abatement actions (42 U.S.C. §9606), cost recovery (42 U.S.C. §9607), and entering into agreements with potentially responsible parties (PRPs) to perform work (42 U.S.C. §9622), to the heads of several executive departments and agencies, including the EPA and the United States Department of Agriculture (USDA).

The Secretary of Agriculture has re-delegated his authorities under Executive Orders 12580 to the Forest Service with respect to land and facilities under Forest Service jurisdiction, custody or control (hereinafter referred to as National Forest System or NFS lands). 7 CFR § 2.60(a)(40). The Secretary of Agriculture re-delegated his authority under Executive Order 13016 with respect to NFS land and resources to the Chief of the Forest Service and the Director of the USDA Office of Procurement and Property

Management, to be exercised with the concurrence of the General Counsel. 7 CFR § 2.93(a)(17)(xiv) (68 Fed. Reg. 27431, 27448, May 20, 2003).

The Forest Service administers National Forest System lands on behalf of the public. The Forest Service is, with certain limitations, delegated the President's CERCLA authority where a release of a hazardous substance is on or the sole source of a release is from a facility under the jurisdiction, custody, or control of the Forest Service. Executive Order 12580, §§2(e)(1), and 4(b)(1). Executive Order 13016 amended Executive Order 12580 to authorize the Secretary of Agriculture use of CERCLA Section 106, 42 U.S.C. §9606, to address releases or threats of releases affecting lands and natural resources under the Forest Service's custody, jurisdiction or control, subject to the concurrence of EPA's Administrator. Executive Order 13016, § 2.

The State of Montana's abandoned mine land ("AML") plan has been approved by the Secretary of the Interior pursuant to Title IV of SMCRA. Pursuant to section 413(b) of SMCRA, 30 U.S.C. § 1242(b), and State law, the State, acting through DEQ, has the authority to engage in cooperative AML projects with Federal agencies, and is authorized to expend SMCRA grant funds for the reclamation of eligible abandoned hard-rock mine sites.

Pursuant to Section 82-4-323, MCA, DEQ is authorized to cooperate with agencies of the Federal Government in its AML program and may reasonably compensate them for any services DEQ requests that they provide. Section 82-4-323, MCA, also authorizes DEQ to receive State, Federal, and other funds and, expend them for reclamation of land affected by mining or mineral exploration. Pursuant to Section 82-4-371, MCA, DEQ may enter upon private property that has been adversely affected by past mining practices and to do all things necessary or expedient to restore or reclaim the property or to abate, control, or prevent the adverse effects of past mining practices. Because no Site has been listed for a remedial action on the National Priorities List pursuant to Section 105 of CERCLA, Sites are eligible for funding through Montana's AML reclamation program pursuant to Section 411 of SMCRA, 30 U.S.C. § 1240a(d).

I. PURPOSE: The purpose of this MOU is to document the cooperation between the parties to expeditiously implement the response and reclamation actions at abandoned mine Sites, which occur on Forest Service and private lands to be reclaimed by DEQ. The parties intend to coordinate their respective authorities under CERCLA, and State laws. This MOU also provides a process for resolving disputes between the Parties that may arise during such response and reclamation actions. This MOU is not intended to address coordination regarding natural resource damage issues.

II. STATEMENT OF MUTUAL BENEFIT AND INTERESTS:

The Parties have also determined that one or more response and reclamation actions may be needed to reduce or remove the threat to human health and/or the

environment at the Sites. The Parties plan to address these threats through the coordinated exercise of the agencies' respective cleanup and reclamation authorities.

All response actions by the Forest Service covered by this MOU shall be consistent with the National Contingency Plan (NCP). Coordination with the State shall also occur prior to any planned removal or reclamation actions by the Forest Service or DEQ, as well as any future post-removal Site control activities.

As a result of cooperative efforts by all Parties to conduct response and reclamation actions at the Sites, the potential human health and environmental impacts associated with these Sites may be mitigated and thereby benefit the citizens of the Nation, State, and County. In addition, cooperative action will have an economic benefit to those citizens located downstream of the Sites by reducing and/or eliminating the impacts to resources that they depend on.

The parties agree as follows:

III. THE DEQ SHALL:

A. Cooperate with the Forest Service on community relations activities.

B. Cooperate with the Forest Service in activities to protect cultural resources.

D. Cooperate with the Forest Service in identifying potential repository locations whether on private or on NFS lands. If the best candidate site for a repository is on NFS lands, the Forest Service and DEQ will consider a Participating Agreement that will outline the terms and conditions for the repository.

E. Cooperate with the Forest Service on comments and recommendations on studies, reports, plans and specifications that will be utilized for the reclamation of NFS lands.

F. Cooperate in preparation of a Road Use Agreement with the Forest Service, which will address the terms and conditions of the use of Roads that may be used in accessing any Sites for reclamation.

IV. THE U.S. FOREST SERVICE SHALL:

A. Consider utilizing its authority under CERCLA to allow DEQ or its designated representatives to sample, test, or measure soils, waters, or sediment on Sites located on NFS lands.

B. Cooperate with DEQ on community relations activities.

C. Cooperate with DEQ in activities to protect Cultural Resources.

D. Cooperate with DEQ in identifying potential repository locations whether on private or on NFS lands. If the best candidate site for a repository is on NFS lands, the Forest Service and DEQ will consider a Participating Agreement that will outline the terms and conditions for the repository.

E. Consider consent for DEQ, and their authorized representatives, for entering and access to NFS land within the Sites for the purposes of conducting investigations and reclamation activities. To the extent practicable, DEQ shall provide advance notice to the Forest Service of at least seven days (7) prior to entering NFS lands.

F. Consider allowing DEQ to utilize Forest Service roads for reclamation activities.

G. Allow DEQ to make comments and recommendations on studies, reports, as well as, plans and specifications that will be utilized in the reclamation and mitigation activities on or effecting NFS lands.

V. IT IS MUTUALLY UNDERSTOOD AND AGREED BY AND BETWEEN THE PARTIES THAT:

A. DISPUTE RESOLUTION. It is anticipated that consultation amongst the Parties should resolve the vast majority of, if not all, technical and legal issues between them. If the Parties do not reach agreement on a disputed item arising from activities at the Site, the issue shall be elevated to the Parties' respective senior management for further discussion and resolution. If the senior management discussion does not resolve the issue, the Forest Service will have the responsibility for making final decisions affecting NFS lands and DEQ will have the responsibility for final decisions affecting private lands. All of their decisions must be consistent with CERCLA and the NCP.

B. LEAD STATUS. The Forest Service shall be the lead agency for portions of the Site on NFS lands. Nevertheless, the Parties recognize that it may be appropriate in some instances for the Parties to agree that a single Party shall undertake all the appropriate response actions on some portions of the Site, irrespective of whether those portions are privately owned or are NFS lands.

C. NOTIFICATION. The Parties shall coordinate with each other to implement cleanup activities under Federal and State law at the Site. This coordination shall include reasonable prior notice of, and an opportunity to participate in, any scheduled meetings with third parties related to the Site, and any onsite activities. In most cases, reasonable prior notice shall be considered seven (7) days. In the event that a meeting needs to be scheduled on shorter notice, the Parties shall use their best efforts to find a mutually agreeable meeting time prior to scheduling the meeting.

D. COMMUNICATION. The Parties will communicate regularly to review work status and resolve any existing or anticipated technical issues and will coordinate on major decision points. Legal issues will be coordinated between the attorneys for the Parties.

E. PRINCIPAL CONTACTS. Individuals listed below are authorized to act in their respective areas for matters related to this instrument.

Principal Cooperator Contacts:

DEQ Contact	DEQ Administrative Contact
Pebbles Clark P.O. Box 200901 Helena, MT, 59620-0901 406-841-5028 406-841-5024 pclark2@mt.gov	Nancy Primo P.O. Box 200901 Helena, MT, 59620-0901 406-841-5004 406-841-5050 nprimo@mt.gov

Principal U.S. Forest Service Contacts:

U.S. Forest Service Program Contact	U.S. Forest Service Administrative Contact
Nancy Rusho 200 East Broadway Missoula, MT 59807 406-329-3634 nrusho@fs.fed.us	Michele Wasienko-Holland Building 24, Fort Missoula Missoula, MT 59804 406-329-1008 mwasienkoholland@fs.fed.us

F. NON-LIABILITY. The U.S. Forest Service does not assume liability for any third party claims for damages arising out of this MOU.

G. NOTICES. Any communications affecting the operations covered by this agreement given by the U.S. Forest Service or the Cooperators is sufficient only if in writing and delivered in person, mailed, or transmitted electronically by e-mail or fax, as follows:

To the U.S. Forest Service Program Manager, at the address specified in the MOU.

To Cooperators, at the Cooperator's address shown in the MOU or such other address designated within the MOU.

Notices are effective when delivered in accordance with this provision, or on the effective date of the notice, whichever is later.

H. PARTICIPATION IN SIMILAR ACTIVITIES. This MOU in no way restricts the U.S. Forest Service or the Cooperator(s) from participating in similar activities with other public or private agencies, organizations, and individuals.

I. ENDORSEMENT. Any Cooperator contributions made under this MOU do not by direct reference or implication convey U.S. Forest Service endorsement of the Cooperator's products or activities.

J. NONBINDING AGREEMENT. This MOU creates no right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity. The parties shall manage their respective resources and activities in a separate, coordinated and mutually beneficial manner to meet the purposes(s) of this MOU. Nothing in this MOU authorizes any of the parties to obligate or transfer funds. Specific projects or activities that involve the transfer of funds, services, or property among the parties require execution of separate agreements and are contingent upon the availability of appropriated funds. These activities must be independently authorized by statute. This MOU does not provide that authority. Negotiation, execution, and administration of these agreements must comply with all applicable law. Each party operates under its own laws, regulations, and policies, subject to the availability of appropriated funds. Nothing in this MOU is intended to alter, limit, or expand the agencies' statutory and regulatory authority.

K. MEMBERS OF U.S. CONGRESS. Pursuant to 41 U.S.C. 22, no United States member of, or United States delegate to, Congress shall be admitted to any share or part of this MOU, or benefits that may arise therefrom, either directly or indirectly.

L. FREEDOM OF INFORMATION ACT (FOIA). Public access to MOU or agreement records must not be limited, except when such records must be kept confidential and would have been exempted from disclosure pursuant to Freedom of Information Act (5 U.S.C. 552) regulations.

M. PUBLIC NOTICES. It is the U.S. Forest Service's policy to inform the public as fully as possible of its programs and activities. The Cooperator is encouraged to give public notice of the receipt of this instrument and, from time to time, to announce progress and accomplishments. Press releases or other public notices should include a statement substantially as follows:

"AML ECAP Program of the U.S. Forest Service, Department of Agriculture, Kootenai National Forest."

The Cooperator may call on the U.S. Forest Service's Office of Communication for advice regarding public notices. The Cooperator is requested to provide copies of notices or announcements to the U.S. Forest Service Program

Manager and to the U.S. Forest Service's Office of Communications as far in advance of release as possible.

N. TERMINATION. Any of the parties, in writing, may terminate this MOU in whole, or in part, at any time before the date of expiration.

O. MODIFICATIONS. Modifications within the scope of this MOU must be made by mutual consent of the parties, by the issuance of a written modification signed and dated by all properly authorized, signatory officials, prior to any changes being performed. Requests for modification should be made, in writing, at least 30 days prior to implementation of the requested change.

P. COMMENCEMENT/EXPIRATION DATE. This MOU is executed as of the date of the last signature and is effective through **December 31, 2014** at which time it will expire, unless extended by an executed modification, signed and dated by all properly authorized, signatory officials.

Q. AUTHORIZED REPRESENTATIVES. By signature below, each party certifies that the individuals listed in this document as representatives of the individual parties are authorized to act in their respective areas for matters related to this MOU. In witness whereof, the parties hereto have executed this MOU as of the last date written below.

RICHARD OPPER, Director Montana Department of Environmental Quality	Date 8/24/10
PAUL BRADFORD, Forest Supervisor U.S. Forest Service, Kootenai National Forest	Date 8/30/2010

The authority and format of this agreement has been reviewed and approved for signature.

/s/ Michele Wasienko-Holland — *August 13, 2010*

MICHELE WASIENKO-HOLLAND — Date
Grants & Agreements Specialist
U.S. Forest Service, Western Montana Acquisition Zone

Burden Statement

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0596-0217. The time required to complete this information collection is estimated to average 3 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call toll free (866) 632-9992 (voice). TDD users can contact USDA through local relay or the Federal relay at (800) 877-8339 (TDD) or (866) 377-8642 (relay voice). USDA is an equal opportunity provider and employer.

REPOSITORY AGREEMENT
between
MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
and
UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
NORTHERN REGION

For the Broken Hill Mine Reclamation Project

This Repository Agreement is hereby entered into by and between the Montana Department of Environmental Quality ("DEQ"), and the United States Department of Agriculture, Forest Service ("Forest Service"), together referred to as the "Parties." The Forest Service enters into this Repository Agreement under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), 42 U.S.C. §§ 9601-9675. DEQ enters into this Repository Agreement under the authority of Title IV of the Surface Mining Control and Reclamation Act of 1977 ("SMCRA"), Public Law 95-87 (30 U.S.C. §§ 1231 through 1243), and Title 82, Chapter 4, Part 3 of the Montana Code Annotated ("MCA").

The Parties hereby agree as follows:

Purpose

1. The purpose of this Agreement is to provide for the Parties to work cooperatively on the cleanup and reclamation of the Broken Hill Mine Site ("the Site") located in Sec. 10, T27N, R34W, Montana Principal Meridian, Sanders County, Montana. The Site is located on the Kootenai National Forest, approximately 4 miles north of Heron, Montana and north of Highway 200. The mine is located within the East Fork of Blue Creek watershed at an elevation of approximately 4,200 feet above mean sea level. Features remaining on the property include two waste rock dumps and two collapsed adits (and associated seasonal/intermittent lower adit discharge). The Site consists of both private lands and National Forest System ("NFS") lands under the jurisdiction, custody, and control of the Forest Service. The preferable cleanup option from a watershed, topographic, engineering, geophysical, economical, and practical standpoint is to dispose of mine wastes at the Site in a common mine waste Repository cell ("the Repository"). This Repository Agreement addresses apportionment of potential future reclamation costs or response costs for the Repository, and establishes responsibility for the design, construction, operation and

maintenance, site control, and periodic inspection work necessary for the Repository.

2. DEQ and the Forest Service shall cooperate as administrative agencies for the project. DEQ shall be lead agency for all reclamation activity, as that term is defined in 30 C.F.R. § 870.5, occurring on private land. The Forest Service shall be lead agency, as defined in 40 C.F.R. § 300.5, for all response actions, as that term is defined in CERCLA, occurring on NFS land.

Statement of Mutual Benefits and Interests

3. The Site is a "mixed-ownership" (*i.e.,* located on both NFS and private land) hard-rock mining site that has unconfined mine wastes containing contaminants of concern, including lead, arsenic, cadmium, and zinc. Investigations of the Site by the DEQ indicate that about 3,600 cubic yards of the total estimated 4,100 cubic yards of mine waste present at the Site lies on NFS lands, and the rest resides on private land.

4. DEQ and Forest Service each have statutory defenses to liability for their respective actions to reclaim the Site. By entering into this Repository Agreement, neither DEQ nor the Forest Service admits to any liability under CERCLA. The defenses to liability, however, do not prevent the Parties from agreeing in this Repository Agreement to apportion reclamation and cleanup costs for the Site, subject to the availability of funding. By entering into this Repository Agreement, neither the United States nor the State of Montana waives, and each does specifically reserve, any and all rights, causes of action or defenses.

DEQ's Interests and Authorities

5. The State of Montana's abandoned mine land ("AML") Reclamation Plan has been approved by the Secretary of the Interior pursuant to Title IV of SMCRA. Pursuant to section 413(b) of SMCRA, 30 U.S.C. § 1242(b), and State law, the State, acting through DEQ, has the authority to engage in cooperative AML projects with Federal agencies, and is authorized to expend SMCRA grant funds for the restoration, reclamation, abatement, control, and prevention of adverse effects of historic hard-rock mining practices on eligible lands. DEQ has authority under SMCRA and State law for reclaiming the Site.

6. Pursuant to Section 82-4-323, MCA, DEQ is authorized to cooperate with agencies of the Federal Government in its AML program. Section 82-4-323, MCA, authorizes DEQ to receive State, Federal, and other funds and expend them for reclamation of land affected by mining or mineral exploration. Pursuant to Section 82-4-371, MCA, DEQ may enter upon private property that has been adversely affected by past mining practices and to do all things necessary or expedient to restore or reclaim the property or to abate, control, or prevent the adverse effects of past mining practices. Because this Site has not been listed for a remedial action on the National Priorities List pursuant to Section 105 of CERCLA, the Site is eligible

for funding through Montana's AML reclamation program pursuant to Section 411 of SMCRA, 30 U.S.C. § 1240a(d).

7. DEQ has determined that land and water resources at the Site have been adversely affected by past mining practices and that the adverse effects are at a stage that, in the public interest, action to restore and reclaim the Site and to abate, control, or prevent the adverse effects should be taken. DEQ states that it has the authority under state law to enter onto private property to restore and reclaim the Site. DEQ believes that it is appropriate to reclaim the property, to remove mine waste from the Site and to place it in the Repository on NFS land.

8. DEQ asserts that under 30 U.S.C. § 1235(l) it is not liable under any provision of Federal law for any costs or damages as a result of actions taken or omitted in the course of carrying out reclamation activity at the Site.

The Forest Service's Authorities

9. The Forest Service has identified releases of contaminants of concern at the Site that present a threat to public health, welfare and the environment. This situation presents an opportunity for DEQ and the Forest Service to be cost effective in the reclamation and cleanup of the Site by working cooperatively on the project. The use of the Repository on NFS land near the Site is the preferable cleanup option for the Forest Service's response action. The Forest Service's participation in this project conforms to the April 7, 1999 USDA Forest Service Policy Concerning Participation in Common Mine Waste Repositories.

10. The Forest Service, acting pursuant to its legal authorities, has determined, pursuant to Section 104(d)(4) of CERCLA, that the Site and the Repository are to be treated as one Site for purposes of CERCLA Section 104. Because portions of the project area include NFS lands, the Forest Service is undertaking a Non-Time Critical Removal Action on the NFS portions of the Site under the authority of Section 104(a) of CERCLA, 42 U.S.C. § 9604(a). The CERCLA action on the NFS portions of the Site was commenced by the Forest Service in a Non-Time Critical Removal Action Memorandum dated April 12, 2011, which authorized a removal action to occur on the NFS lands at the Site.

11. The Forest Service asserts that, because the mining activities were conducted at the Site under the 1872 Mining Law, and the Forest Service neither operated the facility nor arranged for the disposal of mining waste at the facility, the Forest Service is not liable as an "operator" or "arranger" at the Site. The Forest Service also asserts that the United States' interest in lands subject to unpatented mining claims does not make it an "owner" of such claims under CERCLA. Pursuant to Sections 107(d) and 119 of CERCLA, the Forest Service does not become liable under CERCLA as a result of any action or omission while

carrying out response actions at the Site. Therefore, the Forest Service will not become a potentially responsible party ("PRP") under CERCLA as a result of its actions at the Site.

12. The Forest Service has been delegated the authority to conduct response actions under Section 104 of CERCLA with respect to NFS lands pursuant to Executive Order 12580 and 7 C.F.R. § 2.60(a)(39). Pursuant to Section 121(e)(1) of CERCLA, 42 U.S.C. § 9621(e)(1), no Federal, State, or local permits are required for those portions of a removal action occurring onsite.

13. As the Forest Service share of removal action and reclamation costs, the Forest Service will supply the site for the Repository and take over monitoring of the Repository after the first three years of monitoring by the State.

Mutual Agreements and Responsibilities

14. DEQ, as the lead agency for the privately owned portions of the Site, retains the final decision-making authority for the reclamation affecting the privately owned portions of the Site. The Forest Service retains the final decision-making authority for response actions affecting NFS land at the Site, including the Repository.

15. All response/reclamation alternatives planned for implementation at the Broken Hill Mine Site are to be considered interim or removal actions for purposes of CERCLA and are not necessarily considered as final response actions or alternatives. Removal actions on the Site are expected to have a net positive effect on the ground and surface waters. The response/reclamation alternatives at the Site are applicable to the solid media only; and no response/reclamation alternatives will be developed for treatment of ground water or off-site sediments.

16. DEQ will use Abandoned Mine Reclamation funds to pay to reclaim the mine wastes located on the Site. To maximize efficiency and minimize costs to the public, the Parties have agreed that DEQ will take primary responsibility for implementing all response/reclamation activities at the Site, including the excavation of mine wastes on both private land and NFS land, and the design, construction, and placement of wastes in the Repository.

17. DEQ will use Abandoned Mine Reclamation funds to inspect and conduct all routine operation and maintenance of the reclamation components at the Site, including the Repository, for the first 3 years after the Repository cover has been completed. Afterwards, the Forest Service will assume responsibility for all routine operation and maintenance of the Repository. Routine operation and maintenance activities include, but are not limited to such items as, periodic site inspection, repair of any damage caused by erosion (especially following spring snow-melt and specific storm events), repair of any damage caused by the

settlement of the Repository cap, maintaining water run-on and run-off structures at the Repository, reseeding, weed control, and repair of fences.

18. The Forest Service will be responsible for controlling access to the Repository location to facilitate the construction of the Repository and to minimize disturbance or damage to the Repository once it has been completed.

DEQ's Primary Responsibilities

19. DEQ will provide the Forest Service with a copy of the following Site documents for review and comment, and concurrence where appropriate under this Repository Agreement:

    a. Preliminary Assessment

    b. Ownership Determination

    c. Cultural Resource Inventory

    d. Reclamation Work Plan

    e. Site Characterization

    f. Repository Siting Study

    g. Risk Assessment

    h. Expanded Engineering Evaluation/Cost Analysis/Reclamation Alternatives Analysis

    i. Contractor's traffic control and road use plan

    j. Contractor's construction schedule

20. DEQ will implement and manage the reclamation construction contract for the Site on both the NFS land and private land, which will include the following:

    a. Obtain legal access to the privately owned portions of the Site

    b. Prepare the engineering design and the bid package

    c. Conduct advertisement, onsite bidder review, and bidder selection activities

for the construction contract

d. Conduct construction oversight of the project to ensure that it is constructed in accordance with the Action Memorandum and the contract specifications

21. The Parties acknowledge that, pursuant to Section 17-8-103, MCA, DEQ funding for this project is subject to State of Montana budget authorization procedures and the availability of grant funding to the Montana Department of Environmental Quality from the Office of Surface Mining, United States Department of the Interior.

The Forest Service's Primary Responsibilities

22. When the Forest Service is provided an opportunity to make comments or give concurrence under the Repository Agreement, the Forest Service shall provide its comments or concurrence within 30 days of receipt of DEQ's submittal. If the Forest Service fails to respond within the 30 day comment period, DEQ's submittal shall be deemed approved. If the Forest Service responds within the 30 day comment period (other than by indicating complete agreement with DEQ's submittal), DEQ and the Forest Service shall have an additional 30 days to resolve the issues raised by the Forest Service response. In the event that the issues are not resolved to the Forest Service's satisfaction within the additional 30 day comment period, the Forest Service may invoke Dispute Resolution pursuant to Paragraph 30 and 31. If the Forest Service does not invoke Dispute Resolution within the additional 30 day comment period, the Forest Service's comments will be deemed satisfied.

23. The Forest Service will identify for DEQ and assist DEQ (and its contractors) in compliance with any Forest Service requirements that are necessary for implementation of the project, so they can be timely incorporated into the DEQ bid package.

24. The Forest Service will provide road maintenance and improvement specifications to DEQ for any work that the Forest Service determines is required on National Forest System roads as part of this project so that those specifications can be timely incorporated into the DEQ bid package.

25. The Forest Service will cooperate with DEQ and its construction contractor(s) in the development of a traffic safety plan for construction activities so they can be timely incorporated into the DEQ bid package.

26. The Forest Service will identify for DEQ the revegetation specifications for reclaiming disturbances on NFS land, including road cuts and fills and the reclaimed areas.

27. The Forest Service will identify for DEQ's use a borrow source on NFS land to provide

suitable cover soil for the project if necessary.

28. The Forest Service will conduct any actions required to comply with Section 106 of the National Historic Preservation Act of 1966, 16 U.S.C. § 470f, and the Endangered Species Act of 1973, 16 U.S.C. §§ 1531, *et seq.*, for the NFS portions of the project including the Repository area and any borrow areas or roads on NFS land.

Future Responsibility for the Repository

29. In the event that a future response action or reclamation action is necessary at the Repository, other than routine operation and maintenance, the Parties agree to allocate the costs of taking such action under their respective authorities on a volumetric basis, based on the volume of material moved from private and NFS land. Initial estimate is that 3600 cubic yards will come from NFS land and 500 cubic yards will come from private land. Under this formula, DEQ would be responsible for 12% and the Forest Service would be responsible for 88% of such costs.

Dispute Resolution

30. The Dispute Resolution procedures in this section are the exclusive mechanism for resolving disputes under this Repository Agreement. The Parties will attempt to concur on each action undertaken under this Repository Agreement, and the Parties shall attempt to resolve expeditiously and informally any disagreements concerning the implementation of this Repository Agreement. If the Parties fail to resolve such a dispute informally, the Dispute Resolution procedure in the following paragraph shall apply.

31. If the DEQ Project Manager and the Forest Service On Scene Coordinator ("OSC") do not reach agreement on a disputed matter, the issue will be elevated to the Forest Service OSC's and the DEQ Project Manager's direct supervisors within seven days. If the Forest Service and DEQ direct supervisors are unable to reach agreement within seven days, the issue will be further elevated to the Regional Forester for the Forest Service and the DEQ Director. If they cannot reach agreement, the decision of the Regional Forester shall control response activities or reclamation activities affecting NFS land, and the decision of the DEQ Director shall control response activities or reclamation activities affecting private land. Each Party shall give Notice of its decision under this dispute resolution procedure to the other Party within 30 days of finalizing said decision.

Miscellaneous Provisions

32. By signing this Repository Agreement, each Party hereby represents that it has the legal authority to enter into this Repository Agreement, and subject to the respective availability of DEQ and Forest Service funds, has the institutional, managerial, and financial capability to ensure proper planning, management and completion of the project.

33. This Repository Agreement shall be legally enforceable and binding upon the Parties and their successors and assigns.

34. DEQ shall assign one or more Project Managers for this Site. The Forest Service shall assign one or more On-Scene Coordinators for this Site.

DEQ's Project Manager for this Site is:

Pebbles Clark
Mine Waste Cleanup Bureau
Montana Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901
Phone: (406) 841-5028
Fax: (406) 841-5024

The Forest Service's OSC for this Site is:

Nancy Rusho
Northern Region Office
USDA-Forest Service
200 East Broadway
Missoula, MT 59807
Phone: (406) 329-3634
Fax: (406) 329-3536

In the event that either party chooses to change its designation, it shall notify the other party of its new representative as soon as possible.

35. The principal contacts for other than project management issues relating to this Repository Agreement are:

Administrative:

Bobbie Lacklen
USDA – Forest Service
Kootenai National Forest
31374 US Hwy 2
31374 US Highway 2
Libby, MT 59923
Phone: (406) 283-7681

John Koerth
DEQ AML Section Supervisor
Mine Waste Cleanup Bureau
Montana Dept. of Envir. Quality
P.O. Box 200901
Helena, MT 59620-0901
Phone: (406) 841-5026

Legal:

Kirk Minckler
USDA-OGC
740 Simms St., Room 309
Golden, CO 80401
Phone: (303) 275-5549
Fax: (303) 275-5557

Thomas E. Root
DEQ Legal Counsel
1100 N. Last Chance Gulch
P.O. Box 200901
Helena, MT 59620-0901
Phone: (406) 841-5022
Fax: (406) 841-5050

36. DEQ and the Forest Service shall jointly develop and implement a Community Relations Plan, governing all community involvement activities for the Site. The Parties shall conduct community involvement activities cooperatively by providing draft copies of news releases for comment and jointly scheduling public meetings. As the lead agency for the removal action on NFS land, the Forest Service shall approve those aspects of the Community Relations Plan that pertain to the NFS portions of the Site.

37. The Forest Service and DEQ agree to seek sufficient funding to perform their respective obligations under this Repository Agreement. No provision of this Repository Agreement shall be interpreted or construed as a commitment or requirement that the Forest Service or DEQ obligate or pay any funds in contravention of the Anti-Deficiency Act, 31 U.S.C. § 1341 or Section 17-8-103, MCA, respectively, or any other applicable provision of law, in any fiscal year for actions subject to this Repository Agreement.

38. The DEQ shall allow the Forest Service, United States Department of Agriculture Inspector General, or Comptroller General, through any authorized representative, access to and the

right to examine all books, papers, or documents related to this Repository Agreement at reasonable times. DEQ shall provide proper facilities available for such inspection, audit and copying. The Forest Service shall make all such records available for inspection, audit, and copying by any representatives of the State of Montana or the United States (or auditors designated by the state or federal governments) at reasonable times. Forest Service shall provide proper facilities available for such inspection, audit and copying.

39. No part of this instrument shall entitle the DEQ, or any other party, to any share or interest in the Federal land portion of the project other than the right to use and enjoy the same under the existing regulations of the Forest Service, or other applicable law.

40. This Repository Agreement shall in no way restrict the Forest Service or DEQ from participating in similar activities with other public or private agencies, organizations, or individuals.

41. Pursuant to 41 U.S.C. § 22, no Member of, or Delegate to, Congress shall be admitted to any share or part of this Repository Agreement, or to any benefits that may arise therefrom.

42. DEQ and the Forest Service, and any contractors thereof, shall not discriminate against any employee or applicant for employment because of race, color, national origin, handicap, religion, or gender and shall comply with all applicable Federal or State statutes prohibiting discrimination.

43. The provisions of this Repository Agreement are intended solely to ensure interagency coordination that enhances efficiency and effectiveness. It shall not be deemed to create any right, benefit, or trust obligation, either substantive or procedural, enforceable by any person or entity in any court against the United States, its agencies, its officers or any other person.

44. Modifications of this Repository Agreement shall be made by mutual consent of the Parties, and by the issuance of a written modification, signed and dated by both Parties, prior to any changes being performed. Neither party is obligated to fund any changes not properly approved in advance.

45. FREEDOM OF INFORMATION ACT (FOIA). Any information furnished to the Forest Service under this instrument is subject to the Freedom of Information Act (5 U.S.C. § 552).

46. COMMENCEMENT/EXPIRATION DATE. This instrument is executed as of the date of the last signature hereto and is effective through December 31, 2016, at which time it will expire unless extended.

47. NOTICE. Notice shall be in writing by the Parties hereto delivered to the Parties as follows:

If to DEQ:

Pebbles Clark
Mine Waste Cleanup Bureau
Montana Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901
Phone: (406) 841-5028
Fax: (406) 841-5024

If to Forest Service:

Nancy Rusho
Northern Region Office
USDA-Forest Service
200 East Broadway
Missoula, MT 59807
Phone: (406) 329-3634
Fax: (406) 329-3536

48. TERMINATION. Upon 30 days notice to the other Parties, any of the Parties, may terminate the instrument in whole, or in part, at any time before the date of expiration. No Parties shall incur any new obligations for the terminated portions of the instrument after the effective date and shall cancel as many obligations as possible. Full credit shall be allowed for each Party's expenses and all non-cancelable obligations properly incurred up to the effective date of termination.

IN WITNESS WHEREOF, we the undersigned authorized representatives, hereby agree to the terms and conditions set forth in this Repository Agreement as of the effective date hereof.

State of Montana
Department of Environmental Quality

By _____ Date 5/4/11
Richard H. Opper, Director

Approved as to form:

DEQ Legal

United States Department of Agriculture
Forest Service, Northern Region

By _____ Date 4/21/2011
for Leslie A.C. Weldon, Regional Forester

The authority and format of this instrument have been reviewed and approved for signature.

Attachment 5

Consultation and Environmental Assessment Documents

Montana Department of
ENVIRONMENTAL QUALITY
Brian Schweitzer, Governor
P.O. Box 200901 • Helena, MT 59620-0901 • (406) 444-2544 • www.deq.mt.gov

April 21, 2011

Jeffrey Fleischman, Director
Casper Field Office
Office of Surface Mining, Reclamation, and Enforcement (OSMRE)
150 East B Street
PO Box 11018
Casper, WY 82602

RE: Montana Abandoned Mine Reclamation Program
2011 Broken Hill Mine Reclamation Project
Submittal of Eligibility Determination and Environmental Assessment

Dear Mr. Fleischman:

The purpose of this letter is to request that OSMRE agree with the Montana Department of Environmental Quality's (DEQ) determination that the 2011 Broken Hill Mine Reclamation Project is eligible for abandoned mine reclamation grant money and issue a Notice to Proceed to construct the project. The Broken Hill Mine site (site) is located in the Blue Creek Mining District, Sanders County, Montana.

To support DEQ's determination of eligibility, the following documentation is enclosed as PDF files on the attached CD:

- DEQ Eligibility Determination Letter
- Public Participation Verification
- Final Engineering Evaluation and Cost Analysis (EEE/CA)
- Cultural Resources Consultation
- Threatened and Endangered Species Consultation (TES)
- Environmental Justice Documentation
- AMLIS Entry Verification

DEQ Legal concluded that the site is eligible for funding under OSMRE's abandoned mine reclamation program. An advertised public meeting for this project was held in Heron, Montana on February 16, 2011. The EEE/CA was discussed, the preferred alternative was presented, and public comment was taken.

DEQ consulted with the State Historic Preservation Office (SHPO) regarding a finding that the site is not eligible for listing on the National Register and received a letter back from SHPO that concurred with this finding.

DEQ has reviewed the project area for TES and has determined that the proposed mine reclamation actions will not have any adverse effect on TES. DEQ has consulted with the U.S. Fish and Wildlife Service (USFWS) and has requested their concurrence with this determination. DEQ sent a letter to USFWS on March 11, 2011, and to date DEQ has not received a response. A copy of the USFWS consultation letter is included in the attached CD. Also included on the CD is a copy of the file memo stating that DEQ has not received any comment or response from the USFWS.

To comply with the environmental justice policy of the United State Department of the Interior, DEQ analyzed this project to determine if it would have any disproportionately high or adverse human health or environmental effects on minorities and low-income populations and communities. DEQ concluded that the project is in compliance with the environmental justice policy.

DEQ also verified that this project has been entered into the Abandoned Mine Land Inventory System (AMLIS).

DEQ is requesting that OSMRE agree with DEQ's determination of eligibility for abandoned mine reclamation grant money and issue a Notice to Proceed for construction of the project based on DEQ's analysis of potential environmental impacts and the preferred alternative for abating those impacts.

If you have questions about this submittal please contact me at (406) 841-5026.

Sincerely,

John Koerth
Program Manager
Montana Department of Environmental Quality
Abandoned Mine Section

Attachment: CD

Montana Department of
ENVIRONMENTAL QUALITY
Brian Schweitzer, Governor
P.O. Box 200901 • Helena, MT 59620-0901 • (406) 444-2544 • www.deq.mt.gov

January 25, 2010

Director
Casper Field Office
Office of Surface Mining, Reclamation, and Enforcement
150 East B Street, Room 1018
Casper, Wyoming 82601-1018

Re: Broken Hill Site, Blue Creek Mining District, Sanders County, Montana
Eligibility for Abandoned Mine Reclamation funding

Dear Director:

1. Introduction

This letter serves as the Montana Department of Environmental Quality's (DEQ) review and eligibility opinion for your use in making an eligibility determination for proposed reclamation of the Broken Hill Mine Site. The proposal for reclamation consists of a site ("Site") located in the NE1/4, Section 10, Township 27 North, Range 34 West, Montana Principal Meridian. .

Attachment 1 is a copy of the Mineral Survey of the Site. As shown on the Mineral Survey, the Broken Hill site originally consisted of the Broken Hill, Bobby, Tuesday, and Saturday claims. However, patent was issued in 1930 only for the Broken Hill and Bobby Claims. (Attachment 2, Renewable Technologies Incorporated, Broken Hill Mine Site (PA No. 45-005) Blue Creek Mining District Sanders County Montana, Past and Present Landownership/Mine Operators Investigation Phase I (August, 2002), p.7) The mine was operated from 1923 to 1930 and was inactive until 1966. It was active from 1966 – 1968. (Id. pp.1-10) Insofar as the unpatented claims are concerned (The Tuesday and Saturday claims), assessment work was last performed in 1967 and no attempt was made to patent these claims. Presumably, the claims lapsed and became part of the Public Domain, presently administered by Kootenai National Forest. (Id.)

The surface and mineral rights to the Broken Hill and Bobby patented claims and the unpatented claims are privately and publicly owned. The portion of the Site to which

this letter is addressed includes the two a patented mining claims and the public domain upon which wastes from operation of the Broken Hill mine are located.

2. SMCRA requirements

According to Title IV of the Surface Mining Control and Reclamation Act of 1977 (SMCRA), as amended, lands in Montana (a certified state under SMCRA) are eligible for OSM funding for reclamation if they were:

1. Mined or processed for minerals [and] are affected by such mining or processing

2. Abandoned or left in an inadequate reclamation status prior to August 3, 1977 generally, or August 28, 1974 for Forest Service lands or November 26, 1980 for BLM lands

There is an additional requirement regarding responsibility for reclamation of such lands, i.e.,

3. There is no continuing responsibility for reclamation under State or other Federal Statutes.

An overall estimation of wastes at the Site was prepared for the Montana Department of State Lands (predecessor to DEQ) in 1995, and it contains (at pp. 263-64) a discussion of wastes and releases at the Broken Hill Site. (Attachment 3, Pioneer Technical Services; Inc., Montana Department of state Lands Abandoned Mine reclamation Bureau, Abandoned Hardrock Mine Priority Sites, 1995 Summary Report (April 1995). The following eligibility determination is based upon the information contained in Attachments 1, 2, and 3.

Site Affected by Past Mining and Processing Practices

The Broken Hill Mine Site described above was affected by past mining practices. Remaining on the site are waste rock piles and a collapsed adit.(Attachment 3) According to Attachment 2, the Broken Hill and Bobby patented mining claims were located in 1930. Previously, the Broken Hill, Bobby, Tuesday, and Saturday claims were located in 1920. The owner and discoverer, M.J. Dunn, drove two tunnels at different levels, to develop the claims, encountering a vein of 12 oz. per ton and shows of lead and zinc. In 1925, 88 tons of ore was produced, followed 140 tons in the next year. In 1927, 45 tons of ore was produced. Thereafter, the mine was closed until 1966.

In that year, the tunnels were re-opened and a raise between them was driven, producing 94 tons of ore. In 1967, development of the tunnels continued and some diamond drilling was done. In 1968, roads were repaired but no other activity took place. The mine has been inactive since 1968 and no assessment work on the unpatented claims has been completed since 1967. (Appendix 2, pp. 3-10)

According to Appendix 3, there is an estimated 6200 cubic yards of waste rock on site, with arsenic, cadmium, copper, iron, mercury, lead, antimony, and zinc having levels at least 300 % of backgrounds. The adit discharges 25 gpm, exceeding chronic aquatic criteria for mercury, lead, and zinc.

Based upon the above information, the Broken Hill mine site was affected by past mining or mining practices.

Abandoned or Left in an Un-reclaimed or Inadequately Reclaimed Condition Prior to August 3, 1977

According to Attachment 2, mining was discontinued on the Broken Hill site in 1968

Based on the above information, the subject area was abandoned or left in an un-reclaimed or inadequately reclaimed condition prior to August 3, 1977.

No Continuing Reclamation Responsibilities

Reclamation under SMCRA is defined as "Those actions taken to restore mined land as required by this chapter to a post-mining use approved by the regulatory authority." 30 CFR Section 701.5 A similar definition can be found under Montana law, to wit: "Reclamation means backfilling, subsidence stabilization, water control, grading, high wall reduction, top soiling, planting, re-vegetation, and other work to restore an area of land affected by strip mining or underground mining approved by the department...". Section 82-4-203 (26), MCA

The Broken Hill Mine and associated unpatented mining claims operated at least 6 years before enactment of federal reclamation statutes such as SMCRA, the Forest Service Organic Act, or the BLM Organic Act (FLPMA). These federal statutes requiring reclamation was passed in 1977, 1974, and 1980, respectively.

Mining and processing operations on the above described lands also pre-date any State of Montana reclamation legislative authorities. In addition, 82-4-304 MCA specifically exempts from metal mine reclamation requirements "...any exploration or mining work performed" prior to the effective date of the regulations implementing that Act. The effective date for hard rock mining regulations in Montana was September 15, 1971, 4 years after operations on the Broken Hill Mine site had ceased.

Because of the time of operations of the Broken Hill Mine, no reclamation bond was posted because there was no State or Federal law in existence at the time which required such bonds.

Based upon the above information, DEQ has concluded that no continuing reclamation responsibility exists for the Broken Hill Mine and associated unpatented mining claims.

Eligibility under 30 USC Section 1240(a)(d)

The Broken Hill Mine site is not on the National Priorities List. Therefore, the Broken Hill Mine site is not a "site or area" which has been "listed for remedial action pursuant to the Comprehensive Environmental Response Compensation and Liability Act of 1980" (42 USC Section 9601 et. seq.). Therefore, DEQ has concluded that the site is not ineligible for Abandoned Mined Land funding under 30 USC 1240(a)(d) and 30 CFR Section 875.16.

3. Conclusion

Based upon the facts recited and for the reasons set forth above, DEQ has concluded that the Broken Hill Mine site and associated unpatented mining claims are eligible for Abandoned Mine Reclamation funding under SMCRA.

Very Truly Yours,

Thomas E. Root

Thomas E. Root
Special Assistant Attorney General , State of Montana
Montana Department of Environmental Quality
Mine Waste Cleanup Bureau
Abandoned Mined Lands Section

c. J. Koerth, P. Clark – DEQ w/o attach.

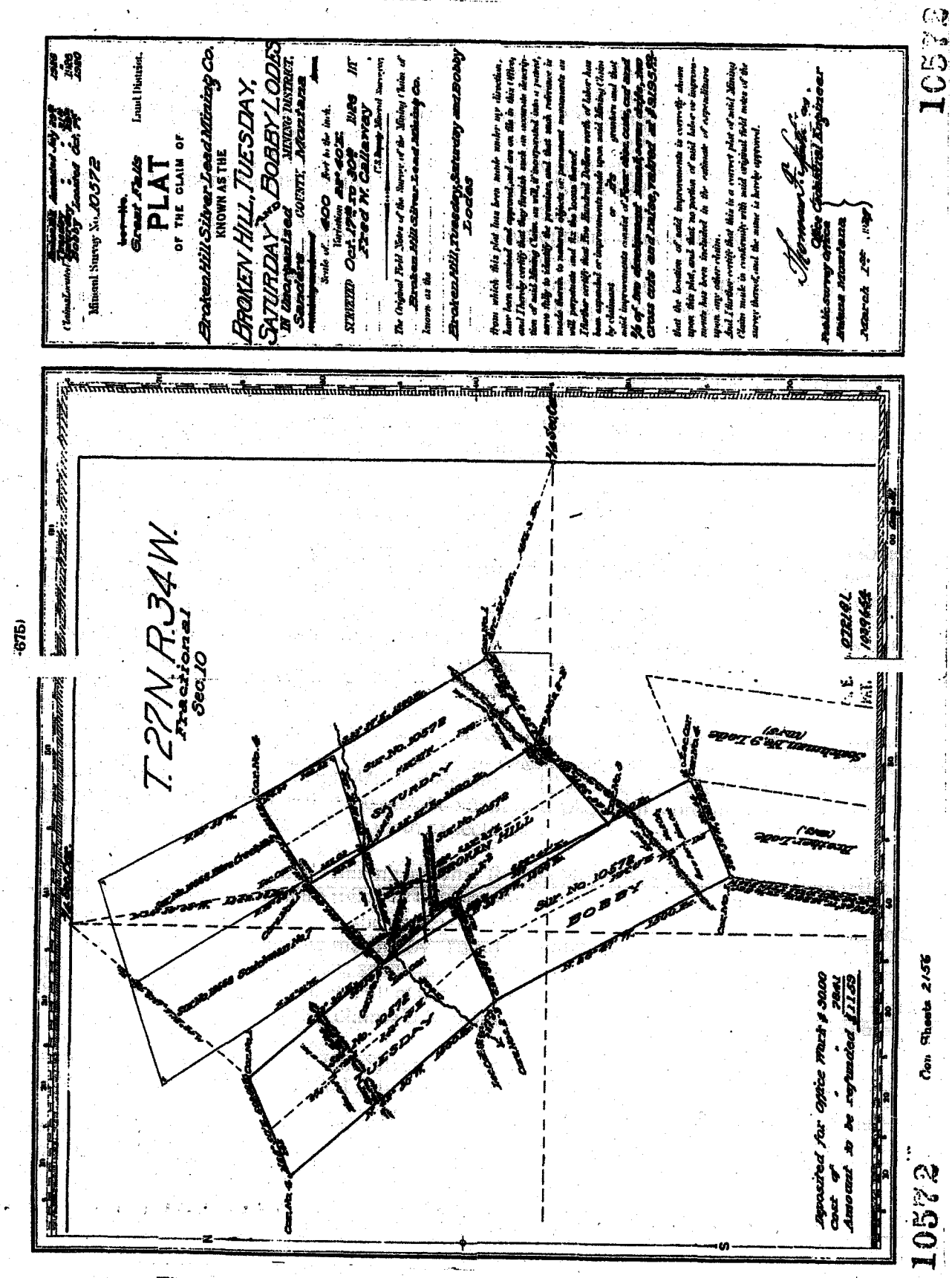


Figure 4. Broken Hill Mine mineral survey map (GLO 1926).

BROKEN HILL MINE SITE (PA No. 45-005)
BLUE CREEK MINING DISTRICT
SANDERS COUNTY, MONTANA

PAST AND PRESENT LANDOWNERSHIP/ MINE OPERATORS INVESTIGATION PHASE I

Prepared for:

Montana Department of Environmental Quality
Mine Waste Cleanup Bureau
PO Box 200901
Helena, Montana 59620-0901

August 2002

Renewable Technologies, Incorporated
511 Metals Bank Building • Butte, Montana 59701

2.0 SITE HISTORY

2.1 Introduction

The Broken Hill Mine site (PA No. 45-005) is in the Blue Creek Mining District, Sanders County, Montana. It lies about 3 miles from the Montana-Idaho line on the steep west flank of Billiard Table Mountain in Section 10, Township 27 North, Range 34 West (Figure 1). An unnamed intermittent drainage to the East Fork of Blue Creek is about 500 feet north of the site. The nearest town is the small community of Heron, Montana, a five mile drive to the south, while Wallace, Idaho is another 35 miles west.

Hazardous features found at the Broken Hill today include two collapsed adits and their associated waste rock dumps (Figure 2).[1] One adit is on the patented Broken Hill claim, and the other adit lies about 250 feet down slope (west) on the unpatented Tuesday claim. The Tuesday adit is currently discharging ground water into the East Fork of the Blue Creek drainage.

The Broken Hill and Tuesday are two of several claims that historically comprised the Broken Hill Mine group. The property produced nominal amounts of silver-lead-zinc ore during the 1920s and in 1966.

2.2 Broken Hill Mine Operating History

In 1920, Idaho miner M. J. Dunn discovered silver-lead ore in the remote mountains of northwestern Montana and filed notice of locations for the Broken Hill, Bobby, Tuesday and several other adjoining claims.[2] In the next two years, Dunn opened two tunnels to develop the Broken Hill lode. One tunnel ran about 100 feet below a surface exposure of ore, while the second tunnel was about 110 feet lower than the first. At 280 feet in, the lower tunnel encountered a vein of twelve-ounce silver ore with a good show in lead and zinc.[3]

By the spring of 1922, Dunn had convinced William Y. Clark and Harry Fairbanks, both of Spokane, Washington, in taking an active interest in his Broken Hill Mine. At that time, the three men incorporated the Broken Hill Silver Lead Mining Company to assume ownership of the property from Dunn. In addition to the Broken Hill, Bobby, and Tuesday, the transaction included the

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[1] Montana Department of State Lands, Abandoned Mine Reclamation Bureau, "Hazardous Materials Inventory, Site Investigation Log Sheet" for the Broken Hill Mine site, PA No. 45-005, 9 April 1993, on file at the Mine Waste Cleanup Bureau, Montana Department of Environmental Quality, Helena, Montana (Appendix A, Document 1. From this point on, references to documents in appendices are by appendix letter and document number only)

[2] Sanders County Clerk and Recorder, Location Book 1, p. 496 (B001), p. 497 (B002); U.S. Surveyor General's Office, "Plat of the Claim of Broken Hill Silver Lead Mining Co. Known as the Broken Hill, Tuesday, Saturday and Bobby Lodes," 27-30 October 1926, on file at Montana State Office, Bureau of Land Management, Billings (A002).

[3] Walter Harvey Weed, *The Mines Handbook [for 1924]* vol. 16 (New York: The Mines Handbook Co., 1925): 1184 (A003) [Subsequent citations of the *Mines Handbook* (and its successor, *Mines Register)* will have abbreviated title, volume, and year only.]

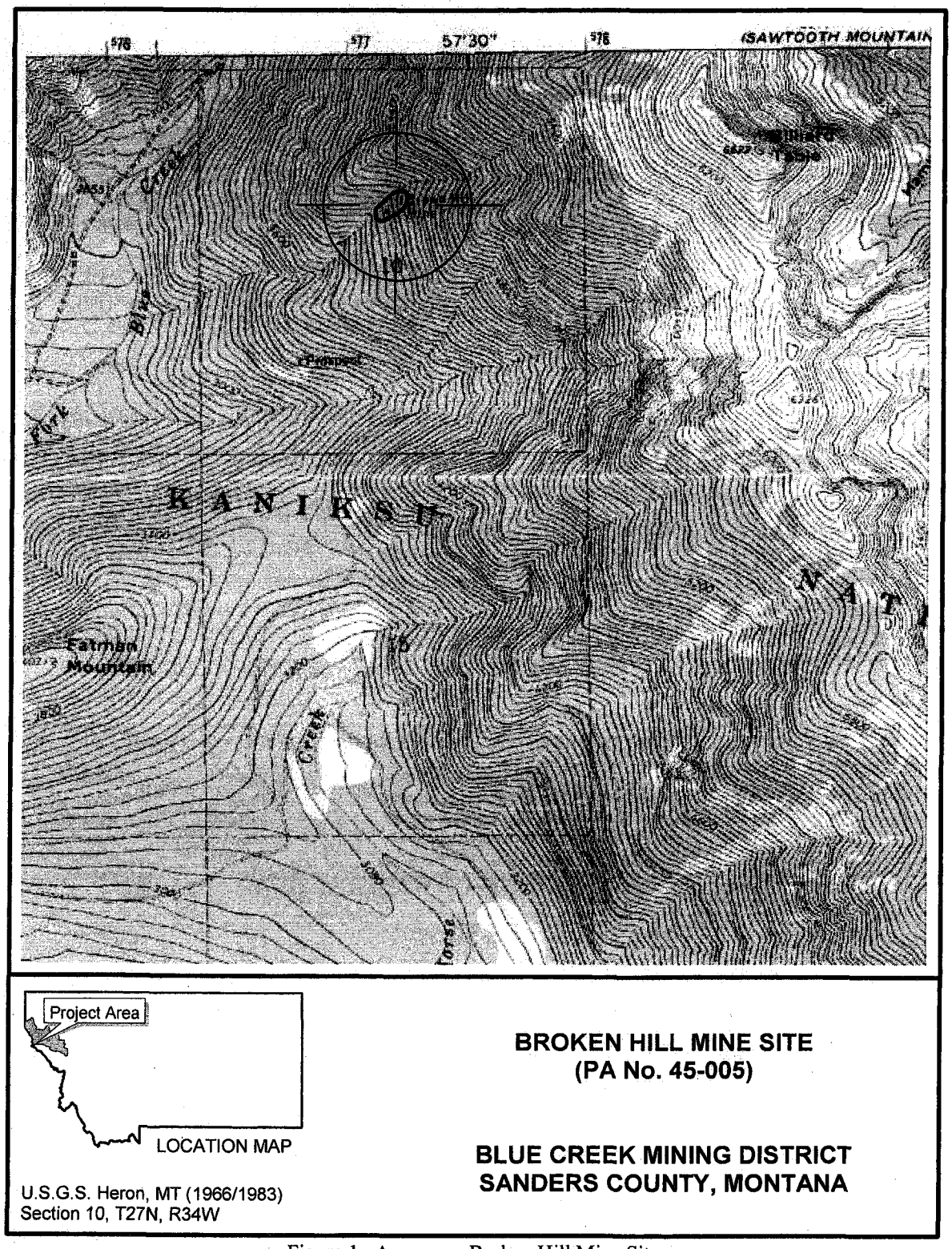
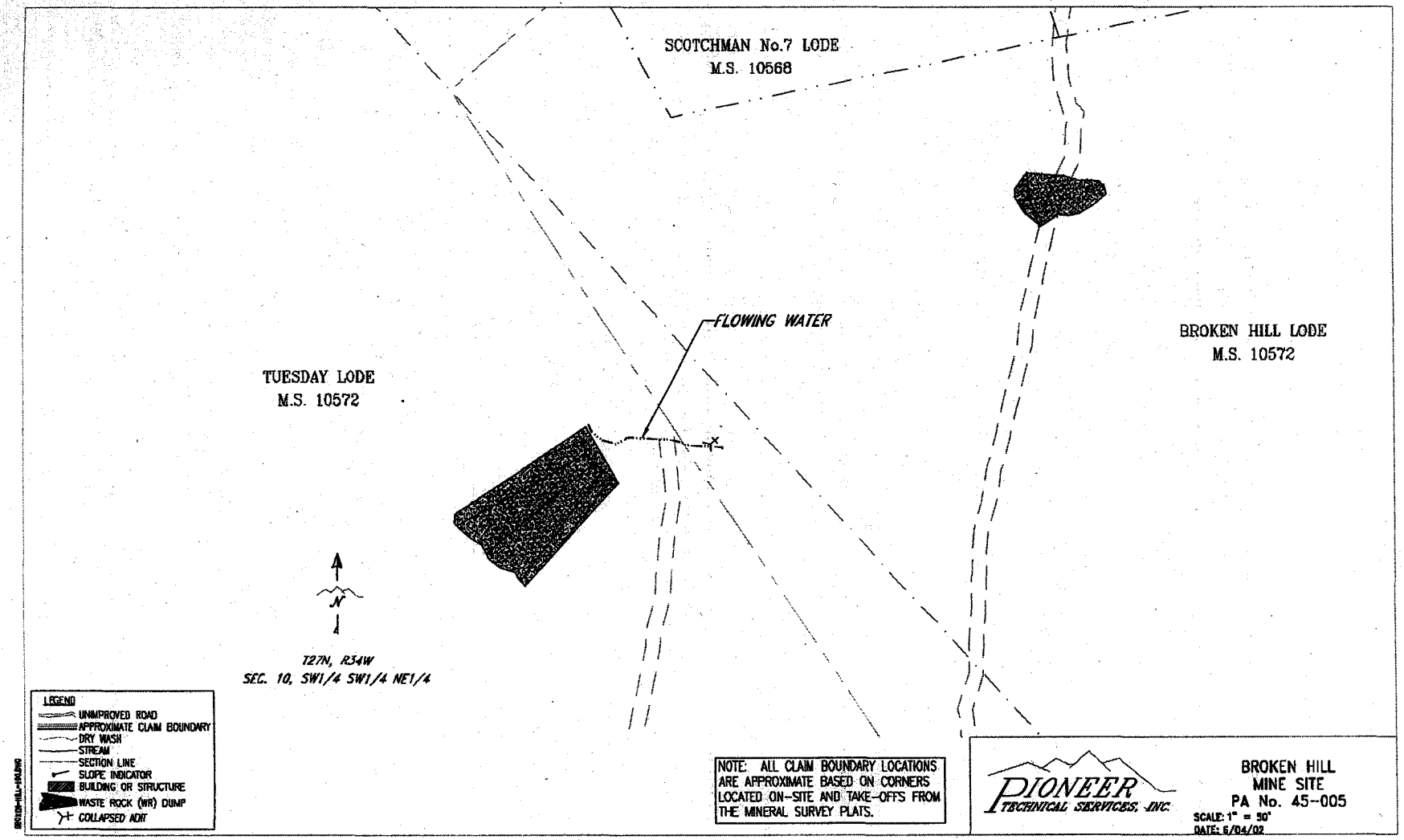


Figure 1. Area map, Broken Hill Mine Site.


SCOTCHMAN No.7 LODE
M.S. 10568
FLOWING WATER
BROKEN HILL LODE
M.S. 10572
TUESDAY LODE
M.S. 10572
N
T27N, R34W
SEC. 10, SW1/4 SW1/4 NE1/4
LEGEND
UNIMPROVED ROAD
APPROXIMATE CLAIM BOUNDARY
DRY WASH
STREAM
SECTION LINE
SLOPE INDICATOR
BUILDING OR STRUCTURE
WASTE ROCK (WR) DUMP
COLLAPSED ADIT
NOTE: ALL CLAIM BOUNDARY LOCATIONS ARE APPROXIMATE BASED ON CORNERS LOCATED ON-SITE AND TAKE-OFFS FROM THE MINERAL SURVEY PLATS.
PIONEER TECHNICAL SERVICES, INC.
BROKEN HILL
MINE SITE
PA No. 45-005
SCALE: 1" = 50'
DATE: 6/04/02

Brother, Scotchman No. 9, and Saturday lodes as well as two nearby millsite claims. Control of the new company lay in the hands of Dunn who became its first president and majority stockholder by a wide margin.[4]

The Broken Hill gained notoriety as "an important new property of much promise" after the Federal Mining and Smelting Company obtained an option on the mine in 1923.[5] Since its incorporation two decades earlier, Federal Mining and Smelting had ranked among the top producers of silver-lead ore in the wealthy Coeur d'Alene Mining District just over the state line in Idaho. However, fearing that its major mines neared exhaustion, the company was aggressively seeking out new properties to add to its active holdings.[6]

Federal Mining and Smelting immediately started development work at the Broken Hill, extending both of the tunnels and drifting on ore. By late 1923, however, only one small test lot of ore had been shipped for treatment. Presumably convinced that the mine lacked insufficient reserves for major production, Federal Mining and Smelting quickly dropped the option in 1924.[7]

Later that same year, Broken Hill Silver Lead Mining completed the annual assessment work necessary to maintain rights to the mine's unpatented claims. In a proof of labor filed with the county, a representative of the company declared that at least $100 had been invested in the building of "cabins" and the "driving of tunnels, drifts and crosscuts." These improvements reportedly benefited six lode locations and two millsite claims.[8]

In 1925, Broken Hill Silver Lead Mining leased out the Broken Hill again, this time "on a royalty basis" to H. C. Conn.[9] Production that year totaled 88 tons of ore, some of which was shipped to the west coast for export. In the following year, Conn sent 140 more tons of Broken Hill ore to a Belgium smelter. In addition, he completed "about 250 feet of prospecting."[10] However, his operation likely had suffered financial losses due to the high cost of shipping ore outside the country.

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[4] Ibid.; Montana Secretary of State, Corporations, Broken Hill Silver Lead Mining Company, Folder F-001720, "Articles of Incorporation," 25 May 1922 (C001); Sanders County Clerk and Recorder, Deed Book 19, p. 121 (B003).

[5] *Mines Handbook* vol. 16 (1924): 1184 (A003).

[6] Ibid., 893 (A003); vol. 17 (1926): 800 (A004).

[7] U.S. Bureau of Mines, *Mineral Resources of the United States, Calendar Year 1923* (Washington, DC: Government Printing Office, 1927): 473 (A005) [Subsequent citation for this source (and its successor, *Minerals Yearbook*) will be by abbreviated title and year only.]; *Mines Handbook* vol. 17 (1926): 800, 1046 (A004).

[8] Sanders County Clerk and Recorder, Affidavit Book 2, p. 604 (B005).

[9] *Mines Handbook* vol. 18 (1931): 1281 (A006).

[10] *Mineral Resources, 1925,* 654 (A007); *1926,* 407 (A008); Montana Bureau of Mines and Geology, *Mines and Mineral Deposits (Except Fuels) Sanders County, Montana,* by F. A. Crowley, Bulletin 34 (Butte: Montana Bureau of Mines and Geology, 1963): 14 (A009).

Hopes that the Broken Hill could be a viable producer revived in 1927 when a custom mill at nearby Kellogg, Idaho was refurbished for the production of lead and zinc concentrates. That year, presumably either Broken Hill Silver Lead Mining or Conn shipped 45 tons of the mine's ore to the custom mill for test treatment.[11] No other shipments followed, suggesting that the metal content of Broken Hill's ore and/or the mill's concentration process had failed to lived up to expectations.

Meanwhile, in the midst of Conn's mining activity, Broken Hill Silver Lead Mining started the process of securing full ownership rights to the Broken Hill Mine group. In October 1926, it paid for a government worker to complete the survey mandatory for patent on the Broken Hill and three adjoining lode locations, including the Bobby, Tuesday, and Saturday. The survey recorded an underground network of two tunnels, seven drifts, two crosscuts, and a raise. Both tunnels developed the lode within the Broken Hill claim, but the portal of the lowest tunnel lay below (west of) the Broken Hill on the Tuesday claim.[12]

While awaiting the patent, Broken Hill Silver Lead Mining kept up with the assessment work on the Broken Hill, Bobby, Tuesday and Saturday.[13] However, by the time the Federal government finally issued a patent in the late summer of 1930, it only included the Broken Hill and Bobby.[14] A few months later, one of Broken Hill Silver Lead Mining's major stockholders and others reorganized the company in an apparent attempt to raise operational capital for a resumption of mining. Their newly-incorporated Continental Mining Company immediately assumed ownership control of the patented Broken Hill and Bobby claims.[15]

Despite a change in corporate ownership, the Broken Hill Mine did not reopen and appears to have remained closed for the next 35 years. There was no mention of the mine in the mining literature of the period, nor were any notices of assessment work filed on any of its unpatented locations.

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[11] *Mineral Resources, 1927*, 777 (A010); Montana Bureau of Mines and Geology, *Mines and Mineral Deposits Sanders County*, Crowley, Bulletin 34, 14 (A009).

[12] U.S. Surveyor General's Office, "Plat of the Claim of Broken Hill Silver Lead Mining Co. Known as the Broken Hill, Tuesday, Saturday and Bobby Lodes," 27-30 October 1926 (A002); *Mines Handbook* vol. 17 (1926): 1046 (A004).

[13] Sanders County Clerk and Recorder, Affidavit Book 3, p. 5 (B010).

[14] Sanders County Clerk and Recorder, Deed Book 31, p. 488 (B011).

[15] Harry Fairbanks held 330,750 shares of Broken Hill Silver Lead Mining's stock as of September 1925, and he was one of the signers of Continental Mining Company's articles at incorporation in 1930. Montana Secretary of State, Corporations, Broken Hill Silver Lead Mining Company, Folder F-001720, "Minutes of Special Meeting of Stockholders," filed 24 September 1925 (C001); Idaho Secretary of State, Archives and Record Management Division, Continental Mining Company, "Articles of Incorporation," 17 October 1930 (C003); Sanders County Clerk and Recorder, Deed Book 31, p. 491 (B012).

In 1952, ownership of the Broken Hill and Bobby claims passed from the long-inactive Continental Mining Company to one of the corporation's stockholders, Walter Nicholls.[16] The property remained in Nicholls' hands for only a short time. By the mid-1950s, Nicholls had died and title to the two claims passed to his heirs Ruth Swann Goddard, William Swann, and James Preston Swann.[17]

In the mid-1960s, a rise in the price of metals finally stimulated a renewal of activity at the Broken Hill. At that time, the Swanns entered into what would prove to be the first in a series of lease and option agreements on the mine. That first agreement granted Joe Williams and his wife Dorothy operational control of the Broken Hill for up to ten years for a 10% royalty on smelter returns. In addition to the patented Broken Hill and Bobby, the lease included rights to the "contiguous unpatented mining claims."[18] In late 1965, Joe Williams along with Preston and William Swann relocated the Tuesday and presumably the other unpatented claims of the former Broken Hill Mine group.[19]

Williams started rehabilitation work at the Broken Hill in 1966 with a workforce of one or two men. The upper and lower tunnels were both reopened, a shaft retimbered, and a new ore bin erected. Following that, the crew drove a 110-foot raise between the tunnels and shipped just under 94 tons of lead-silver-zinc ore.[20] Williams also transferred ½ interest in his lease agreement to Arthur Jensen within the year. One condition of that agreement stipulated Jensen to pay the wages of a miner to work with Williams.[21]

Williams may have continued operations at the Broken Hill into early 1967. At that time, he signed an option to sell his outstanding ½ interest in the lease to John Bohlman.[22] Meanwhile, Arthur Jensen retained Donald Russell to administrate his lease interest and supervise the mine's workforce.[23]

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[16] Sanders County Clerk and Recorder, Deed Book 57, p. 191 (B013); Idaho Secretary of State, Archives and Record Management Division, Continental Mining Company, "Amendments to Articles of Incorporation," 16 January 1946 (C003).

[17] Sanders County Clerk and Recorder, Decree Book 4, p. 445 (B014).

[18] Sanders County Clerk and Recorder, Lease Book 2, p. 424 (B015).

[19] Sanders County Clerk and Recorder, Location Book 19, p. 527 (B016).

[20] Montana Bureau of Mines and Geology, questionnaire for 1966, on file in the Broken Hill Mine File, located in Mining Property File, Montana Bureau of Mines and Geology, Montana Tech, Butte (A011) [Subsequent citations for various documents in the file will be abbreviated as "in the Broken Hill Mine File."]

[21] Sanders County Clerk and Recorder, Lease Book 2, p. 440 (B017).

[22] Sanders County Clerk and Recorder, Lease Book 2, p. 449 (B018).

[23] Sanders County Clerk and Recorder, Miscellaneous Book 9, p. 40 (B019).

In mid-June 1967, C. W. Thornton, operating under the business name of the Thornton Construction Company, subleased both Jensen's and Bohlman's lease interests in the Broken Hill. His sublease agreements included purchase options contingent on a down payment of $4,000, plus additional payments totaling $27,000. The latter payments were to be made as royalties on net smelter returns.[24]

While available information is very sketchy, it appears that the Bunker Hill Company, another large Coeur d'Alene mining firm, conducted some survey work and exploration drilling at the Broken Hill around the time that Thornton assumed the sublease agreements. One contemporary account indicated that Bunker Hill had advised Thornton that additional work was necessary to verify the feasibility of developing the mine's ore.[25] Bunker Hill apparently chose not to pick up the option on the Broken Hill itself.

In late June of 1967, a geologist with the Montana Bureau of Mines and Geology visited the Broken Hill and assessed Thornton's operation. He found Thornton and a crew of three of four men engaged in development work. Thornton reported his intention of moving a floatation mill from a property near Slyvanite to the Broken Hill, if milling of the mine's ore proved "feasible." While the geologist concurred that "the mine could produce low-grade ore," suitable for milling on-site, he recommended thorough testing "on a large amount of representative rock before operating [the] mill on [a] large scale."[26] Thornton repaired the mine's tunnels and ran diamond drill test holes over the next few weeks.[27] However, he transferred all of his rights to the lease agreements soon after that, without ever instigating milling on-site.[28]

Later that same summer, the newly incorporated Great Western Industries assumed all interest in the sublease agreements on the Broken Hill's patented and unpatented claims.[29] One of the company's directors and stockholders, Edward Schenkel explored the property with diamond drilling and built a new access road by the end of the year.[30] In the following summer of 1968, some road repairs and clearing of brush were completed at the mine's unpatented claims, but otherwise

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[24] Sublease agreements to C. W. Thornton are Exhibit A's in: Sanders County Clerk and Recorder, Miscellaneous Book 9, p. 98 (B020) and p. 104 (B021).

[25] Montana Bureau of Mines and Geology, "State Technical Services Mine Visit Report," by K.T. Bondurant, 27 June 1967, in the Broken Hill Mine File (A012).

[26] Ibid. (A012)

[27] Sanders County Clerk and Recorder, Affidavit Book 5, p. 202 (B023).

[28] Sanders County Clerk and Recorder, Miscellaneous Book 9, p. 98 (B020); p. 104 (B021).

[29] One of Great Western Industries' principals, John M. Hill assumed the sublease agreements on the Broken Hill from Thornton a few days after the company's incorporation articles were filed on August 11, 1967. Later in the month, Hill assigned the subleases to Great Western Industries. Montana Secretary of State, Corporations, Great Western Industries, Folder D-0033282, "Articles of Incorporation," 28 July 1967 (C005); Sanders County Clerk and Recorder, Miscellaneous Book 9, p. 98 (B020); p. 104 (B021); p. 110 (B022).

[30] Montana Bureau of Mines and Geology, questionnaire for 1967, in the Broken Hill Mine File (A011).

the Broken Hill was inactive.[31] Contemporary reports suggest that Great Western Industries continued to hold the sublease agreements for four more years, but the Broken Hill remained idle.[32]

In 1973, Arthur Jensen reassumed operational control of the Broken Hill. He retained his lease interest for three more years. Again, however, the mine was inactive.[33] Sources consulted indicated that the Broken Hill was never leased out again after that.

As of the fall of 1976, William Swann and Ruth Swann Goddard each still held the 1/3 ownership interest that they had inherited over 20 years ago in the mine's patented Broken Hill and Bobby claims. Meanwhile, James Swann had died and his 1/3 interest became divided between his heirs.[34] The two claims remained in the hands of the Swann Family for 17 more years until John Fitchett and Meggen Fitchett obtained a warranty deed to the property.[35] The Fitchetts transferred the title to a trust under their names in 1994.[36] The trust still owns the Broken Hill and Bobby claims at present.

The year 1967 is the last known time that annual assessment work was completed at the Tuesday and other unpatented locations at the Broken Hill Mine. Likewise, there has been no attempt to patent the claims since then. These public lands are administered by the Kootenai National Forest.

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[31] Sanders County Clerk and Recorder, Affidavit Book 5, p. 202 (B023).

[32] Montana Bureau of Mines and Geology, *Directory of Mining Enterprises for 1969,* Bulletin 77, 23 (A013); *1970,* Bulletin 82, 19 (A014); *1971,* Bulletin 86, 16 (A015); *1972,* Bulletin 88, 21(A016). Each of these reports lists Edward Schenkel as the operator at the Broken Hill rather than Great Western Industries. However, since Schenkel was an official of the company, RTI has assumed that he made the reports as the company's representative.

[33] Montana Bureau of Mines and Geology, *Directory of Mining Enterprises for 1973,* Bulletin 92, 22 (A017); *1974,* Bulletin 95, 23 (A018); *1975,* Bulletin 100, 22 (A019).

[34] Sanders County Clerk and Recorder, Microfiche 6482 (B025)

[35] Sanders County Clerk and Recorder, Microfiche 8129 (B027); 8202 (B028).

[36] Sanders County Clerk and Recorder, Microfiche 12102 (B029).

MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

te Name: Broken Hill
escription: T 27N R 34W
District: Blue Creek
: N 48° 07' 15"
de: W 115° 58' 06"
tus: Private/Public
Heron
ors: Bullock, Flammang, Clark
zation: Pioneer Technical Services, Inc.

County: Sanders
Section(s): SW 1/4, SW, 1/4, NE 1/4, Sec. 10
Mine Type: Hardrock/Ag, Pb, Zn
Primary Drainage: East Fork Blue Creek
USGS Code: 17010213
Secondary Drainage: East Fork Blue Creek
Date Investigated: August 3, 1993
P.A. # 45-005

here were no mill tailings associated with this site.

he volume of waste rock associated with this site was estimated to be 6200 cubic ards. The following elements were elevated at least three times background:

rsenic: 508 to 1140 mg/kg
admium: 15.2 to 26 mg/kg
opper: 140J to 342J mg/kg
ron: 94,400 mg/kg
Mercury: 2.53J to 27.2J mg/kg.
Lead: 18,700J to 55,900J mg/kg
Antimony: 61.3 to 344 mg/kg
Zinc: 9600 to 11,400 mg/kg.

he waste rock dumps were mostly unvegetated.

collapsed discharging adit (GW-1) was present, with a flow of approximately 25 gpm, a H of 8.71, and a specific conductance of 75 umhos/cm. The adit discharge did not xceed any MCL/MCLGs. Chronic aquatic life criteria for mercury, lead and zinc and cute aquatic life criteria for lead and zinc were exceeded in this sample of the ischarge.

dry tributary to the East Fork of Dry Creek was approximately 100 feet north of the site. here were no direct runoff pathways to surface water identified during this investigation. herefore, surface water and stream sediment samples were not collected.

ne plastic barrel half full of an unknown material was present at the base of WR-1.

Broken Hill PA# 45-005
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER -BULLOCK
INVESTIGATION DATE: 08/03/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
45-005-WR-1	1140	27.9	15.2	7.25	5.25	342 J	94400	27.2 J	992	3.84	55900 J	344	9600	NR
45-005-WR-2	508	19.8	26	5.86	4.5	140 J	44200	2.53 J	426	6.23	18700 J	61.3	11400	NR
BACKGROUND	8.68	142	0.6 U	10.4	10.5	21.2 J	22100	0.06 J	710	14.4	33.8 J	6.84 U	78.2	NR

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	TOTAL SULFUR ACID BASE t/1000t	NEUTRAL. POTENT. t/1000t	SULFUR ACID BASE POTENT. t/1000t	SULFATE SULFUR %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC SULFUR ACID BASE t/1000t	SULFUR ACID BASE POTENT. t/1000t
45-005-WR-1	2.80	87.5	-5.78	-93.3	1.86	0.08	0.86	2.50	-8.28
45-005-WR-2	2.46	76.9	-4.12	-81.0	0.59	0.15	1.72	4.69	-8.81

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC. (mg CaCO3/L)
45-005-GW-1	30.4	2.01 U	2.57 U	9.7 U	6.83 U	2.97	69.6	0.044 J	15.2	12.7 U	107	30.7 U	867	23.4

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Wet Chemistry
Results in mg/l

FIELD I.D.	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
45-005-GW-1	52	6.7	< 5	< 0.05	NR

LEGEND

WR1 - Composite of subsamples WR1A, 1B, 1C, and 3.
WR2 - Composite of subsamples WR2A and 2B.
BACKGROUND - From the Holliday Mine (45-009-SS-1).
GW1 - From the flow out of adit #2.

IN THE TWENTIETH JUDICIAL DISTRICT
OF THE STATE OF MONTANA, IN AND FOR THE COUNTY OF SANDERS

STATE OF MONTANA
COUNTY OF SANDERS- SS

Public Meeting
Broken Hill Mine Reclamation Project
Montana Department of Environmental Quality

When: 6 p.m., Wednesday, February 16, 2011. Where: Community Center, Building #2 Railroad Avenue, Heron, Montana.

The Montana Department of Environmental Quality (DEQ) in cooperation with the Kootenai National Forest will conduct a public meeting to present information and receive public comment on the Broken Hill Mine Reclamation Project located approximately 4 miles north of Heron, Montana in the Cabinet Mountains of Sanders County.

The public meeting is scheduled for 6 p.m., Wednesday, February 16, 2011, at the Community Center in Heron. The Community Center, Building #2, is located on Railroad Avenue. The public is encouraged to attend and will have an opportunity to comment.

The DEQ Abandoned Mine Section will reclaim mine waste contamination at the Broken Hill Mine site. The site is contaminated with various heavy metals, with arsenic and lead being the primary contaminants of concern. The contamination poses a potential threat to human health and the environment. The site ranks 18th on the DEQ Priority Abandoned Hard Rock Mine list of 133 sites.

For more information or to submit written comments, contact Pebbles Clark at pclark2@mt.gov or DEQ Remediation Division, PO Box 200901, Helena, MT 59620-0901. The Expanded Engineering Evaluation and Cost Analysis (EEE/CA) report and other project reports are available for review at the Trout Creek Ranger Station, 2693 MT Hwy 200, Trout Creek, Montana and on the web at www.deq.mt.gov under public interest, public meetings. The DEQ will make reasonable accommodations for persons with disabilities who wish to participate in this meeting. If you require an accommodation, please contact Mary Ann Dunwell at (406) 841-5016 or mdunwell@mt.gov.

Published in the Sanders County Ledger January 27 and February 3 & 10, 2011

$69.60

AFFIDAVIT OF PUBLICATION

Tom Eggensperger, being duly sworn, deposes and says:

That he resides at Thompson Falls, Montana, and is the publisher of the **SANDERS COUNTY LEDGER**, a newspaper of general circulation, published weekly at Thompson Falls, Montana and that he printed in said newspaper the

Public Meeting – Broken Hill Mine

hereto annexed to for 3 consecutive week(s), the first publication in the issue dated January 27, 2011 and the final publication dated February 10, 2011.

And that said notice was printed in the regular and entire issue of said newspaper and not in any supplement thereof.

Signed Tom Eggensperger

Subscribed and sworn to me before this 10th day of February, 2011

Signed Bina Eggensperger

Bina Eggensperger, Notary Public

NOTARY PUBLIC in and for the State of Montana, residing at Thompson Falls, Montana. My commission expires July 11, 2011.

I hereby certify that I have read Sec. 18-7-201 to 18-7-205, MCA and subsequent revisions, and declare that the price or rate charged the State of Montana for the publication for which claim is made is not in excess of the minimum rate charged any other advertiser for publication or advertisement.

BINA EGGENSPERGER NOTARIAL SEAL STATE OF MONTANA

BINA EGGENSPERGER
NOTARY PUBLIC for the
State of Montana
Residing at Thompson Falls, Montana
My Commission Expires
July 11, 2011

(SEAL)

Josef
DEQ - AMR

Broken Hill Mine (24SA0541)

200210090!

Montana Department of
ENVIRONMENTAL QUALITY

Judy Martz, Governor

P.O. Box 200901 • Helena, MT 59620-0901 • (406) 444-2544 • www.deq.state.mt.us

October 8, 2002

RECEIVED

BY:

Mr. Josef Warhank
Review and Compliance Officer
State Historic Preservation Office
1410 8TH Avenue
Helena, Montana 59620-1202

CONCUR
MONTANA SHPO
DATE 4 Nov 02 SIGNED Josef Warhank

RE: Section 106 review of the Broken Hill Mine site, 24SA0541

Dear Mr. Warhank,

The Department of Environmental Quality – Mine Waste Cleanup Bureau (DEQ) is evaluating possible mine waste clean up activities at the Broken Hill Mine site in Sanders County, Montana. Our current philosophy and strategy is to conduct cultural resource investigations as early as possible in the site evaluation process. If we decide to proceed to reclamation activity, funding for the project will come through a Title IV grant issued from the Office of Surface Mining Reclamation and Enforcement. The attached report details our examination of the area for cultural values in accordance with the requirements of 36CFR800.

The study was conducted by Frontier Historical Consultants during the fall of 2001, and summer of 2002. The report represents a compilation of research by Meadowlark Search for realty and chain of title history, RTI for owner/operator histories, Pioneer Technical Services for GPS mapping of the site, and Frontier Historical Consultants for on-site recordation, photographic documentation, mapping verification and detail, data compilation and report preparation. We agree with our consultant's recommendations that the Broken Hill Mine site (24SA0541) is not individually significant under National Register criteria A, B, C or D, and would not qualify as a historic landscape. While the Broken Hill Mine site may once have been significant to the development of mining and the local economy in the Sanders County region, it no longer exhibits sufficient cultural values to be considered potentially eligible to the National Register of Historic Places. Similarly, the Broken Hill Mine does not contribute to the National Register eligibility of the local Blue Creek Mining District. In accordance with the Advisory Council on Historic Preservation regulations at 36CFR§800.4(c)(2), we request the SHPO's concurrence on our findings of no historic property. If you have any questions, please do not hesitate to call me at 444-1294.

Thank you very much for your consideration.

Sincerely,

Dale Herbert
Mine Waste Cleanup Bureau

RECEIVED
NOV 07 2002
Dept. of Environmental Remediation

file: DEQ/AMR/2002

Montana Department of Environmental Quality

Memo

To: File

From: Pebbles Clark, DEQ-AML

Date: 4/20/2011

Re: 2011 Broken Hill Mine Reclamation Project - Letter to USFWS Regarding Threatened and Endangered Species

---

On March 11, 2011, Pebbles Clark, DEQ-AML Project Manager, wrote a letter to the USFWS informing them of the proposed reclamation actions at the Broken Hill Mine. Attached to the letter was a copy of the Natural Heritage Foundation species of concern findings for Section 10, T27N, R34W, site maps, a copy of the EEE/CA, a copy of DEQ's consultation with Steve Johnson, Wildlife Biologist with the Kootenai Nation Forest Service, and a copy of DEQ's consultation with Bruce Sterling, Wildlife Biologist with Montana Fish, Wildlife, and Parks. The letter stated that DEQ determined that the proposed reclamation actions are not likely to have any adverse effect on any federally listed threatened or endangered species. The letter requested that the USFWS review the documentation and concur with DEQ findings of no impact. The letter stated that if the USFWS did not concur or disagreed with DEQ determination, then the USFWS should contact DEQ.

As of April 20, 2011, DEQ has not received any comment or response from the USFWS with regard to the proposed reclamation actions affect on threatened and endangered species at the Broken Hill Mine.

Montana Department of
ENVIRONMENTAL QUALITY
Brian Schweitzer, Governor

P.O. Box 200901 • Helena, MT 59620-0901 • (406) 444-2544 • www.deq.mt.gov

March 11, 2011

R. Mark Wilson, Field Supervisor
Montana Field Office
USFWS Ecological Services
585 Shephard Way
Helena, MT 59601

RE: Proposed Abandoned Mine Reclamation Project
Broken Hill Mine
Section 10, Township 27 North, Range 34 West, Sanders County, Montana
Request for Concurrence with Findings

Dear Mr. Wilson:

As a condition of approval for Montana's Abandoned Mine Reclamation program by USDOI – Office of Surface Mining, Montana is required to consult with the US Fish and Wildlife Service (USFWS) during project planning to ensure that proposed reclamation actions will have no impact on federally listed threatened or endangered species (TES). (See Federal Register, Vol. 60, No. 138, pages 36998-37002).

Montana's Abandoned Mine Reclamation Program (DEQ) is planning abandoned mine reclamation at the Broken Hill Mine, located approximately four miles north of Heron, Montana, in the Cabinet Mountain Range. The Broken Hill Mine Site (BHMS) includes portions of private and publically owned lands, is located within Bear Management Unit 4 of the Cabinet-Yaak Grizzly Bear Recovery Zone (CYGBRZ), and encompasses approximately 1.5 acres of mining impacted land (Attachment 1a and 1b).

DEQ is working jointly with United States Forest Service Regional staff and Kootenai National Forest (KNF) staff on reclamation activities and planning. Reclamation activities are planned to take place in summer 2011 under a 45 to 60 day construction contract. Proposed reclamation activities include excavating approximately 4,100 cubic yards of waste rock, transporting it approximately 0.25 miles via Forest Service Road 2290 and placing it in a capped, engineered repository located on KNF land; applying cover soil to the repository; grading and revegetating the repository and all disturbed areas, closing two collapsed adits, and constructing an infiltration trench for the lower adit discharge. I have enclosed a copy of the Draft Expanded Engineering Evaluation and Cost Analysis Report (EEE/CA) dated November 2010, for your review

(Attachment 2). This document details the preferred reclamation alternative for the BHMS and includes summaries of site investigation activities and results, risk analysis, and cost benefit analysis. This document and other project related documents are available electronically for download at the following DEQ website:
http://deq.mt.gov/AbandonedMines/CurrentProjects.mcpx

DEQ consulted with the Montana Natural Heritage Program and determined TES listed by the USFWS that may be present in the project area (Attachment 3). TES that may be present at the BHMS are listed in Table 1.

Table 1: BHMS Threatened or Endangered Species

Animal Species	Scientific Name	Status	Potential at BHMS
Gray Wolf	*Canis lupis*	LE,XN	Low, No Habitat
Canada Lynx	*Lynx canadensis*	LT	Low, No Habitat
Grizzly Bear	*Ursus arctos horribilis*	LT, XN,DM	Moderate, CYGBRZ

DM – Recovered, delisted, and being monitored
LE – Listed Endangered
LT – Listed Threatened
XN – Experimental – Nonessential population

Since the BHMS is located within the CYGBRZ, DEQ has also consulted with Steve Johnson, Wildlife Biologist with KNF and Bruce Sterling, Wildlife Biologist with Montana Department of Fish Wildlife and Parks (MTFWP) to receive comment on the proposed reclamation plan and its impact on TES (Attachment 4a and 4b). Below is a summary of comments and mitigation measures recommended by KNF and MTFWP.

Gray Wolf
No mitigation measures will be necessary. During DEQ consultation with Steve Johnson, KNF, he stated that there are no known dens or rendezvous sites in the project area, the project will not impact prey species, and the project will cause no change to secure habitat.

Canada Lynx
No mitigation measures will be necessary. During DEQ consultation with Steve Johnson, KNF, he stated that the repository is below 4,000 feet and is outside lynx habitat, the mine site is above 4,000 feet and is not lynx habitat types, and that the project area is not located in critical lynx habitat.

Grizzly Bear
The Broken Hill Mine Reclamation Project is located within Bear Management Unit 4 of the CYGBRZ (Attachment 1b). During DEQ consultation with Steve Johnson, KNF, and Bruce Sterling, MTFWP, they suggested the following mitigation measures be implemented:

- Begin work June 16, 2011, or later, after grizzly bear spring season.
- No camping at the work site.
- Food and garbage will be required to be stored in a bear resistant manner.
- Site access is via Forest Service Road 2290 which is currently a restricted road. For moving window analysis, KNF staff will show this road as "open" for 2011.

Based on these consultations, DEQ will implement the above grizzly bear mitigation measures to mitigate impacts to grizzly bears during the reclamation project.

Based on DEQ staff evaluation of the site and TES mitigation efforts recommended by KNF and MTFWP, DEQ has concluded that proposed mine reclamation actions are not likely to have any adverse effect on any federally listed threatened or endangered species or habitat necessary for their survival. Reclamation activities will ultimately improve habitat for both plant and animal species.

The DEQ is requesting that USFWS review this determination and concur, in writing, with our findings. If USFWS is not able to concur, or has any disagreement with this determination, DEQ requests that USFWS provide written comment addressing any concerns and/or additional mitigation measures required.

For your convenience I have included this letter and all attachments as electronic PDF documents on the enclosed CD (Attachment 5). Feel free to contact me at my office telephone (406) 841-5028 or through email at pclark2@mt.gov if you have any questions or concerns about this project.

Sincerely,

Pebbles Clark

Pebbles Clark
Project Manager
Montana Department of Environmental Quality
Mine Waste Cleanup Bureau
Abandoned Mine Section

Attachments: Attachment 1a: Site Location Map
Attachment 1b: Site Location Details
Attachment 2: Draft Expanded Engineering Evaluation and Cost Analysis Report (EEE/CA) dated November 2010
Attachment 3: Montana Natural Heritage Program Consultation
Attachment 4a: Steve Johnson, KNF, Consultation
Attachment 4b: Bruce Sterling, MTFWP, Consultation
Attachment 5: CD

MT FWP
Consultation

Clark, Pebbles

From: Sterling, Bruce
Sent: Tuesday, March 08, 2011 1:54 PM
To: Clark, Pebbles
Subject: Broken Hill Project

Hi Pebbles,

Just a quick follow-up letter regarding our phone conversation this morning.

With the heavy snow accumulations in the area of the project it is my understanding that work will not begin before June 1st and more likely around June 15th.
It is my recommendation that all work be completed by September 1st to reduced conflicts with the start of the archery big game season.

It was nice talking with you.
Take care,

Bruce Sterling
Area Wildlife Biologist
MFWP
Thompson Falls

Clark, Pebbles

From: Clark, Pebbles
Sent: Monday, February 28, 2011 11:10 AM
To: Sterling, Bruce
Subject: Upcoming Reclamation Project, Sanders County
Attachments: Broken Hill_Project Map 1.pdf; Broken Hill_Project Map 2.pdf

Hi Bruce, 827 - 4389

My name is Pebbles Clark and I am a Reclamation Specialist with the DEQ Abandoned Mine Program. I left you a voice mail last Friday and figured I would just shoot you an email. I am currently working with the Kootenai NF on the Broken Hill Mine Reclamation Project which is located approximately 4 miles north of Heron, MT (see Map 1). This is a small mine with ~4,100 cy of mine waste located on private and public lands totally ~1.5 acres of mining impacted land. The short version of the reclamation plan is to construct a repository on KNF land located ~0.25 miles from the Broken Hill, haul the waste to repository via FS2290, and cap the waste (see Map 2). This project is planned to go to construction this summer.

I got your name from Steve Johnsen, Wildlife Biologist over at the KNF as the person at FWP that I needed to contact about this project. As part of DEQ's project planning, the Abandoned Mine Program is required to consult with USFWS to ensure that reclamation actions will have no adverse impact on federally listed threatened or endangered species. I consulted with the Natural Heritage Foundation and grizzly bears, Canada lynx, and gray wolf are the threatened or endangered species in the project area. This project is also located within the Cabinet-Yaak Grizzly Bear Recovery Zone.

Before consulting with the USFWS, I wanted to touch base with the local MT FWP folks and get FWPs comments/input on our proposed project and then include those comments into my USFWS consultation. After discussing the project with Steve Johnsen at the KNF, he mentioned that the KNF would prefer that the project not start prior to June 15, 2011, due to grizzly bear habitat.

The Draft Expanded Engineering Evaluation and Cost Analysis Report (EEE/CA) which details the specifics of our reclamation plan can be found on our website at the link below under the Broken Hill project. I can also put a hard copy in the mail to you if you prefer.
http://deq.mt.gov/AbandonedMines/CurrentProjects.mcpx

Please shoot me an email or give me a call (406) 841-5028 when you get a moment. Thanks!

Pebbles Clark
Reclamation Specialist
Montana Department of Environmental Quality
Abandoned Mine Lands Program
Ph: (406) 841-5028
Fx: (406) 841-5024
Email: pclark2@mt.gov

3/8 9:40 AM left message

11:05 done by Sept. 1 archery season

Kootenai NF

Consultation

Clark, Pebbles

From: Steve Johnsen [sjohnsen@fs.fed.us]
Sent: Wednesday, March 09, 2011 10:34 AM
To: Clark, Pebbles
Cc: Doug Grupenhoff
Subject: Re: USFWS Consultation
Attachments: broken hill mine.docx

Pebbles,
Take a look at this. If you need anything else, let me know. Steve

Steve Johnsen
Wildlife Biologist
Cabinet R. D.
406-827-0731

"Clark, Pebbles" <PClark2@mt.gov>

03/08/2011 12:09 PM

To Steve Johnsen <sjohnsen@fs.fed.us>
cc
Subject USFWS Consultation

Hi Steve,

Would you please send me an email summarizing any restrictions/comments you have related to threatened and endangered species (specifically grizzly bears) and the Broken Hill Mine Reclamation Project preferred alternative. After our meeting on Feb. 16th you had mentioned not starting prior to June 15, 2011, due to grizzly bear habitat and expressed that you did not have too many other concerns. An email summarizing your comments would be appreciated. That way I can attach your comments and MT FWP's comments to my USFWS consultation letter. If you need specific information on the project, there is a hard copy of the EEE/CA at your office, and it can be found on our website http://deq.mt.gov/AbandonedMines/CurrentProjects.mcpx under the Broken Hill project. Thanks and I appreciate your help on this project!

Pebbles Clark
Reclamation Specialist
Montana Department of Environmental Quality
Abandoned Mine Lands Program
Ph: (406) 841-5028
Fx: (406) 841-5024
Email: pclark2@mt.gov

Broken Hill Mine 3/9/11

Threatened and Endangered Species Considerations

Gray Wolf – no mitigation necessary

No known den or rendezvous sites in the project area.
No impacts to prey species
No change to secure habitat

Canada Lynx – no mitigation necessary

Repository below 4,000 feet, outside lynx habitat
Mine site above 4,000 feet, not lynx habitat types
Project area not in critical habitat

Grizzly Bear

Within Bear Management Unit 4 of Cabinet\Yaak Grizzly Bear Recovery Zone

Mitigations
Begin work June, 16 or later, after grizzly bear spring season
No camping at work site, food and garbage must be stored in a bear resistant manner
Access to site is via FSR 2290, a restricted road. For moving window analysis road will be shown as open for 2011.

MONTANA
Natural Heritage
Program

P.O. Box 201800 • 1515 East Sixth Avenue • Helena, MT 59620-1800 • fax 406.444.0581 • tel 406.444.5354 • http://mtnhp.org

October 21, 2010

Pebbles Clark
MT DEQ
1100 N. Last Chance Gulch
Helena, Montana 59620

Dear Pebbles,

I am writing in response to your recent request regarding Montana species of concern in the vicinity of the Broken Hill Mine, in Section 10, T27N, R34W. I checked our databases for information in this general area and have enclosed 8 species occurrence reports for 7 species of concern and a map depicting species of concern locations. Note that the maps are in Adobe GeoPDF format. With the appropriate Adobe Reader, it provides a convenient way to query and understand the information presented on the map. Documentation is included.

Please keep in mind the following when using and interpreting the enclosed information and maps:

(1) These materials are the result of a search of our database for species of concern that occur in an area defined by requested township, range and section with an additional one-mile buffer surrounding the requested area. This is done to provide a more inclusive set of records and to capture records that may be immediately adjacent to the requested area. Reports are provided for the species of concern that are located in your requested area with a one-mile buffer. Species of concern outside of this buffered area may be depicted on the map due to the map extent, but are not selected for the SOC report.

(2) On the map, polygons represent one or more source features as well as the locational uncertainty associated with the source features. A source feature is a point, line, or polygon that is the basic mapping unit of a Species Occurrence (SO) representation. The recorded location of the occurrence may vary from its true location due to many factors, including the level of expertise of the data collector, differences in survey techniques and equipment used, and the amount and type of information obtained. Therefore, this inaccuracy is characterized as locational uncertainty, and is now incorporated in the representation of an SO. If you have a question concerning a specific SO, please do not hesitate to contact us.

(3) This report may include sensitive data, and is not intended for general distribution, publication or for use outside of your agency. In particular, public release of specific location information may jeopardize the welfare of threatened, endangered, or sensitive species or communities.

(4) The accompanying map(s) display management status, which may differ from ownership. Also, this report may include data from privately owned lands, and approval by the landowner is advisable if specific location information is considered for distribution. Features shown on this map do not imply public access to any lands.

(5) Additional biological data for the search area(s) may be available from other sources. We suggest you contact the U.S. Fish and Wildlife Service for any additional information on threatened and endangered species (406-449-5225). Also, significant gaps exist in the Heritage Program's fisheries data, and we suggest you contact the Montana Rivers Information System for information related to your area of interest (406-444-3345).

(6) Additional information on species habitat, ecology and management is available on our web site in the Plant and Animal Field Guides, which we encourage you to consult for valuable information. You can access these guides at http://mtnhp.org. General information on any species can be found by accessing the link to NatureServe Explorer.

The results of a data search by the Montana Natural Heritage Program reflect the current status of our data collection efforts. These results are not intended as a final statement on sensitive species within a given area, or as a substitute for on-site surveys, which may be required for environmental assessments. The information is intended for project screening only with respect to species of concern, and not as a determination of environmental impacts, which should be gained in consultation with appropriate agencies and authorities.

I hope the enclosed information is helpful to you. Please feel free to contact me at (406) 444-3290 or via my e-mail address, below, should you have any questions or require additional information.

Sincerely,

Martin P. Miller
Montana Natural Heritage Program
martinm@mt.gov

MONTANA Natural Heritage Program
Natural Resource Information System
Montana State Library
PO Box 201800
Helena, MT 59620-1800
(406)444-3009 mtnhp@mt.gov

Species of Concern Data Report

Visit http://mtnhp.org for additional information.

Report Date:
Thursday, October 21, 2010

Falco peregrinus

View Species Info in MT Field Guide

Common Name: Peregrine Falcon
Description: Vertebrate Animal

Mapping Delineation:
Confirmed nesting area buffered by a minimum distance of 500 meters in order to encompass the area around the nest known to be defended by adults as well as the minimum distance reported between nests. Otherwise the nest area is buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters.

Species Status

Natural Heritage Ranks:

State: S3
Global: G4

Federal Agency Status: Click for Status Help

U.S. Fish & Wildlife Service: DM
U.S. Forest Service: SENSITIVE
U.S. Bureau of Land Management: SENSITIVE

FWP CFWCS Tier: 2

MT PIF Code:

Species Occurrences

Species Occurence Map Label: 177408
First Observation Date:
Last Observation Date:

SO Number: 734,779
Acreage: 69,706
SO Rank:

Oncorhynchus clarkii lewisi

View Species Info in MT Field Guide

Common Name: Westslope Cutthroat Trout
Description: Vertebrate Animal

Mapping Delineation:
Stream reaches and standing water bodies where the species presence has been confirmed through direct capture or where they are believed to be present based on the professional judgement of a fisheries biologist due to confirmed presence in adjacent areas. In order to reflect the importance of adjacent terrestrial habitats to survival, stream reaches are buffered 100 meters, standing water bodies greater than 1 acre are buffered 50 meters, and standing water bodies less than 1 acre are buffered 30 meters into the terrestrial habitat based on PACFISH/INFISH Riparian Conservation Area standards.

Species Status

Natural Heritage Ranks:

State: S2
Global: G4T3

Federal Agency Status: Click for Status Help

U.S. Fish & Wildlife Service:
U.S. Forest Service: SENSITIVE
U.S. Bureau of Land Management: SENSITIVE

FWP CFWCS Tier: 1

MT PIF Code:

Species Occurrences

Species Occurence Map Label: 261475
First Observation Date:
Last Observation Date:

SO Number: 40,365
Acreage: 247
SO Rank:

Species Occurence Map Label: 261565
First Observation Date:
Last Observation Date:

SO Number: 40,414
Acreage: 508
SO Rank:

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Helena, MT 59620-1800
(406)444-3009 mtnhp@mt.gov

Species of Concern Data Report

Visit http://mtnhp.org for additional information.

Report Date:
Thursday, October 21, 2010

Canis lupus

View Species Info in MT Field Guide

Common Name: Gray Wolf
Description: Vertebrate Animal
Mapping Delineation:
U.S. Fish and Wildlife Service recovery area boundaries for northwestern Montana where populations are classified as Endangered and southwestern Montana where populations are classified as Experimental Nonessential.

Species Status

Natural Heritage Ranks:

State: S4
Global: G4

Federal Agency Status: Click for Status Help

U.S. Fish & Wildlife Service: LE, XN
U.S. Forest Service: SENSITIVE
U.S. Bureau of Land Management: SENSITIVE

FWP CFWCS Tier: 1

MT PIF Code:

Species Occurrences

Species Occurence Map Label: 218198
First Observation Date:
Last Observation Date:

SO Number: 45
Acreage: 36,979,424
SO Rank:

Ursus arctos

View Species Info in MT Field Guide

Common Name: Grizzly Bear
Description: Vertebrate Animal
Mapping Delineation:
U.S. Fish and Wildlife Service recovery area boundaries for the Northern Continental Divide and Cabinet-Yaak recovery areas where recovery efforts continue and the boundaries of the Yellowstone distinct population segment where bears were recently delisted from the Endangered Species Act.

Species Status

Natural Heritage Ranks:

State: S2S3
Global: G4

Federal Agency Status: Click for Status Help

U.S. Fish & Wildlife Service: LT,XN
U.S. Forest Service: THREATENED
U.S. Bureau of Land Management: SENSITIVE

FWP CFWCS Tier: 1

MT PIF Code:

Species Occurrences

Species Occurence Map Label: 193725
First Observation Date:
Last Observation Date:

SO Number: 1
Acreage: 1,334,874
SO Rank:

Martes pennanti

View Species Info in MT Field Guide

Common Name: Fisher
Description: Vertebrate Animal
Mapping Delineation:
Confirmed area of occupancy based on the documented presence of adults or juveniles within tracking regions containing core habitat for the species. Outer boundaries of tracking regions are defined by areas of forest cover on individual mountain ranges or clusters of adjacent mountain ranges with continuous forest cover.

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Montana State Library
PO Box 201800
Helena, MT 59620-1800
(406)444-3009 mtnhp@mt.gov

Species of Concern Data Report

Visit http://mtnhp.org for additional information.

Report Date:
Thursday, October 21, 2010

Species Status

Natural Heritage Ranks:

State: S3
Global: G5

Federal Agency Status:

Click for Status Help

U.S. Fish & Wildlife Service:
U.S. Forest Service: SENSITIVE
U.S. Bureau of Land Management: SENSITIVE

FWP CFWCS Tier: 2

MT PIF Code:

Species Occurrences

Species Occurence Map Label: 158071
First Observation Date: 1965
Last Observation Date: 2005
SO Number: 1
Acreage: 3,666,428
SO Rank:

Gulo gulo

View Species Info in MT Field Guide

Common Name: Wolverine
Description: Vertebrate Animal

Mapping Delineation:
Confirmed area of occupancy based on the documented presence of adults or juveniles within tracking regions containing core habitat for the species. Outer boundaries of tracking regions are defined by areas of forest cover on individual mountain ranges or clusters of adjacent mountain ranges with continuous forest cover.

Species Status

Natural Heritage Ranks:

State: S3
Global: G4

Federal Agency Status:

Click for Status Help

U.S. Fish & Wildlife Service:
U.S. Forest Service: SENSITIVE
U.S. Bureau of Land Management: SENSITIVE

FWP CFWCS Tier: 2

MT PIF Code:

Species Occurrences

Species Occurence Map Label: 158005
First Observation Date: 1933
Last Observation Date: 2004
SO Number: 1
Acreage: 3,666,428
SO Rank:

Lynx canadensis

View Species Info in MT Field Guide

Common Name: Canada Lynx
Description: Vertebrate Animal

Mapping Delineation:
Confirmed area of occupancy based on the documented presence of adults or juveniles within tracking regions containing core habitat for the species. Outer boundaries of tracking regions are defined by areas of forest cover on individual mountain ranges or clusters of adjacent mountain ranges with continuous forest cover.

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Species of Concern Data Report

Visit http://mtnhp.org for additional information.

Report Date:
Thursday, October 21, 2010

Species Status

Natural Heritage Ranks:

State: S3
Global: G5

Federal Agency Status:

Click for Status Help

U.S. Fish & Wildlife Service: LT
U.S. Forest Service: THREATENED
U.S. Bureau of Land Management: SPECIAL STATUS

FWP CFWCS Tier: 1

MT PIF Code:

Species Occurrences

Species Occurence Map Label: 157985
First Observation Date: 1921
Last Observation Date: 2003

SO Number: 1
Acreage: 3,666,428
SO Rank:

Montana Species of Concern
Broken Hill Mine

SPECIES OF CONCERN: A polygon feature representing only what is known from direct observation with a defined level of certainty regarding the spatial location of the feature.

NonVascular Plants
NonVascular Plants

Vascular Plants
Vascular Plants

Invertebrates
Invertebrates

Amphibians
Amphibians

Fish
Fish

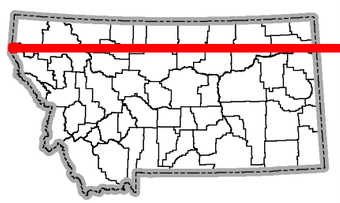
Reptiles
Reptiles

Birds
Birds

Mammals
Mammals

Sites
Sites

Wetland and Riparian Classes
Lacustrine
Freshwater Pond
Freshwater Emergent Wetland
Freshwater Shrub Wetland
Freshwater Forested Wetland
Riverine
Riparian Emergent
Riparian Shrub
Riparian Forested



Not all legend items may occur on the map.

Features shown on this map do not imply public access to any lands.

This map displays management status, which may vary from ownership.

MONTANA Natural Heritage Program

581
261421
261
26137
17740
565
158071
16726
1569
193725
158005
157985
218198
264588
264586
183797
261475
20601

Natural Resource Information System, Montana State Library
1515 East Sixth Ave., Helena, MT 59620-1800

406 444-5354 http://mtnhp.org mtnhp@mt.gov

0 0.5 1 2 3 4 Miles

Map Document: K:\REQUESTS\Requests\11\MTSL\11mtsl0008\11mtsl0008.mxd (10/21/2010)

ENVIRONMENTAL JUSTICE CHECKLIST
for
NEPA COMPLIANCE DOCUMENTS

Project Name: Broken Hill Mine Reclamation Project, Sanders County, MT (PAD 45-005)

The State of Montana Mine Waste Cleanup Bureau (MWCB) identifies and addresses any disproportionately high and adverse human health or environmental effects of its programs, policies and projects on minorities and low-income populations and communities. For the above-named project, the MWCB has determined as follows:

I. Identification

The MWCB has anticipated the effects and impacts of this mine reclamation project on the following populations and communities:

(1) minorities
(2) low-income

Process description and conclusions:

_X_ Located this MWCB project on state map of counties, Attachment 1.

Project is located in _Sanders County, Montana

_X_ Checked the following census tables for the above-named county.

_X_ 1. minority populations data, Attachment 2
_X_ 2. poverty status data, Attachment 3

_X_ Checked state census table data for (1) and (2) populations, Attachment 3 and 4.

_X_ Compared the distribution of (1) and (2) populations with the state distributions.

II. Analysis and Evaluation

Does the project confer a benefit or a risk?

_X_ Benefit. Move to III (below)
If the environmental consequences to (1) or (2) of the proposed project are insignificant or there is no impact, direct or indirect, move to III below.

___ Risk.

What is the risk?_____

_____

Is the risk significant?_____
If NO, move to III below.

If YES, determine the equity of the distribution of any risk.

__No_ Is there a disproportionate impact on (1) or (2)?

If NO, move to III below.

If YES,

When significant and disproportionate impacts to minority and low-income populations and communities are identified, clearly evaluate the impacts and state the environmental consequences of the proposed project as follows:

(a) Site's priority on the MWCB ranking is __

(b) Analyze whether this project should go forward in light of its disproportionate impact in comparison to its priority ranking. Give conclusions with reasons.

_____

_____

III. Opportunity for Meaningful Participation

Were (1) and (2) populations given an opportunity to participate in project design process?

__X__ YES

How was this accomplished?

Standardized public comment and review process for all AML projects. A Public Meeting to discuss the project and allow the public to comment was conducted on February 16, 2011, at 6:00 PM in Building #2 located at the Community Center in Heron, MT.

___ NO

Explain why not.

IV. Conclusion

The proposed abandoned mine reclamation project

__**X**__ **is**
___ is not

in compliance with the environmental justice policy of the United States Department of Interior, as stated in Secretary Bruce Babbitt's August 17, 1994 directive memorandum for the reasons detailed above.

Date: March 9, 2011 by Pebbles Clark

Project Manager: Pebbles Clark

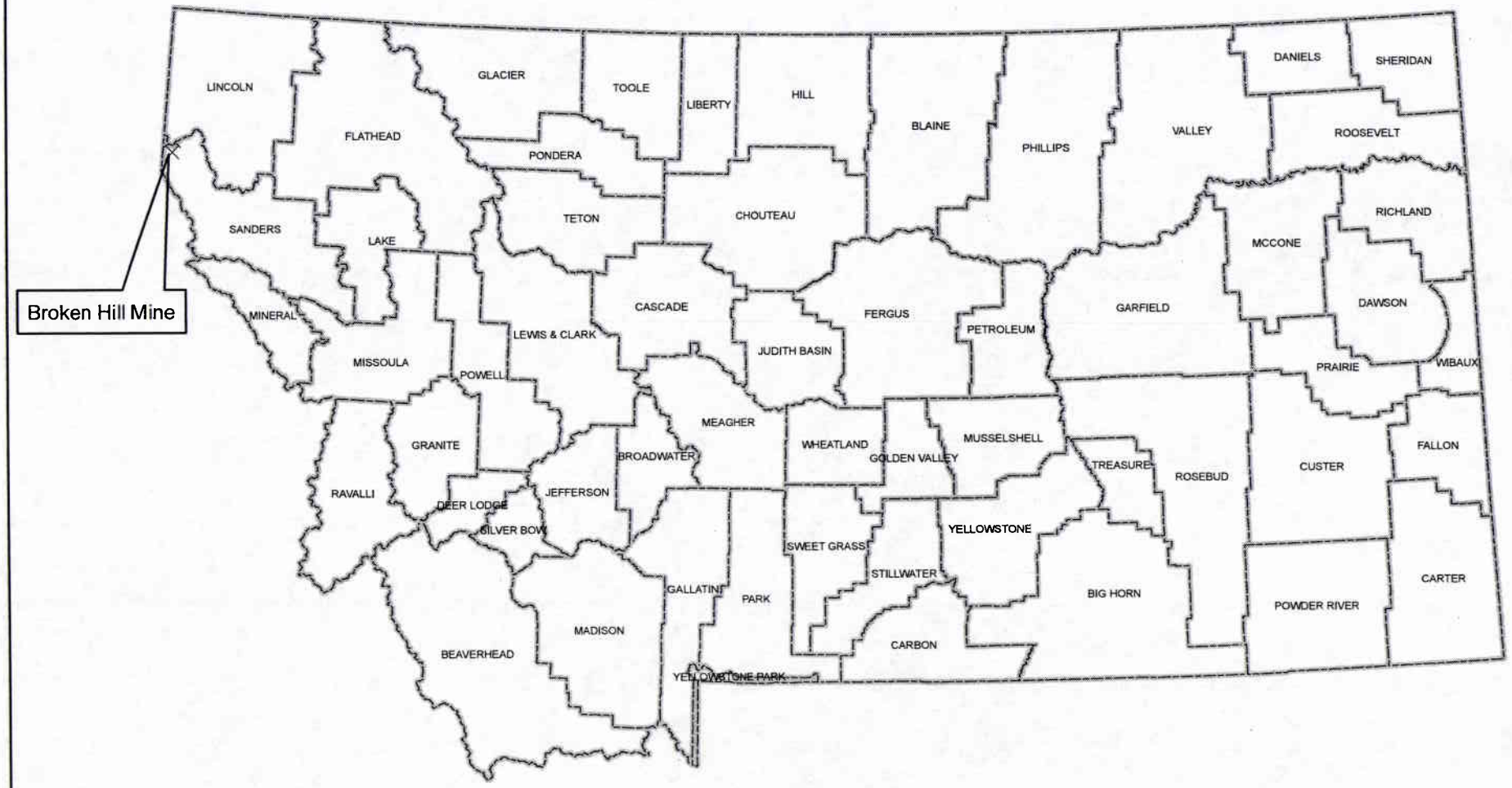
Enclosures

Project Name: Broken Hill Mine Reclamation Project

The MWCB has prioritized the above project in accordance with its statutory mandates and has also determined from United States Government Census figures that there is no disproportionate effect on any demographic population with regard to either income level or minority status. The Broken Hill Mine is currently ranked number 18 on the MWCB Hard Rock Priority Site List. No consideration regarding the selection of this project was made in relation to income or race.

For the above-named project, as it does for each of its projects, the MWCB provided the public with full opportunity for meaningful participation by minority and low-income populations through a standardized public participation and comment process. In addition, reclamation project reports, studies and work plans are available for public inspection at all times.

Broken Hill Mine
Sanders County, Montana
PAD No. 45-005



Attachment 1

Attachment 2

U.S. Census Bureau

American FactFinder

FACT SHEET

Sanders County, Montana

View a Fact Sheet for a **race, ethnic, or ancestry group**

Census 2000 Demographic Profile Highlights:

General Characteristics - show more >>	Number	Percent	U.S.		
Total population	10,227			map	brief
Male	5,166	50.5	49.1%	map	brief
Female	5,061	49.5	50.9%	map	brief
Median age (years)	44.2	(X)	35.3	map	brief
Under 5 years	482	4.7	6.8%	map	
18 years and over	7,794	76.2	74.3%		
65 years and over	1,724	16.9	12.4%	map	brief
One race	9,957	97.4	97.6%		
White	9,400	91.9	75.1%	map	brief
Black or African American	13	0.1	12.3%	map	brief
American Indian and Alaska Native	485	4.7	0.9%	map	brief
Asian	31	0.3	3.6%	map	brief
Native Hawaiian and Other Pacific Islander	1	0.0	0.1%	map	brief
Some other race	27	0.3	5.5%	map	
Two or more races	270	2.6	2.4%	map	brief
Hispanic or Latino (of any race)	159	1.6	12.5%	map	brief
Household population	10,033	98.1	97.2%	map	brief
Group quarters population	194	1.9	2.8%	map	
Average household size	2.35	(X)	2.59	map	brief
Average family size	2.86	(X)	3.14	map	
Total housing units	5,271			map	
Occupied housing units	4,273	81.1	91.0%		brief
Owner-occupied housing units	3,265	76.4	66.2%	map	
Renter-occupied housing units	1,008	23.6	33.8%	map	brief
Vacant housing units	998	18.9	9.0%	map	

Social Characteristics - show more >>	Number	Percent	U.S.		
Population 25 years and over	7,242				
High school graduate or higher	5,878	81.2	80.4%	map	brief
Bachelor's degree or higher	1,126	15.5	24.4%	map	
Civilian veterans (civilian population 18 years and over)	1,699	21.8	12.7%	map	brief
Disability status (population 5 years and over)	2,354	24.4	19.3%	map	brief
Foreign born	203	2.0	11.1%	map	brief
Male, Now married, except separated (population 15 years and over)	2,571	61.4	56.7%		brief
Female, Now married, except separated (population 15 years and over)	2,531	61.1	52.1%		brief
Speak a language other than English at home (population 5 years and over)	394	4.0	17.9%	map	brief

Economic Characteristics - show more >>	Number	Percent	U.S.		
In labor force (population 16 years and over)	4,383	53.6	63.9%		brief
Mean travel time to work in minutes (workers 16 years and over)	22.3	(X)	25.5	map	brief
Median household income in 1999 (dollars)	26,852	(X)	41,994	map	
Median family income in 1999 (dollars)	31,340	(X)	50,046	map	
Per capita income in 1999 (dollars)	14,593	(X)	21,587	map	
Families below poverty level	389	13.3	9.2%	map	brief
Individuals below poverty level	1,737	17.2	12.4%	map	

Housing Characteristics - show more >>	Number	Percent	U.S.		
Single-family owner-occupied homes	1,490				brief
Median value (dollars)	82,900	(X)	119,600	map	brief
Median of selected monthly owner costs	(X)	(X)			brief
With a mortgage (dollars)	713	(X)	1,088	map	
Not mortgaged (dollars)	224	(X)	295		

(X) Not applicable.

Source: U.S. Census Bureau, Summary File 1 (SF 1) and Summary File 3 (SF 3)

U.S. Census Bureau
American FactFinder

Montana -- County
GCT-P6. Race and Hispanic or Latino: 2000
Data Set: **Census 2000 Summary File 1 (SF 1) 100-Percent Data**

NOTE: For information on confidentiality protection, nonsampling error, definitions, and count corrections see http://factfinder.census.gov/home/en/datanotes/expsf1u.htm.

Geographic area	Total population	Percent of total population								
		Race								
		One race						Two or more races	Hispanic or Latino (of any race)	White alone, not Hispanic or Latino
		White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some other race			
Montana	902,195	90.6	0.3	6.2	0.5	0.1	0.6	1.7	2.0	89.5
COUNTY										
Beaverhead County	9,202	95.9	0.2	1.5	0.2	0.0	1.1	1.2	2.7	94.4
Big Horn County	12,671	36.6	0.0	59.7	0.2	0.0	0.7	2.8	3.7	35.2
Blaine County	7,009	52.6	0.2	45.4	0.1	0.0	0.2	1.5	1.0	52.4
Broadwater County	4,385	97.0	0.3	1.2	0.1	0.1	0.3	1.0	1.3	96.1
Carbon County	9,552	97.1	0.3	0.7	0.4	0.0	0.6	1.0	1.8	96.2
Carter County	1,360	98.6	0.1	0.4	0.1	0.0	0.3	0.5	0.6	98.5
Cascade County	80,357	90.7	1.1	4.2	0.8	0.1	0.7	2.4	2.4	89.5
Chouteau County	5,970	84.0	0.1	14.6	0.2	0.1	0.2	0.7	0.7	83.9
Custer County	11,696	97.0	0.1	1.3	0.3	0.1	0.3	1.0	1.5	96.0
Daniels County	2,017	96.0	0.0	1.3	0.2	0.1	0.6	1.7	1.6	95.7
Dawson County	9,059	97.4	0.3	1.2	0.1	0.0	0.3	0.6	0.9	97.0
Deer Lodge County	9,417	95.9	0.2	1.8	0.4	0.0	0.2	1.6	1.6	94.7
Fallon County	2,837	98.6	0.1	0.3	0.4	0.0	0.1	0.5	0.4	98.3
Fergus County	11,893	97.1	0.1	1.2	0.2	0.0	0.3	1.2	0.8	96.7
Flathead County	74,471	96.3	0.2	1.1	0.5	0.1	0.4	1.5	1.4	95.4
Gallatin County	67,831	96.2	0.2	0.9	0.9	0.1	0.5	1.2	1.5	95.3
Garfield County	1,279	99.1	0.1	0.4	0.1	0.1	0.0	0.2	0.4	98.8
Glacier County	13,247	35.4	0.1	61.8	0.1	0.1	0.2	2.4	1.2	35.3
Golden Valley County	1,042	99.1	0.0	0.6	0.1	0.0	0.0	0.2	1.2	97.9
Granite County	2,830	96.3	0.0	1.3	0.1	0.0	0.5	1.8	1.3	95.3
Hill County	16,673	79.5	0.1	17.3	0.4	0.0	0.4	2.3	1.2	79.1
Jefferson County	10,049	96.1	0.1	1.3	0.4	0.1	0.4	1.7	1.5	95.2
Judith Basin County	2,329	98.6	0.0	0.3	0.1	0.0	0.0	0.9	0.6	98.2
Lake County	26,507	71.4	0.1	23.8	0.3	0.0	0.7	3.7	2.5	70.6
Lewis and Clark County	55,716	95.2	0.2	2.0	0.5	0.1	0.4	1.6	1.5	94.4
Liberty County	2,158	99.2	0.0	0.1	0.3	0.0	0.1	0.3	0.2	99.1
Lincoln County	18,837	96.1	0.1	1.2	0.3	0.0	0.4	1.9	1.4	95.1
McCone County	1,977	97.0	0.3	1.1	0.3	0.0	0.0	1.4	1.0	96.3
Madison County	6,851	97.0	0.0	0.5	0.3	0.0	0.8	1.4	1.9	96.0
Meagher County	1,932	97.2	0.0	1.0	0.2	0.1	0.6	1.0	1.5	96.8
Mineral County	3,884	94.6	0.2	1.9	0.5	0.0	0.3	2.5	1.6	93.6
Missoula County	95,802	94.0	0.3	2.3	1.0	0.1	0.4	1.9	1.6	93.1
Musselshell County	4,497	96.9	0.1	1.3	0.2	0.0	0.4	1.2	1.6	95.9
Park County	15,694	96.6	0.4	0.9	0.4	0.0	0.5	1.2	1.8	95.5
Petroleum County	493	99.2	0.0	0.2	0.0	0.0	0.2	0.4	1.2	98.2
Phillips County	4,601	89.4	0.2	7.6	0.3	0.0	0.4	2.1	1.2	88.8
Pondera County	6,424	83.7	0.1	14.5	0.1	0.0	0.1	1.5	0.8	83.2
Powder River County	1,858	97.4	0.0	1.8	0.1	0.0	0.2	0.5	0.6	97.0
Powell County	7,180	92.5	0.5	3.5	0.4	0.0	0.7	2.3	1.9	91.5

Geographic area	Total population	Percent of total population								
		Race								
		One race						Two or more races	Hispanic or Latino (of any race)	White alone, not Hispanic or Latino
		White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some other race			
Prairie County	1,199	98.0	0.0	0.5	0.2	0.0	0.2	1.2	0.7	97.7
Ravalli County	36,070	96.7	0.1	0.9	0.3	0.1	0.4	1.4	1.9	95.5
Richland County	9,667	96.6	0.1	1.5	0.2	0.0	0.8	0.8	2.2	95.4
Roosevelt County	10,620	40.9	0.0	55.8	0.4	0.0	0.3	2.5	1.2	40.8
Rosebud County	9,383	64.4	0.2	32.4	0.3	0.0	0.7	2.0	2.3	63.5
Sanders County	10,227	91.9	0.1	4.7	0.3	0.0	0.3	2.6	1.6	90.9
Sheridan County	4,105	97.0	0.1	1.2	0.3	0.0	0.2	1.2	1.1	96.4
Silver Bow County	34,606	95.4	0.2	2.0	0.4	0.1	0.6	1.4	2.7	93.7
Stillwater County	8,195	96.8	0.1	0.7	0.2	0.0	0.9	1.2	2.0	95.9
Sweet Grass County	3,609	97.0	0.1	0.6	0.3	0.0	0.7	1.3	1.5	96.1
Teton County	6,445	96.3	0.2	1.5	0.1	0.0	0.4	1.5	1.1	95.6
Toole County	5,267	93.9	0.2	3.2	0.3	0.0	0.3	2.1	1.2	93.3
Treasure County	861	96.4	0.1	1.6	0.3	0.0	0.9	0.6	1.5	95.6
Valley County	7,675	88.1	0.1	9.4	0.2	0.0	0.3	1.8	0.8	87.8
Wheatland County	2,259	97.0	0.1	0.6	0.2	0.2	0.3	1.6	1.1	96.4
Wibaux County	1,068	98.0	0.2	0.5	0.2	0.0	0.3	0.8	0.4	97.8
Yellowstone County	129,352	92.8	0.4	3.1	0.5	0.0	1.3	1.9	3.7	91.0

(X) Not applicable
Source: U.S. Census Bureau, Census 2000 Summary File 1, Matrix P8.

U.S. Census Bureau

American FactFinder

Attachment 3

Montana -- County

GCT-P14. Income and Poverty in 1999: 2000

Data Set: **Census 2000 Summary File 3 (SF 3) - Sample Data**

NOTE: Data based on a sample except in P3, P4, H3, and H4. For information on confidentiality protection, sampling error, nonsampling error, definitions, and count corrections see http://factfinder.census.gov/home/en/datanotes/expsf3.htm.

Geographic area	Median income in 1999 (dollars)		Per capita income in 1999 (dollars)	Median earnings in 1999 of full-time, year-round workers (dollars)		Income in 1999 below poverty level			
						Percent of population for whom poverty status is determined			
	House-holds	Families		Male	Female	All ages	Related children under 18 years	65 years and over	Percent of families
Montana	33,024	40,487	17,151	30,503	20,914	14.6	18.4	9.1	10.5
COUNTY									
Beaverhead County	28,962	38,971	15,621	26,162	18,115	17.1	20.3	12.2	12.8
Big Horn County	27,684	31,095	10,792	23,814	18,884	29.2	37.0	20.1	23.7
Blaine County	25,247	30,616	12,101	23,627	20,469	28.1	36.5	19.9	23.4
Broadwater County	32,689	36,524	16,237	28,495	19,500	10.8	13.7	7.9	7.6
Carbon County	32,139	38,405	17,204	30,226	19,945	11.6	14.3	8.8	8.2
Carter County	26,313	32,262	13,280	21,466	15,703	18.1	16.2	16.4	15.9
Cascade County	32,971	39,949	17,566	28,993	20,970	13.5	18.6	8.4	10.4
Chouteau County	29,150	32,399	14,851	22,080	19,318	20.5	29.3	8.4	16.5
Custer County	30,000	38,779	15,876	27,857	18,343	15.1	18.1	9.1	10.1
Daniels County	27,306	35,722	16,055	24,405	18,421	16.9	19.2	13.2	13.4
Dawson County	31,393	38,455	15,368	29,487	18,929	14.9	18.7	11.2	11.7
Deer Lodge County	26,305	36,158	15,580	27,230	18,719	15.8	21.4	9.8	11.6
Fallon County	29,944	38,636	16,014	27,045	18,077	12.5	17.5	6.6	9.5
Fergus County	30,409	36,609	15,808	27,260	18,138	15.4	19.4	12.2	10.6
Flathead County	34,466	40,702	18,112	31,908	20,619	13.0	16.7	8.6	9.4
Gallatin County	38,120	46,639	19,074	30,866	21,330	12.8	10.5	5.6	6.3
Garfield County	25,917	31,111	13,930	20,474	14,531	21.5	27.9	17.4	16.7
Glacier County	27,921	31,193	11,597	27,445	23,036	27.3	32.7	20.1	23.5
Golden Valley County	27,308	35,000	13,573	14,028	19,063	25.8	20.4	21.6	16.5
Granite County	27,813	33,485	16,636	26,250	17,961	16.8	24.2	8.5	13.9
Hill County	30,781	38,179	14,935	29,908	19,874	18.4	23.3	9.0	15.3
Jefferson County	41,506	48,912	18,250	34,753	25,011	9.0	10.4	9.6	6.7
Judith Basin County	29,241	34,243	14,291	21,789	14,615	21.1	30.6	13.3	16.3
Lake County	28,740	34,033	15,173	27,009	19,162	18.7	24.2	8.3	14.0
Lewis and Clark County	37,360	46,766	18,763	33,515	23,961	10.9	12.6	6.5	7.3
Liberty County	30,284	37,361	14,882	23,158	16,579	20.3	28.9	15.5	19.0
Lincoln County	26,754	31,784	13,923	30,299	20,600	19.2	26.4	10.8	14.2
McCone County	29,718	35,887	15,162	22,768	15,368	16.8	19.4	11.2	14.1
Madison County	30,233	35,536	16,944	26,606	17,917	12.1	14.2	9.3	10.2
Meagher County	29,375	33,879	15,019	22,083	15,417	18.9	27.4	13.0	16.4
Mineral County	27,143	32,096	15,166	26,782	18,258	15.8	18.7	8.5	12.8
Missoula County	34,454	44,865	17,808	31,605	21,720	14.8	14.6	8.2	8.8
Musselshell County	25,527	32,298	15,389	25,000	17,813	19.9	31.7	10.5	13.0
Park County	31,739	40,561	17,704	28,215	19,973	11.4	13.1	10.1	7.2
Petroleum County	24,107	32,667	15,986	20,694	17,188	23.2	25.6	17.3	21.0
Phillips County	28,702	37,529	15,058	25,132	20,274	18.3	23.1	12.1	13.8

High

Low

Project County

Geographic area	Median income in 1999 (dollars)		Per capita income in 1999 (dollars)	Median earnings in 1999 of full-time, year-round workers (dollars)		Income in 1999 below poverty level			
						Percent of population for whom poverty status is determined			
	House-holds	Families		Male	Female	All ages	Related children under 18 years	65 years and over	Percent of families
Pondera County	30,464	36,484	14,276	27,125	19,314	18.8	23.4	8.3	15.0
Powder River County	28,398	34,671	15,351	23,971	17,411	12.9	12.7	16.3	9.9
Powell County	30,625	35,836	13,816	26,366	20,457	12.6	16.2	6.0	10.2
Prairie County	25,451	32,292	14,422	22,424	18,833	17.2	23.6	15.5	13.3
Ravalli County	31,992	38,397	17,935	30,994	19,987	13.8	20.1	6.3	9.6
Richland County	32,110	39,348	16,006	29,069	19,203	12.2	13.9	9.0	8.1
Roosevelt County	24,834	27,833	11,347	25,177	19,728	32.4	41.6	15.1	27.6
Rosebud County	35,898	41,631	15,032	38,688	20,640	22.4	31.8	15.1	17.8
Sanders County	26,852	31,340	14,593	28,340	17,630	17.2	23.3	9.2	13.3
Sheridan County	29,518	35,345	16,038	23,053	20,112	14.7	16.4	15.8	10.6
Silver Bow County	30,402	40,018	17,009	31,295	21,610	14.9	19.2	8.9	10.7
Stillwater County	39,205	45,238	18,468	32,148	19,271	9.8	12.2	9.2	6.2
Sweet Grass County	32,422	38,750	17,880	28,385	17,245	11.4	15.1	9.1	9.0
Teton County	30,197	36,662	14,635	25,794	18,389	16.6	25.6	8.4	12.2
Toole County	30,169	39,600	14,731	27,284	19,141	12.9	15.0	9.5	9.7
Treasure County	29,830	34,219	14,392	22,750	17,188	14.7	22.8	11.1	8.5
Valley County	30,979	39,044	16,246	27,233	17,686	13.5	15.4	14.4	9.5
Wheatland County	24,492	32,500	11,954	14,185	15,000	20.4	16.0	15.5	11.1
Wibaux County	28,224	34,265	16,121	22,750	18,667	15.3	18.7	12.6	8.6
Yellowstone County	36,727	45,277	19,303	33,475	21,566	11.1	14.5	7.4	8.5

(X) Not applicable.
Source: U.S. Census Bureau, Census 2000 Summary File 3, Matrices P53, P77, P82, P87, P90, PCT47, and PCT52.

U.S. Census Bureau
American FactFinder

Attachment 4

FACT SHEET

Montana

View a Fact Sheet for a **race, ethnic, or ancestry group**

Census 2000 Demographic Profile Highlights:

General Characteristics - show more >>	Number	Percent	U.S.		
Total population	902,195			map	brief
Male	449,480	49.8	49.1%	map	brief
Female	452,715	50.2	50.9%	map	brief
Median age (years)	37.5	(X)	35.3	map	brief
Under 5 years	54,869	6.1	6.8%	map	
18 years and over	672,133	74.5	74.3%		
65 years and over	120,949	13.4	12.4%	map	brief
One race	886,465	98.3	97.6%		
White	817,229	90.6	75.1%	map	brief
Black or African American	2,692	0.3	12.3%	map	brief
American Indian and Alaska Native	56,068	6.2	0.9%	map	brief
Asian	4,691	0.5	3.6%	map	brief
Native Hawaiian and Other Pacific Islander	470	0.1	0.1%	map	brief
Some other race	5,315	0.6	5.5%	map	
Two or more races	15,730	1.7	2.4%	map	brief
Hispanic or Latino (of any race)	18,081	2.0	12.5%	map	brief
Household population	877,433	97.3	97.2%	map	brief
Group quarters population	24,762	2.7	2.8%	map	
Average household size	2.45	(X)	2.59	map	brief
Average family size	2.99	(X)	3.14	map	
Total housing units	412,633			map	
Occupied housing units	358,667	86.9	91.0%		brief
Owner-occupied housing units	247,723	69.1	66.2%	map	
Renter-occupied housing units	110,944	30.9	33.8%	map	brief
Vacant housing units	53,966	13.1	9.0%	map	

Social Characteristics - show more >>	Number	Percent	U.S.		
Population 25 years and over	586,621				
High school graduate or higher	511,263	87.2	80.4%	map	brief
Bachelor's degree or higher	142,961	24.4	24.4%	map	
Civilian veterans (civilian population 18 years and over)	108,476	16.2	12.7%	map	brief
Disability status (population 5 years and over)	145,732	17.5	19.3%	map	brief
Foreign born	16,396	1.8	11.1%	map	brief
Male, Now married, except separated (population 15 years and over)	206,335	58.3	56.7%		brief
Female, Now married, except separated (population 15 years and over)	204,044	56.3	52.1%		brief
Speak a language other than English at home (population 5 years and over)	44,331	5.2	17.9%	map	brief

Economic Characteristics - show more >>	Number	Percent	U.S.		
In labor force (population 16 years and over)	458,306	65.4	63.9%		brief
Mean travel time to work in minutes (workers 16 years and over)	17.7	(X)	25.5	map	brief
Median household income in 1999 (dollars)	33,024	(X)	41,994	map	
Median family income in 1999 (dollars)	40,487	(X)	50,046	map	
Per capita income in 1999 (dollars)	17,151	(X)	21,587	map	
Families below poverty level	25,004	10.5	9.2%	map	brief
Individuals below poverty level	128,355	14.6	12.4%	map	

Housing Characteristics - show more >>	Number	Percent	U.S.		
Single-family owner-occupied homes	165,397				brief
Median value (dollars)	99,500	(X)	119,600	map	brief
Median of selected monthly owner costs	(X)	(X)			brief
With a mortgage (dollars)	863	(X)	1,088	map	
Not mortgaged (dollars)	261	(X)	295		

(X) Not applicable.
Source: U.S. Census Bureau, Summary File 1 (SF 1) and Summary File 3 (SF 3)

Report Selection Criteria **From the current AMLIS data files.**

Priority	Type of Mining	State/Tribe
All Priorities	**All Mining Types**	**MONTANA**
Problem Types		Program Area
All Problem Types		**All Program Areas**

Additional Criteria
County is Equal to "Sanders" and County is Equal to "SANDERS"

Office of Surface Mining - Reclamation and Enforcement

Abandoned Mine Land Inventory System (AMLIS)

Problem Type Cost Detail

State Priority and Problem Type	Unfunded Cost	Funded Cost	Completed Cost	Total Cost
MT - MONTANA				
Priority 2 Clogged Streams (Miles)				
MT045002NCA JACK WAITE	50,000	0	0	50,000
Total for P 2 Clogged Streams	50,000	0	0	50,000
Priority 2 Clogged Stream Lands (Acres)				
MT045002NCA JACK WAITE	50,000	0	0	50,000
Total for P 2 Clogged Stream Lands	50,000	0	0	50,000
Priority 2 Dangerous Piles & Embankments (Acres)				
MT045047NCA LOWER LETTERMAN	50,000	0	0	50,000
MT045017NCA S & H	50,000	0	0	50,000
MT045010NCA MONTRO GOLD	200,000	0	0	200,000
MT045009NCA HOLLIDAY	100,000	0	0	100,000
MT045005NCA BROKEN HILL	100,000	0	0	100,000
MT045002NCA JACK WAITE	50,000	0	0	50,000
Total for P 2 Dangerous Piles & Embankments	550,000	0	0	550,000
Priority 2 Hazardous Equipment & Facilities (Count)				
MT045005NCA BROKEN HILL	5,000	0	0	5,000
Total for P 2 Hazardous Equipment & Facilities	5,000	0	0	5,000
Priority 2 Portals (Count)				
MT045010NCA MONTRO GOLD	5,000	0	0	5,000
MT045002NCA JACK WAITE	5,000	0	0	5,000
MT045017NCA S & H	5,000	0	0	5,000
MT045047NCA LOWER LETTERMAN	5,000	0	0	5,000
Total for P 2 Portals	20,000	0	0	20,000
Priority 2 Vertical Opening (Count)				
MT045047NCA LOWER LETTERMAN	10,000	0	0	10,000
Total for P 2 Vertical Opening	10,000	0	0	10,000
Total for **MONTANA**	685,000	0	0	685,000

Attachment 6

EEE/CA

Portage

RPT-5007
Rev. 0 (Final)

Final Expanded Engineering Evaluation and Cost Analysis Report for the Broken Hill Mine Site, Sanders County, Montana

Applicability: BHMS	Effective Date: 3/31/11	Owner: Alan Dreesbach
For most recent revision or additional information: https://sharepoint.portageinc.com/default.aspx		Signature:

History of Revisions

Revision	Issue Date	Action	Description
		New Document	

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Figures

Tables

ACRONYMS

ABA	acid base accounting
AM	action memorandum
amsl	above mean sea level
AIMSS	Abandoned and Inactive Mines Scoring System
ALAD	aminolevulinic acid dehydrase
ARAR	applicable or relevant and appropriate requirements
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
BHMS	Broken Hill Mine Site
BMP	best management practice
BRHS	British Regional Heart Study
CEC	cation exchange capacity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
COPC	contaminant of potential concern
MDEQ	Montana Department of Environmental Quality
EEE/CA	expanded engineering evaluation and cost analysis
ELCR	estimated lifetime cancer risk
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ESA	Endangered Species Act
EQ	ecological impact quotient
FR	forest road

GWIC	Groundwater Information Center
HHS	human health standard
HI	hazard index
HMO	hazardous mine opening
HQ	hazard quotient
IDL	instrument detection limit
IQ	intelligence quotient
LOAEL	lowest observed adverse effects level
MBMG	Montana Bureau of Mines and Geology
MS	matrix spike
MSD	matrix spike duplicate
MWCB	Mine Waste Cleanup Bureau
NCP	National Contingency plan
NHANES	National Health and Nutrition Examination Survey
NHPA	National Historic Preservation Act
NOAEL	no observed adverse effects levels
PMM	Principal Montana Meridian
PRSC	post-removal site control
QA/QC	quality assurance/quality control
RAGS	Risk Assessment Guidance for Superfund
RBCG	risk-based cleanup guidelines
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RI	reclamation investigation

RPD	relative percent difference
RSL	regional screening level
SMCRA	Surface Mining Control and Reclamation Act
SPLP	synthetic precipitation leaching procedure
s.u.	standard units
TAL	target analyte list
TDS	total dissolved solids
TCLP	toxicity characteristic leaching procedure
UCL	upper confidence limit
USFS	United States Forest Service

1. INTRODUCTION

This expanded engineering evaluation/cost evaluation (EEE/CA) report analyzes reclamation alternatives for waste rock associated with the Broken Hill Mine Site (BHMS) located in northwestern Montana. Reclamation activities at the BHMS are designed to comply with the requirements of the National Oil and Hazardous Substances Pollution Contingency Plan, more commonly called the National Contingency Plan (NCP), are considered removal actions, and are not considered the final reclamation remedies or alternatives. Per the NCP, an analysis of applicable or relevant and appropriate requirements (ARARs) related to environmental media and the removal action at the BHMS has been prepared in support of this EEE/CA. The reclamation alternatives presented in this EEE/CA are applicable to the solid media only; no reclamation alternatives were developed for treatment of surface water or groundwater. ARARs presented for surface water and groundwater environmental media are for informational purposes only.

This report was prepared by Portage, Inc., (Portage) for the Montana Department of Environmental Quality (MDEQ) Mine Waste Cleanup Bureau (MWCB). This report satisfies the provisions of Portage Task Order #8, Task 2, DEQ Contract No. 407025. Previously completed tasks on this project have included:

- Task Order #7, Task 1: Preparation of a reclamation work plan (April 2009)
- Task Order #7, Task 2: Completion of the onsite reclamation investigation (July 2009)
- Task Order #7, Task 3: Completion of the reclamation investigation report (January 2010)
- Task Order #8, Task 1: Completion of repository site investigations and report (September 2010).

Portage Task Order #8, Task 2 required the completion of data review, analysis, and alternatives evaluation sufficient to prepare an EEE/CA report. The elements of this EEE/CA report include this introduction; background; a description of previous investigations; a summary of waste characterization results; a human health and ecological risk assessment summary; an analysis of ARARs; a statement of reclamation objectives and goals; development and screening of reclamation alternatives; detailed analysis of reclamation alternatives; comparative analysis of the reclamation alternatives; and a statement of the preferred reclamation alternative.

Sections 2 through 5 present the background data and the results of previous analysis. Section 6 is the statement of the reclamation objectives and goals. Section 7 presents reclamation technologies and the development and screening of reclamation alternatives. Alternatives that were considered but not included for detailed evaluation are screened in this section. Section 8 is the detailed evaluation of reclamation alternatives that passed the screening process. In the detailed evaluation, each alternative is evaluated against seven evaluation criteria:

- Overall protection of human health and the environment
- Compliance with ARARs

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost.

The comparative analysis of reclamation alternatives in Section 9 provides the basis of the preferred alternative selection in Section 10.

View of Cabinet Gorge from the Broken Hill Mine

2. BACKGROUND

The BHMS is an abandoned hard rock mine located in Sanders County, Montana. The BHMS produced silver, lead, and zinc. The significant features remaining on the mine property include two waste rock dumps, two collapsed adits (and associated seasonal/intermittent lower adit discharge), and roadways. Previous investigation by Pioneer Technical Services, Inc., (Pioneer) in 1993 indicated elevated arsenic, cadmium, copper, iron, mercury, lead, antimony, and zinc in onsite waste rock and elevated arsenic and lead in the adit discharge. In July of 2009, Portage performed a reclamation investigation (RI) to further characterize the nature and extent of contamination at the BHMS. The *Reclamation Investigation Report for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2010a) was completed in January of 2010.

During the RI, samples were collected to support site characterization and risk assessment. The sampling included material from the upper and lower waste rock dumps, background soil sampling, and sampling of adit discharge water. The following summarizes the findings related to BHMS sampling in 2009:

- Elevated metals concentrations were noted in background soil samples, consistent with mineralization occurring in the mining district
- Lead exceeded the U.S. Environmental Protection Agency (EPA) regional screening levels (RSLs) for soils in both waste rock dumps and in adjacent soils
- Lead exceeded the MDEQ risk-based cleanup guidelines (RBCG) in both waste rock piles and in soils adjacent to the upper waste rock dump
- Arsenic exceeded the EPA RSL for arsenic in both waste rock piles and in soils adjacent to the lower waste rock dump
- Arsenic exceeded the MDEQ RBCG in both waste rock samples
- The EPA RSLs for antimony, iron, and mercury were exceeded in the upper waste dump only
- Antimony, arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, and zinc concentrations in the upper waste rock dump exceeded background concentrations; and antimony, arsenic, cadmium, copper, iron, lead, mercury, nickel, and zinc concentrations in the lower waste rock dump exceeded background concentrations.
- Antimony, arsenic, cadmium, copper, iron, lead, mercury, and zinc concentrations in both the upper and lower waste rock dumps exceeded background concentrations by a factor of three or more and are considered elevated.
- The lead concentration resulting from synthetic precipitation leaching procedure (SPLP) extract testing of the waste rock exceeded the human health standard for water and the acute aquatic life standard as found in the “Montana Numeric Water Quality Standards” (MDEQ 2010).

- Arsenic and lead exceed human health standards for water; and cadmium, lead, and zinc exceeded both chronic and acute aquatic life standards as found in the "Montana Numeric Water Quality Standards" (MDEQ 2010).

Risk assessment of the data indicated both potential human exposure and ecological impacts exceeding what EPA establishes as healthy benchmarks. The human cancer risk factor of 1×10^{-6} is exceeded and the noncancer hazard index (HI) of 1 is exceeded. Ecological impact quotients (EQs) are also exceeded for plant phytotoxicity and for deer. The RI results demonstrated the need for site reclamation that is protective of human health and the environment. The purpose of this EEE/CA report is to identify a preferred alternative for site reclamation that achieves reclamation objectives and risk-based cleanup goals for the BHMS.

Waste rock dump at the Broken Hill Mine

2.1 Mining History

The early history of the Broken Hill Mine includes conflicting accounts. Early mine inspector reports state the first period of significance for the Broken Hill Mine was in 1906, when there was intermittent small-scale production. However, later sources put the development of the mine in the early

1920s, which is consistent with the original patent filing in 1920 (FHC 2002). The mine was worked by varying owners and operators until 1930, when it became inactive.

The 1920 patent survey recorded two tunnels, seven drifts, two crosscuts, and a raise. The mine was worked through the series of tunnels and drifts. The ore was oxide of iron carrying as much as 80% excess iron, which made it desirable for fluxing. The Montana Bureau of Mines and Geology (MBMG) reports that the Federal Bureau of Mining production records indicate 273 tons of ore were produced from 1925 to 1927, from which 942 oz of silver, 53,057 lb of lead, and 176,632 lb of zinc were extracted. The Federal Bureau of Mining reported two adits: one adit tunnel being 350 ft long and another 108 ft long with a raise connecting the two tunnels (MBMG 1963).

The mine remained closed until 1965, when other owners and operators had renewed interest in mining at the Broken Hill Mine. Approximately 94 tons of ore were mined in 1966. Road improvements, tunnel repair, and ore removal were performed; however, in 1973, the mine was inactive again and remains so today. Fewer than 400 tons of ore were recorded as being shipped from the Broken Hill Mine since its original discovery (RTI 2002). The cultural resource inventory for the BHMS, indicates that all ore was shipped off site for processing and no milling or amalgamating equipment was noted at the BHMS (FHC 2002).

2.2 Climate

The climate of the BHMS is based on the nearest climate station at Heron, Montana. Average monthly temperatures ranges from an average high of 82.9°F in July to an average low of 18.4°F in January. The average annual high temperature is 56.4°F and the average annual low temperature is 32°F. Average annual total precipitation is 33.57 in. per year, with the majority of precipitation occurring as snow between the months of November and April. Average annual snowfall is 85.7 in. (WRCC 2010). The BHMS is located in mountainous terrain at an elevation approximately 1,000 ft higher than Heron, which may increase total annual precipitation and total precipitation as snowfall.

2.3 Geology, Hydrogeology, and Hydrology

The following sections present a summary of site geology, hydrogeology, and surface water hydrology.

2.3.1 Local and Regional Geology

During the Proterozoic Era, a shallow subsiding marine basin formed in northwestern Montana where great thicknesses of homogeneous sand, silt, clay, and carbonate sediments accumulated. Low-grade regional metamorphism later indurated these sediments into a mixture of resistant quartzites, siltites, argillites, and limestones; this thick sequence of fine-grained, quartzite-rich calcareous and noncalcareous rocks is the Belt Series. The Belt Series is subdivided into four general groups in ascending order: Lower Belt or Pre-Ravalli, Ravalli, Middle Belt Carbonate, and Missoula Groups (Montana Agricultural Experiment Station and USDA 1980). The BHMS is in the Ravalli Group. The MBMG reported that selected dump samples at the BHMS contained pyrite, pyrrhotite, sphalerite, galena, chalcopyrite, and arsenopyrite. They are present in a gangue of quartz, tourmaline, and tremolite.

2.3.2 Soils

Hard, fine-grained Belt Series rocks typically weather to fine sandy or loamy soils with high percentages of coarse fragments. Most soils are weakly developed. These Sharrott series soils consist of shallow residual or colluvial soils developed on the moderately sloping to steep ridges and mountain slopes of hard thinly-bedded argillite at an elevation of 3,000 to 4,500 ft. They are well-drained soils with medium run-off and moderate permeability ranging from 0.6 to 2.0 in./hour. Depth to bedrock is typically 4 to 20 in., and coarse fragment content is 50 to 80%. Clay content is usually 5 to 20%. They are slightly sticky (after pressure, soil adheres to both thumb and finger and tends to stretch somewhat before pulling apart) to slightly plastic (moderate pressure is required to deform soil mass) when wet. Soils may be classified as a loamy-skeletal, mixed Lithic Ustocrept (Montana Agricultural Experiment Station and USDA 1980).

2.3.3 Hydrogeology

The MBMG Groundwater Information Center (GWIC) database lists one well log within a 1-mile radius of the BHMS. The well is located 1 mile to the northwest in Section 2 of Township 27 North and Range 34 West. The well has a static water level of 92 ft below ground surface (bgs) and a yield of 5 gal per minute and is used for domestic purposes (GWIC 2008). There are no lithologic details available for this well. The GWIC database lists 35 well logs within a 4-mile radius of the BHMS.

2.3.4 Surface Water Hydrology

The BHMS is located within the watershed of an unnamed, ephemeral tributary to the East Fork of Blue Creek. The unnamed tributary lies 100 ft to the north of the BHMS and reaches its confluence with the East Fork of Blue Creek approximately 0.75 mile downstream from the BHMS. The unnamed tributary begins approximately 4,000 ft upstream from the BHMS (USGS 1997).

The East Fork of Blue Creek reaches its confluence with Blue Creek 2 miles from its confluence with the unnamed tributary. Blue Creek empties into Cabinet Gorge Reservoir of the Clark Fork River 0.5 miles from the confluence of the East Fork with Blue Creek proper.

As described further in Section 3.3, there is an intermittent adit discharge associated with the lower waste rock dump. The discharge has been observed as seasonal and low volume.

2.4 Current Site Setting

The following sections describe the current physical setting of the BHMS in addition to current land use and ownership.

2.4.1 Location and Topography

The BHMS is located approximately 4 miles north of Heron, Montana, (Figure 1) and north of U.S. Highway 200 in Sanders County. The BHMS falls within the Blue Creek Mining District, which is bordered to the west by the Clark Fork Mining District, to the south by the Clark Fork River, and on the northeast by the drainage of Blue Creek. The BHMS is situated in the East Fork of Blue Creek at an elevation of approximately 4,200 ft above mean sea level (amsl) in Section 10, Township 27 North,

Range 34 West, Principal Montana Meridian (PMM). The latitude and longitude are North 48° 07’ 15” and West 115° 58’ 06”. The BHMS features comprise approximately 1.5 acres of land that has been impacted by historic metal mining.

The surrounding area consists of moderately steep to steep mountain slopes and hillsides. Site topography is characterized by steep mountainous terrain rising from a narrow valley floor draining the East Fork of Blue Creek. Forest Road (FR) 2290 begins at an elevation of 2,625 ft amsl at its junction with FR 409 and terminates at an elevation of approximately 3,320 ft amsl near the BHMS. Billiard Table Mountain is a prominent peak northeast of the BHMS at an elevation of 6,622 ft amsl.

2.4.2 Vegetation and Wildlife

The BHMS is characterized by native plants growing on undisturbed areas around the site; little or no vegetation is currently growing on the waste rock piles. Dominant trees onsite include Douglas fir (*Pseudotsuga menziesii*), Engelmann spruce (*Picea engelmannii*), and Sitka alder. Shrubs and other vegetative species include thimbleberry (MNHP 2008). Other trees, shrubs, and forbs are found across and around the site in lower densities. There is regrowth of the forest in some mining-impacted areas, particularly on the lower haul road used for mining operations. Knapweed is widespread in all areas of relatively recent disturbance, with the exception of the waste rock dumps.

The habitat surrounding the BHMS supports a variety of wildlife including deer, elk, bobcat, black bear, potentially lynx and wolverine, and miscellaneous smaller mammals such as rabbits, squirrels, mice, and voles (MNHP 2008). Many species of birds are found around the site throughout the year, including various songbirds, owls, and raptors.

Mixed shrubs and coniferous forest at the BHMS

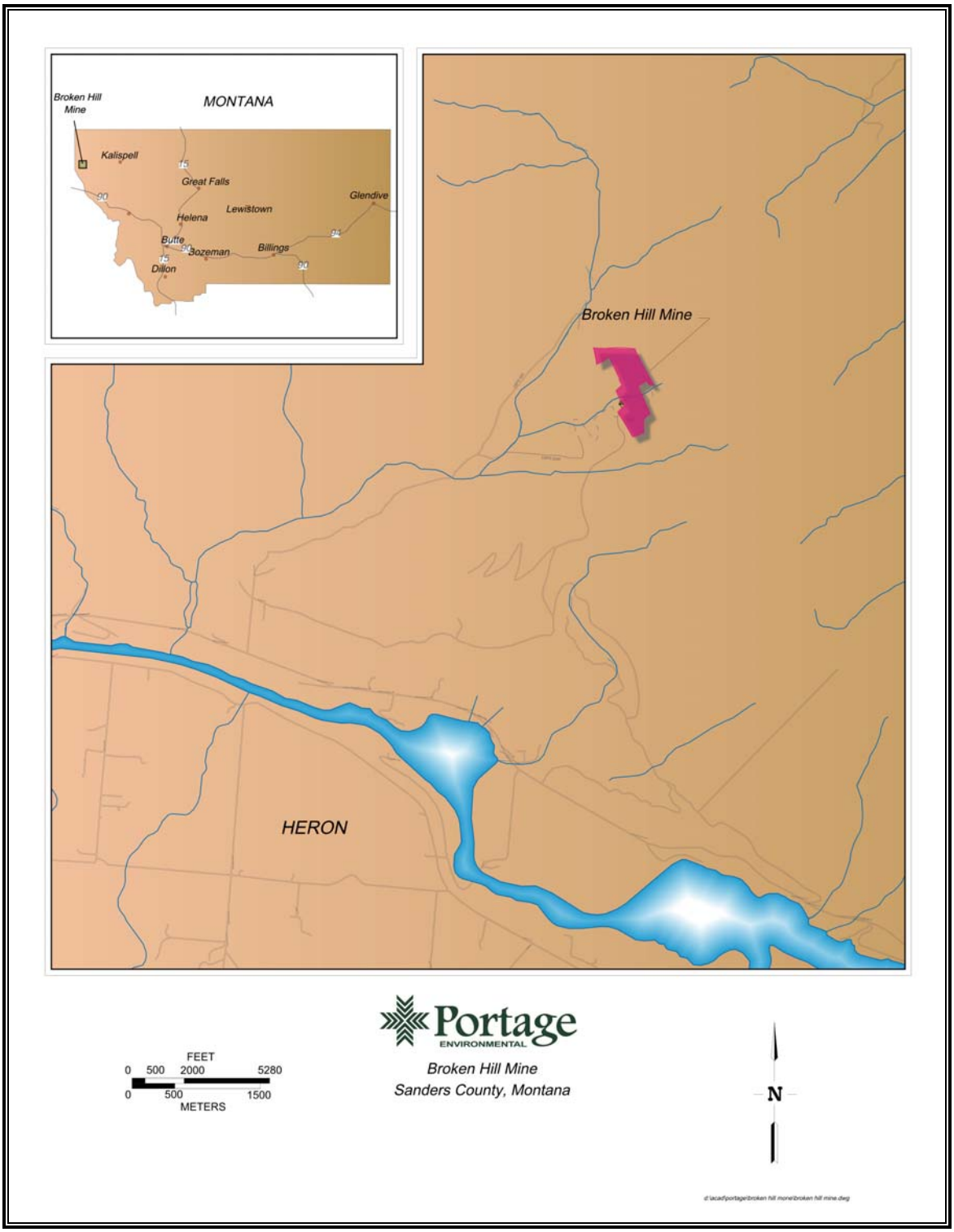

Figure 1. The BHMS within Montana.

The Montana Natural Heritage Program lists several species of concern that may exist within the area surrounding the BHMS. Table 1 lists the species of concern and their current federal status.

Table 1. Sensitive species.

Common Name	Scientific Name	USFWS Federal Status
Peregrine falcon	Falco peregrinus	Recovered, delisted, and being monitored
Westslope cutthroat trout	Oncorhynchus clarkii lewisi[a]	-
Gray wolf	Canis lupus	Listed Endangered
Grizzly bear	Ursus arctos horribilis	Listed Threatened
Fisher	Martes pennanti[a]	-
Wolverine	Gulo gulo[a]	-
Canadian lynx	Lynx canadensis	Listed Threatened

USFWS = US Fish and Wildlife Service

a. - No current federal designation

The BHMS lies within a habitat protection area for grizzly bear administered by the Kootenai National Forest. Access to the area is restricted seasonally.

2.4.3 Historic or Archaeologically Significant Features

A cultural inventory and assessment of the BHMS conducted in 2002 concluded that the site has greatly diminished integrity both as an individual site and as a historic landscape and would not be eligible for the National Register of Historic Places (FHC 2002). Also, it was determined that because there were no habitable features at the site, there is likely no archeological significance. The conclusion was based on the near total degradation of site adits and the general degradation of site features. Further, the site was not recommended to be eligible as a national historic mining landscape.

2.4.4 Land Use and Population

The BHMS is located on private land and on the Kootenai National Forest. The primary land use in the vicinity of the site is commercial (logging) and recreational. The population in Sanders County is 11,096 people, with approximately four persons per square mile (USCB 2009).

2.4.5 Land Ownership

The BHMS land ownership is divided into two parcels (RTI 2002). The upper adit and waste rock dump are located on the patented Broken Hill claim (Mineral Survey #10572.) The Broken Hill claim is currently owned by a private company, Sanders Mtn. Development, LLC of Kalispell, Montana. The lower adit and the majority of the lower waste rock dump are located on the unpatented Tuesday Lode (Mineral Survey #10572.) The Tuesday Lode and surrounding lands are administered by the Kootenai National Forest.

3. WASTE CHARACTERISTICS AND SUMMARY OF RECLAMATION INVESTIGATION

The following sections summarize the results of the waste characterization performed in support of the 2009 RI.

3.1 Background Sampling

Three background soil samples were collected during the RI (BHMS-BG-1, BHMS-BG-2, and BHMS-BG-3) above the upper waste rock dump and its associated adit in naturally occurring soil as shown in Figure 2. Each sample was composed of dark-brown loam with course materials. Site preparation (pre-sampling) included scraping off duff/decomposing plant material from the surface to expose actual soil. All of the background samples contained approximately 10% coarse fragments and 90% loamy soil. Each background sample was submitted for target analyte list (TAL) metals, texture, cation exchange capacity (CEC), acid base accounting (ABA), and agricultural analyses.

The background sampling analytical results are presented in Tables 2 and 3. Table 2 presents the metals concentrations compared to EPA Region 9 RSLs for residential soil (EPA 2010a), and Table 3 presents the metals concentrations compared to MDEQ RBCGs (MDEQ 1996). The results highlighted in bold exceed RSLs and RBCGs, respectively.

Based on the analytical results, metals in background soils are below the MDEQ RBCGs. The arsenic value in soil sample BHMS-BG-2 (67 ppm) exceeds the EPA RSL (0.39 ppm) and the MDEQ soil screening value (40 ppm). The mean arsenic concentration for background soils (44 ppm) also exceeds the EPA RSL and MDEQ soil screening value. Lead in BHMS-BG-3 (1,020 ppm) exceeds the EPA RSL (400 ppm). The mean lead concentration (560 ppm) also exceeds the EPA RSL.

Table 2. BHMS background soil concentrations (ppm) compared to EPA RSLs.

Analyte	EPA RSL[a]	Mean Background	BHMS-BG-1	BHMS-BG-2	BHMS-BG-3
Antimony	310	12	5UJ	5UJ	12J
Arsenic	0.39 (40)[b]	**44**	28	**67**	36
Barium	15,000	241	304J	199J	220J
Cadmium	70	1	1U	1U	1U
Chromium	280	6	7	5	6
Copper	3,100	13	12	14	24
Iron	55,000	14,833	13,300	13,300	17,900
Lead	400	**560**	350	309	**1,020**
Manganese	Not applicable	1,720	2,510	1,430	1,220
Mercury	6.7	0.50U	0.50U	0.50U	0.50U

Table 2. (continued)

Analyte	EPA RSL[a]	Mean Background	BHMS-BG-1	BHMS-BG-2	BHMS-BG-3
Nickel	14,000	7	7	8	6
Silver	390	7	5U	5U	7
Zinc	23,000	257	205	162	404

a. Regional screening level table, residential soil values (EPA 2010a).

b. 0.39 ppm is the arsenic residential soil RSL for the carcinogenic endpoint. MDEQ uses a soil screening value of 40 ppm for arsenic based on background arsenic values for Montana soils (MDEQ 2005).

UJ–The material was analyzed for but not detected. The sample quantitation limit is an estimated quantity.

J–The analyte was positively identified in the sample, but the associated numerical value may not be an accurate representation of the amount actually present in the sample.

U–The material was analyzed for but was not detected. The associated numerical value is the sample quantitation limit.

Bold–Value exceeds the EPA RSL or, in the case of arsenic, the MDEQ soil screening value.

Table 3. BHMS background soil concentrations (ppm) compared to MDEQ RBCGs.

Analyte	MDEQ RBCG	Mean Background	BHMS-BG-1 Background	BHMS-BG-2 Background	BHMS-BG-3 Background
Antimony	586	12	5UJ	5UJ	12J
Arsenic	323	44	28	67	36
Barium	103,000	241	304J	199J	220J
Cadmium	1,750	1U	1U	1U	1U
Chromium	1,470,000	6	7	5	6
Copper	54,200	13	12	14	24
Iron	Not Applicable	14,833	13,300	13,300	17,900
Lead	2,200	560	350	309	1,020
Manganese	7,330	1,720	2,510	1,430	1,220
Mercury	440	0.50U	0.50U	0.50U	0.50U
Nickel	29,300	7	7	8	6
Silver	Not Applicable	7	5U	5U	7
Zinc	440,000	257	205	162	404

RBCG = risk-based cleanup guideline (MDEQ 1996).

UJ–The material was analyzed for but not detected. The sample quantitation limit is an estimated quantity.

J–The analyte was positively identified in the sample, but the associated numerical value may not be an accurate representation of the amount actually present in the sample.

U–The material was analyzed for but was not detected. The associated numerical value is the sample quantitation limit.

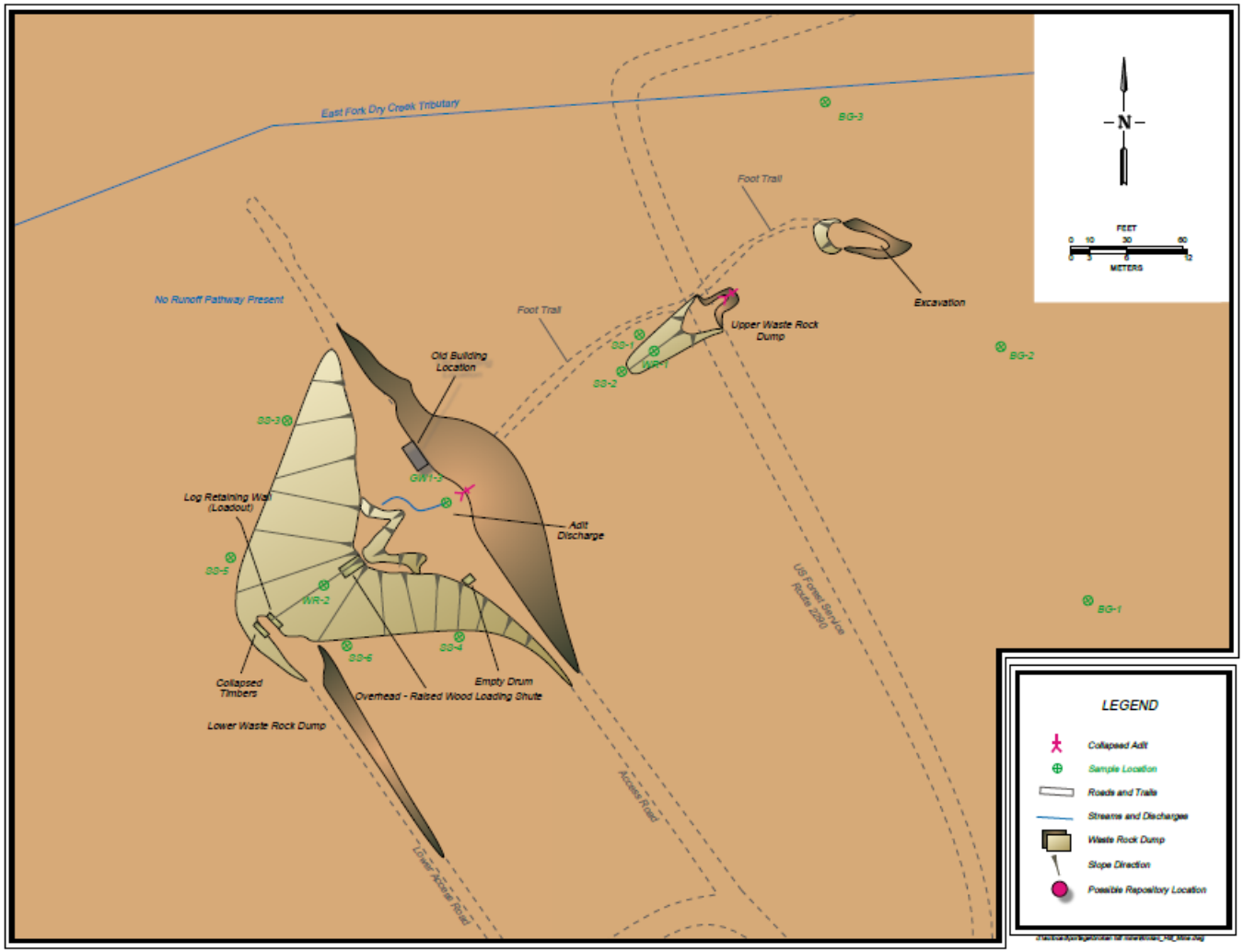

Figure 2. BHMS RI sample locations.

3.2 Mine Waste Characterization

The two waste rock piles contain the mining waste associated with the BHMS. During the 2009 RI, six soil samples (two from the upper and four from the lower waste rock dump areas) were collected from the periphery of the waste rock dumps to establish the spatial boundaries of contamination around each dump. To better understand how the waste rock might release metals over time, waste rock samples from each of the dumps were collected to evaluate the mobility of metals they contain under environmental conditions. To support this effort, one waste rock sample was collected from each dump and submitted for SPLP extraction. Each SPLP extraction was analyzed for total metals. Also during the 2009 RI, a composite sample of waste rock from each dump was collected and analyzed for total metals to confirm the results of previous investigations which characterized total metals concentrations in waste rock (Pioneer 1993).

Analytical results for the soil and waste rock samples are presented in Tables 4, 5, and 6. In Table 4, the metals concentrations are compared to EPA Region 9 RSLs for residential soil. In Table 5, the metals are compared to MDEQ RBCGs. In Table 6, the metals concentrations are compared to mean background values. Metals concentrations which exceed mean background by a factor of three or more are considered elevated for the purpose of characterization. Results highlighted in bold indicate exceedance of RSLs, RBCGs, and/or mean background. The following summarizes these comparisons:

- Lead exceeded the EPA RSLs in all samples except BHMS-SS-2 (adjacent to upper waste rock dump)
- Lead exceeded the MDEQ RBCG in both waste rock samples and BHMS-SS-1 (adjacent to the upper waste rock dump)
- Arsenic exceeded the EPA RSL in both waste rock samples and BHMS-SS-5 (lower waste rock dump)
- Arsenic exceeded the MDEQ RBCG in both waste rock samples
- The EPA RSL for antimony, iron, and mercury was exceeded in the upper waste dump only
- Lead exceeded background concentrations in eight of ten samples by a factor of three or more
- Copper exceeded background concentrations in four of ten samples by a factor of three or more
- Cadmium exceeded background concentrations in six of ten samples by a factor of three or more
- Antimony, arsenic, iron and mercury exceeded background concentrations in three of ten samples by a factor of three or more
- Zinc exceeded background concentrations in nine of ten samples by a factor of three or more.

Table 4. BHMS solid matrix total metals analytical results (ppm) compared to EPA RSLs.

Analyte	EPA RSL[a]	WR-1 Upper Waste Rock Dump[b]	WR-2 Lower Waste Rock Dump[b]	WR-1 Upper Waste Rock Dump[c]	WR-2 Lower Waste Rock Dump[c]	BHMS-SS-1 Upper Waste Rock Dump	BHMS-SS-2 Upper Waste Rock Dump	BHMS-SS-3 Lower Waste Rock Dump	BHMS-SS-4 Lower Waste Rock Dump	BHMS-SS-5 Lower Waste Rock Dump	BHMS-SS-6 Lower Waste Rock Dump	BHMS-SS-7 Duplicate of SS-6
Antimony	310	**344**	61.3	34	12	5UJ	5UJ	5UJ	5UJ	5UJ	5UJ	5UJ
Arsenic	0.39 (40)[d]	**1,140**	**508**	**743**	**117**	21	13	32	11	**171**	22	20
Barium	15,000	27.9	19.8	17	42	186J	188J	28J	48J	65J	154J	102J
Cadmium	70	15.2	26	2	3	4	1U	4	1U	26	1U	1U
Chromium	280	5.25	4.5	6	6	8	5	5U	6	5	6	5U
Copper	3,100	342J	140J	171	61	18	13	17	19	29	22	14
Iron	55,000	**94,400**	44,200	**55,800**	18,300	22,300	12,500	8,410	14,200	9,690	14,700	13,000
Lead	400	**55,900J**	**18,700**	**14,100**	**2,760**	**2,540**	355	**1,160**	**642**	**2,110**	**1,130**	**737**
Manganese	Not applicable	992	426	634	524	1,680	1,050	322	283	1,170	738	466
Mercury	6.7	**27.2J**	2.53J	4	0.83	0.50U	0.50U	0.50U	0.50U	0.50U	0.50U	0.50U
Nickel	14,000	3.84	6.23	5U	10	10	7	7	8	8	8	5
Silver	390	NA	NA	26	5	5U	5U	5U	5U	5U	5U	5U
Zinc	23,000	9,600	11,400	1,800	1,480	926	1,050	1,680	751	4,410	866	535

Table 4. (continued)

a. EPA RSL table, residential soil values (EPA 2010a).

b. Total metals analytical results from 1993 AMRB Hazardous Materials Inventory (Pioneer 1993).

c. Total metals analytical results from additional 2009 solid matrix samples (Portage, 2010a).

d. 0.39 ppm is the arsenic residential soil RSL for the carcinogenic endpoint. The MDEQ uses a soil screening value of 40 ppm for arsenic based on background arsenic values for Montana soils (MDEQ 2005).

UJ–The material was analyzed for but not detected. The sample quantitation limit is an estimated quantity.

J–The analyte was positively identified in the sample, but the associated numerical value may not be an accurate representation of the amount actually present in the sample.

U–The material was analyzed for but was not detected. The associated numerical value is the sample quantitation limit.

Bold– Value exceeds the EPA RSL or, for arsenic, the MDEQ soil screening value.

NA = Not analyzed.

Table 5. BHMS solid matrix total metals analytical results (ppm) compared to MDEQ RBCGs.

Analyte	MDEQ RBCG[a]	WR-1 Upper Waste Rock Dump[b]	WR-2 Lower Waste Rock Dump[b]	WR-1 Upper Waste Rock Dump[c]	WR-2 Lower Waste Rock Dump[c]	BHMS-SS-1 Upper Waste Rock Dump	BHMS-SS-2 Upper Waste Rock Dump	BHMS-SS-3 Lower Waste Rock Dump	BHMS-SS-4 Lower Waste Rock Dump	BHMS-SS-5 Lower Waste Rock Dump	BHMS-SS-6 Lower Waste Rock Dump	BHMS-SS-7 Duplicate of SS-6
Antimony	586	344	61.3	34	12	5UJ	5UJ	5UJ	5UJ	5UJ	5UJ	5UJ
Arsenic	323	**1,140**	**508**	**743**	117	21	13	32	11	171	22	20
Barium	103,000	27.9	19.8	17	42	186J	188J	28J	48J	65J	154J	102J
Cadmium	1,750	15.2	26	2	3	4	1U	4	1U	26	1U	1U
Chromium	1,470,000	5.25	4.5	6	6	8	5	5U	6	5	6	5U
Copper	54,200	342J	140J	171	61	18	13	17	19	29	22	14
Iron	Not applicable	94,400	44,200	55,800	18,300	22,300	12,500	8,410	14,200	9,690	14,700	13,000
Lead	2,200	**55,900J**	**18,700**	**14,100**	**2,760**	**2,540**	355	1,160	642	2,110	1,130	737
Manganese	7,330	992	426	634	524	1,680	1,050	322	283	1,170	738	466
Mercury	440	27.2J	2.53J	4	0.83	0.50U	0.50U	0.50U	0.50U	0.50U	0.50U	0.50U
Nickel	29,300	3.84	6.23	5U	10	10	7	7	8	8	8	5
Silver	Not applicable	NA	NA	26	5	5U	5U	5U	5U	5U	5U	5U
Zinc	440,000	9,600	11,400	1,800	1,480	926	1,050	1,680	751	4,410	866	535

Table 5. (continued)

a. MDEQ risk-based cleanup guideline (MDEQ 1996).
b. Total metals analytical results from 1993 AMRB Hazardous Materials Inventory (Pioneer 1993).
c. Total metals analytical results from additional 2009 solid matrix samples (Portage, 2010a).
UJ–The material was analyzed for but not detected. The sample quantitation limit is an estimated quantity.
J– The analyte was positively identified in the sample, but the associated numerical value may not be an accurate representation of the amount actually present in the sample.
U– The material was analyzed for but was not detected. The associated numerical value is the sample quantitation limit.
Bold–Value exceeds the MDEQ RBCG.
NA–Not analyzed.

Table 6. BHMS solid matrix total metals analytical results (ppm) compared to mean background.

Analyte	Mean Background	WR-1 Upper Waste Rock Dump[a]	WR-2 Lower Waste Rock Dump[a]	WR-1 Upper Waste Rock Dump[b]	WR-2 Lower Waste Rock Dump[b]	BHMS-SS-1 Upper Waste Rock Dump	BHMS-SS-2 Upper Waste Rock Dump	BHMS-SS-3 Lower Waste Rock Dump	BHMS-SS-4 Lower Waste Rock Dump	BHMS-SS-5 Lower Waste Rock Dump	BHMS-SS-6 Lower Waste Rock Dump	BHMS-SS-7 Duplicate of SS-6
Antimony	12J	**344**	**61.3**	**34**	12	5UJ	5UJ	5UJ	5UJ	5UJ	5UJ	5UJ
Arsenic	44	**1,140**	**508**	**743**	117	21	13	32	11	171	22	20
Barium	241	27.9	19.8	17	42	186J	188J	28J	48J	65J	154J	102J
Cadmium	1U	**15.2**	**26**	2	**3**	**4**	1U	**4**	1U	**26**	1U	1U
Chromium	6	5.25	4.5	6	6	8	5	5U	6	5	6	5U
Copper	17	**342J**	**140J**	**171**	**61**	18	13	17	19	29	22	14
Iron	14,833	**94,400**	**44,200**	**55,800**	18,300	22,300	12,500	8,410	14,200	9,690	14,700	13,000
Lead	560	**55,900J**	**18,700**	**14,100**	**2,760**	**2,540**	355	**1,160**	642	**2,110**	**1,130**	737
Manganese	1,720	992	426	634	524	1,680	1,050	322	283	1,170	738	466
Mercury	0.5U	**27.2J**	**2.53J**	**4**	0.83	0.50U	0.50U	0.50U	0.50U	0.50U	0.50U	0.50U
Nickel	7	3.84	6.23	5U	10	10	7	7	8	8	8	5
Silver	7	NA	NA	**26**	5	5U	5U	5U	5U	5U	5U	5U
Zinc	257	**9,600**	**11,400**	**1,800**	**1,480**	**926**	**1,050**	**1,680**	751	**4,410**	**866**	535

a. Total metals analytical results from 1993 AMRB Hazardous Materials Inventory (Pioneer 1993).

b. Total metals analytical results from additional 2009 solid matrix samples (Portage, 2010a).

UJ–The material was analyzed for but not detected. The sample quantitation limit is an estimated quantity.

J–The analyte was positively identified in the sample, but the associated numerical value may not be an accurate representation of the amount actually present in the sample.

U–The material was analyzed for but was not detected. The associated numerical value is the sample quantitation limit.

Bold–Value exceeds the mean background level by factor of three or more.

NA = Not analyzed.

As noted, two waste rock samples underwent SPLP extraction and total metals analysis. This method determines the total metals that would be leached under simulated environmental conditions. The leaching is performed with a dilute acid extraction fluid to reflect the pH of the acidic precipitation in the geographic region, to evaluate environmental mobility of metals. The SPLP results are presented in Table 7.

Table 7. BHMS laboratory SPLP total metals analytical results (ppm).

	Sb	Cu	Fe	Hg	Mn	Ni	Zn	As	Ba	Cd	Cr	Pb	Ag
WR-1 Upper Waste Rock Dump	0.5U	0.5U	1UJ	.02U	0.5U	0.5U	1U	0.5U	10U	0.1U	0.5U	9.0	0.5U
WR-2 Lower Waste Rock Dump	0.5U	0.5U	1UJ	.02U	0.5U	0.5U	1U	0.5U	10U	0.1U	0.5U	0.5U	0.5U

UJ–The material was analyzed for but not detected. The sample quantitation limit is an estimated quantity.
U–The material was analyzed for but was not detected. The associated numerical value is the sample quantitation limit.

With the exception of lead in the upper waste rock dump, none of the samples showed detectable levels of target metals, indicating limited mobility of these metals in the environment. This is a reasonable outcome, considering the overwhelming majority of the mine waste is rock, with very little fines found at the site (i.e., no milling/size reduction took place at the site). The metals being bound in the natural rock of the region limits their contact with surface waters and reduces the amount of metals available for leaching. The rock form also significantly reduces the risk of large sedimentation events due to contact with surface water.

The SPLP extract for lead in sample BHMS-WR-1 (upper waste rock dump) was measured at 9 ppm (9,000 ppb). The human health standard for lead in water from the “Montana Numeric Water Quality Standards” is 15 ppb (MDEQ 2010). The acute aquatic life standard from the “Montana Numeric Water Quality Standards” is 13.98 ppb (MDEQ 2010).

At the request of MDEQ, Portage personnel traveled to the BHMS in November 2009 to acquire waste rock samples from both the upper and lower dumps. The data were collected to confirm 1993 results and to ensure that no significant changes had occurred since the previous sampling effort. To support this effort, one composite waste rock sample was collected from each of the waste rock dumps (upper and lower) and analyzed for total metals. The November 2009 waste rock total metals data are also presented in Tables 5 and 6.

The 1993 waste rock data were generated by collecting multiple subsamples from individual areas within each dump and combining subsamples from that dump into a single composite sample (e.g., WR-1 subsamples combined with other WR-1 subsamples). The stakes/markers used to identify where 1993 subsamples were collected were not evident in 2009. As a result, the supplemental samples collected in November of 2009 are not from these locations. However, the 2009 composite samples were collected from multiple locations at each dump, similar to prior sampling.

In comparing the results of the two sampling efforts, it is clear that the waste rock has a relatively high degree of heterogeneity. Relative percent differences (RPDs) between the 1993 and 2009 results

were rather high (>35%). However, field duplicates collected during 2009 showed similar variability, indicating the spread in the data has more to do with the sample matrix than sampling precision. In general, the results from the 1993 sampling were higher for the majority of constituents. In particular, the primary contaminant of potential concern (arsenic) was higher. Results for metals with lesser human and/or ecological toxicity were slightly higher in the 2009 data. These included chromium in WR-1 and barium and manganese in WR-2. For purposes of examining site conditions, the 1993 data were retained for assessment, because the results generally represent the maximum concentrations found at the site and, therefore, their use is more protective of human health and the environment.

3.3 Surface Water Characterization

Water at the BHMS originates from the collapsed adit that divides the upper and lower waste rock dumps (Figure 2). Although it has not been measured, the volume of this seepage has been observed to be very low. To better understand the composition of the discharge, three water samples were collected. The first was an unfiltered sample collected for total metals and water quality parameters and to confirm the results of the 1993 sampling effort. The other two samples were filtered and preserved to determine whether the metals found in the 1993 unfiltered samples reflect natural conditions or sediment loading led to the elevated concentrations observed in the water. The data are presented in a series of tables that follow to provide context to the results. The following describes the data presentation:

- Table 8 presents the water-dissolved metals and a comparison to the MDEQ RBCGs
- Table 9 presents the water dissolved metals and a comparison to the “Montana Numeric Water Quality Standards” (MDEQ 2010) for aquatic life (acute values), aquatic life (chronic levels), and the human health values (surface water) for reference
- Table 10 presents the water total metals data and a comparison to the MDEQ RBCGs
- Table 11 presents the water total metals data compared to the “Montana Numeric Water Quality Standards” for aquatic life (acute levels), aquatic life (chronic levels), and human health values (surface water) for reference[a]
- Table 12 presents the water quality parameter data.

a. The adit discharge results from 1993 are also included in Tables 11 and 12.

Table 8. BHMS water dissolved metals (ppb) vs. MDEQ RBCG.

	MDEQ RBCG[a]	BHMS-GW-2	BHMS-GW-3 Duplicate of GW-2
Antimony	204	5U	5U
Arsenic	153	31	31
Barium	35,800	100U	100U
Cadmium	256	1	1
Calcium	None	9,000	9,000
Chromium	511,000 (as Cr III)	10U	10U
Copper	18,900	10U	10U
Iron	None	30U	30U
Lead	220	10U	10U
Magnesium	None	1,000U	1,000U
Manganese	2,560	10U	10U
Mercury	153	1U	1U
Nickel	10,200	10U	10U
Silver	None	4U	5U
Zinc	153,000	420	480

ppb = parts per billion.
a. MDEQ risk-based recreational cleanup guidelines (MDEQ 1996).
U–The material was analyzed for but was not detected. The associated numerical value is the sample quantitation limit.

Table 9. BHMS water dissolved metals (ppb) vs. "Montana Numeric Water Quality Standards."

	Human Health Standard[a]	Acute Aquatic Life Standard	Chronic Aquatic Life Standard	BHMS-GW-2	BHMS-GW-3 Duplicate of GW-2
Antimony	5.6[b]	None	None	5U	5U
Arsenic	10[b]	340 [b]	150[b]	**31**	**31**
Barium	1,000[c]	None	None	100U	100U
Cadmium	5[d]	0.52 @ 25 ppm hardness	0.097 @ 25 ppm hardness	**1**	**1**
Calcium	None	None	None	9,000	9,000
Chromium	100[d]	None	None	10U	10U
Copper	1,300[b]	3.79 @ 25 ppm hardness	2.85 @ 25 ppm hardness	10U	10U
Iron	300[e]	None	1,000[b]	30U	30U
Lead	15[b]	13.98 @ 25ppm hardness	0.545 @ 25ppm hardness	10U	10U
Magnesium	None	None	None	1,000U	1,000U
Manganese	50[e]	None	None	10U	10U
Mercury	0.05[b]	1.7[b]	0.91[b]	1U	1U
Nickel	100[f]	145 @ 25 ppm hardness	16.1 @ 25 ppm hardness	10U	10U
Silver	100[f]	0.374 @ 25 ppm hardness	None	5U	5U
Zinc	2,000[f]	37 @ 25 ppm hardness	37 @ 25 ppm hardness	**420**	**480**

ppb = parts per billion.
a. Human health standards for surface water, Circular DEQ-7, "Montana Numeric Water Quality Standards" (MDEQ 2010).
b. Priority pollutant (MDEQ 2010).
c. Non priority pollutant (MDEQ 2010).
d. Maximum contaminant level (MDEQ 2010).
e. Secondary maximum contaminant level based on aesthetic properties (MDEQ 2010).
f. Health advisory (MDEQ 2010).
U–The material was analyzed for but was not detected. The associated numerical value is the sample quantitation limit.
Bold–Value exceeds the human health standard or Montana acute aquatic life standard.

The comparison of dissolved metals values from the BHMS adit discharge to MDEQ RBCGs reveals metals in the adit discharge do not exceed associated recreational cleanup guidelines. Arsenic exceeded the human health standard (HHS) and both cadmium and zinc exceeded the aquatic life standards listed in the "Montana Numeric Water Quality Standards" (MDEQ 2010).

Table 10. BHMS water total metals (ppb) vs. MDEQ RBCGs.

	MDEQ RBCG[a]	BHMS-GW-1	GW-1 1993 Level[b]
Antimony	204	5U	30.7U
Arsenic	153	31	30.4
Barium	35,800	100U	2.01U
Cadmium	256	2	2.57U
Calcium	None	9,000	NA
Chromium	511,000 (as Cr III)	10U	6.83U
Copper	18,900	10U	2.97
Iron	None	30U	69.6
Lead	220	20	107
Magnesium	None	1,000U	NA
Manganese	2,560	10U	15.2
Mercury	153	1U	0.044J
Nickel	10,200	10U	12.7U
Silver	None	5U	Not analyzed
Zinc	153,000	580	867

ppb = parts per billion.

a. MDEQ risk-based recreational cleanup guidelines (MDEQ 1996).

b. Analytical results from 1993 AMRB Hazardous Materials Inventory (Pioneer 1993).

U–The material was analyzed for but was not detected. The associated numerical value is the sample quantitation limit.

NA–Not analyzed.

Table 11. BHMS water total metals (ppb) vs. "Montana Numeric Water Quality Standards."

	Human Health Standard[a]	Acute Aquatic Life Standard	Chronic Aquatic Life Standard	BHMS-GW-1	GW-1 1993 Level[b]
Antimony	5.6[c]	None	None	5U	30.7U
Arsenic	10[c]	340 [c]	150[c]	**31**	30.4
Barium	1,000[d]	None	None	100U	2.01U
Cadmium	5[e]	0.52 @ 25 ppm hardness	0.097 @ 25 ppm hardness	**2**	2.57U
Chromium	100[e]	None	None	10U	6.83U
Copper	1,300[c]	3.79 @ 25 ppm hardness	2.85@ 25 ppm hardness	10U	**2.97**
Iron	300[f]	None	1,000 [c]	30U	69.6
Lead	15[c]	13.98 @ 25 ppm hardness	0.545 @ 25 ppm hardness	**20**	**107**
Manganese	50[f]	None	None	10U	15.2
Mercury	0.05[c]	1.7[c]	0.91[c]	1U	0.044J
Nickel	100[g]	145 @ 25 ppm hardness	16.1 @ 25 ppm hardness	10U	12.7U
Silver	100[g]	0.374 @ 25 ppm hardness	None	5U	Not analyzed
Zinc	2,000[g]	37 @ 25 ppm hardness	37 @ 25 ppm hardness	**580**	**867**

ppb = parts per billion.

a. Human health standards for surface water, Circular DEQ-7, "Montana Numeric Water Quality Standards" (MDEQ 2010).

b. Analytical results from 1993 AMRB Hazardous Materials Inventory (Pioneer 1993).

c. Non priority pollutant (MDEQ 2010).

d. Priority Pollutant, Circular DEQ-7, "Montana Numeric Water Quality Standards" (MDEQ 2010).

e. Maximum contaminant level (MDEQ 2008).

f. Secondary maximum contaminant level based on aesthetic properties (MDEQ 2008).

g. Health advisory (MDEQ 2008).

U–The material was analyzed for but was not detected. The associated numerical value is the sample quantitation limit.

Bold–Values exceed either the HHS and/or the Aquatic Life Standard.

As the results show, none of the total metals in the adit discharge exceeded their associated RBCG. The HHS for arsenic and lead were exceeded. Cadmium, copper, lead, and zinc all exceed aquatic life standards from the "Montana Numeric Water Quality Standards."

Table 12. Water quality parameter analytical results (ppm) for the BHMS.

	Chloride	Carbonate as CO_3	Sulfate	Hardness	Nitrate/ Nitrite	Alkalinity as $CaCO_3$	Total Acidity as $CaCO_3$	TDS	Bicarbonate as HCO_3
BHMS -GW-1	1U	4U	3	25	0.11	24	4U	42	29
GW-2	NA	NA	NA	25	NA	NA	NA	NA	NA
GW-3	NA	NA	NA	25	NA	NA	NA	NA	NA

TDS = total dissolved solids.
U–The material was analyzed for but was not detected. The associated numerical value is the sample quantitation limit.
NA = Not analyzed.

The water quality parameters indicate limited nutrient loading in the adit discharge. This result is consistent with observed conditions, as the discharge emerges from underground mine working without contacting a large area at the site before seeping back into the lower waste rock dump and disappearing from the surface. The water clarity at the discharge is high, with no observable loading in the water or staining on the gravel at the discharge point.

3.4 Assessment of Airborne Particulate Emissions

No assessment of airborne particulate emissions was performed. Because the wastes associated with the BHMS are primarily rock and coarse fragments, it is unlikely that inhalation of contaminated airborne particulate matter is a significant human exposure pathway. Also, the risk of ecological exposure from aerial deposition of contaminated particulate matter is considered to be negligible.

3.5 Assessment of Physical Hazards

The primary physical hazard present at the BHMS consists of steep slopes associated with the waste rock dumps and two hazardous mine openings (HMOs) (two collapsed adits). The dumps consist of loose rock and granular material at the angle of repose. The waste rock piles appear stable as no surface indications of slope instability were noted during site inspection (overhanging material, extreme erosion, cracking, fissuring, etc.). A partially collapsed adit located above the upper waste rock dump is a significant fall hazard. The opening is approximately 8 ft deep. The mine adits are currently collapsed, and underground mine workings are not immediately accessible. An attempt was made to find mine maps, but none were identified and the condition of underground workings at the BHMS is unknown.

3.6 Potential Repository Site Investigation

An investigation of potential repository sites was performed in May of 2010 (Portage 2010b). The investigation focused on the suitability and subsurface characteristics of four potential repository sites located on Kootenai National Forest land near the BHMS. The sites were located in cooperation with MDEQ and Kootenai National Forest staff as potential environmentally and geographically suitable sites.

Figure 3 shows the potential repository site locations in relation to the BHMS. Each site investigated has adequate surface area available for repository construction based on the following estimate:

- The BHMS waste rock volume is approximately 4,100 yd^3 (approximately 500 yd^3 in the upper dump and 3,600 yd^3 in the lower dump)
- The average burial depth of waste in the repository is 5 to 6 ft
- Based on the average burial depth, the repository footprint would be approximately ½ acre
- Based on the average burial depth, the site disturbance footprint (not including additional access roadway development) would be approximately ¾ acres.

The investigation determined that the subgrade at all sites has sufficient bearing capacity and shear strength for repository construction. Settlement after construction would likely be imperceptible. No adverse geotechnical conditions were observed (exposed or excessively shallow bedrock, seeps, slumps, boggy areas, peat, unstable areas, or excessive erosion) at any of the sites investigated. Also, there was no evidence of shallow groundwater at any of the sites investigated. All test pits were excavated to the bedrock surface (as deep as 19 feet) with no evidence of groundwater indicated in any test pit. Sufficient material is available at each site for growth media and general fill for shaping and buttressing the repository. Material suitable for hydrologic barriers was not found. Repository hydrologic barrier construction will require construction of a geosynthetic liner system, importation of low-permeability soils, or amendment of onsite soils. The results of the geotechnical investigation are detailed in the *Repository Investigation Report for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2010b) and are summarized in the following sections.

3.6.1 Road Bench Site #1

Road Bench Site #1 is located on an unnamed ridge near the BHMS in the SE1/4 of the NW1/4 of Section 15, Township 27N, Range 34W, PMM, Sanders County, Montana. Bench Site 1 is located adjacent to FR 2290 approximately 0.75 miles south of the BHMS at an elevation of approximately 3,740 ft amsl. As the second smallest of the four sites investigated, it still has adequate acreage available for repository construction. Because the ridge is moderately sloped, a constructed repository could be contoured to existing site topography creating a more natural appearing landform. At approximately 0.64 miles, the site offers the second shortest haul distance from the BHMS.

The subsurface at Road Bench Site #1 consists of ½ to 1½ ft of topsoil and then consists of angular rock and silt to the bedrock surface. Topsoil is present in sufficient quantities for a supply of repository cover material. Bedrock was encountered at between 3 and 9 ft bgs. The results of geotechnical testing do not indicate adverse subsurface conditions, and excavated site material could be used as general fill for repository construction.

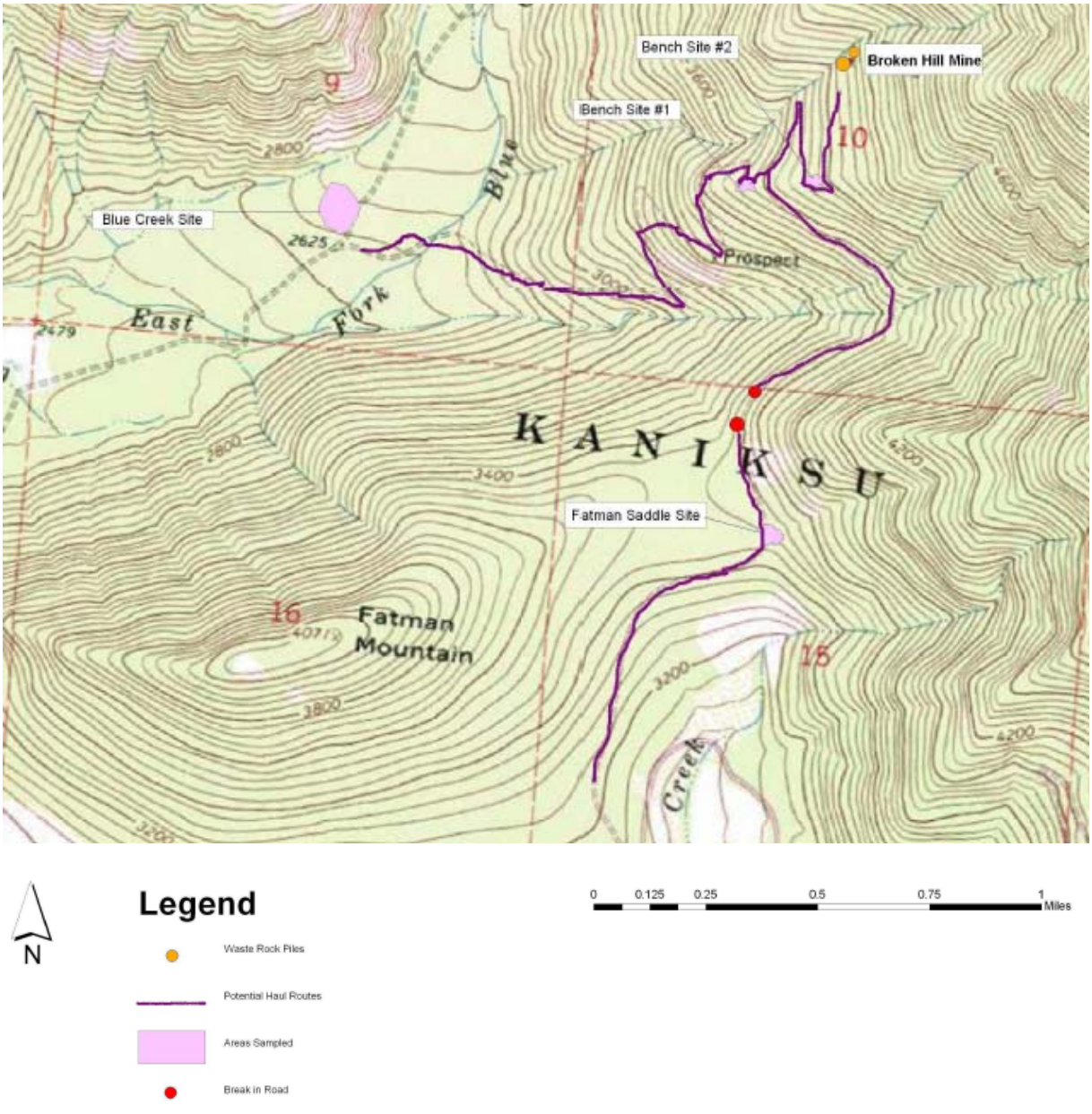

Figure 3. Potential repository site locations (Base Map: 1:24,000 Scale Digital Format Map, Heron, Montana, USGS, 1983).

3.6.2 Road Bench Site #2

Road Bench Site #2 is located on the same unnamed ridge as Bench Site 1, near the BHMS in the SE1/4 of the NW1/4 of Section 15, Township 27N, Range 34W, PMM, Sanders County, Montana. Bench Site 2 is located adjacent to FR 2290 approximately 0.25 miles southwest of the BHMS at an elevation of approximately 3,920 ft amsl. As the smallest of the four sites investigated, it has adequate acreage available for repository construction. Because the ridge is moderately sloped, a constructed repository could be contoured to existing site topography creating a more natural appearing landform. At approximately 0.21 miles, the site offers the shortest haul distance from the BHMS.

The subsurface at Road Bench Site #2 consists of 0 to 2 ft of topsoil and then consists of angular rock, sand, and silt to the bedrock surface. Topsoil is present in sufficient quantities for a supply of repository cover material. Bedrock was encountered in one test pit at 7 ft bgs. The results of geotechnical testing do not indicate adverse subsurface conditions, and excavated site material could be used as general fill for repository construction.

Test pit excavation at Road Bench Site #2

3.6.3 Fatman Saddle

Fatman Saddle in the SE1/4 of the NW1/4 of Section 15, Township 27N, Range 34W, PMM, Sanders County, Montana. Fatman Saddle is a prominent saddle off the northeastern flank of Fatman Mountain approximately 1 mile south of the BHMS at an elevation of approximately 3,480 ft amsl. The Fatman Saddle site was the second largest site investigated, and it has adequate acreage available for repository construction. Mildly sloping terrain at the site would be used to create a natural appearing landform during repository construction, but final contouring would result in a more mounded appearance when compared to either road bench site. The haul from the BHMS to Fatman Saddle is complicated by a break in FR 2290 in steep, rocky terrain. Significant road improvements would be required to complete this haul route.

The subsurface at the Fatman Saddle site consists of 0 to 2 ft of topsoil and then consists of angular rock, sand, and silt to the bedrock surface. Topsoil is present in sufficient quantities for a supply of repository cover material. Bedrock was encountered at between 5 and 19 ft bgs. The results of geotechnical testing do not indicate adverse subsurface conditions, and excavated site material could be used as general fill for repository construction.

Fatman Saddle

3.6.4 Blue Creek Bench

The Blue Creek Bench site is located in the NW1/4 of the SE1/4 of Section 9, Township 27N, Range 34W, PMM, Sanders County, Montana. The bench is located in the valley floor approximately 1 mile southwest of the BHMS at an elevation of approximately 2,660 ft amsl. This site was the largest site investigated, and it has adequate acreage available for repository construction. The topography of the Blue Creek Bench site is generally level, and a constructed repository using a balanced cut and fill would appear as a mounded landform. The haul from the BHMS would be on steep sections of FR 2290 over approximately 2.25 miles. Also, the Blue Creek Bench site is located near the East Fork of Blue Creek and is the potential repository site nearest a significant body of surface water.

The subsurface at the Blue Creek Bench site consists of 0 to 2 ft of topsoil and then consists of sub-rounded rock, sand, and silt to the bedrock surface. Topsoil is present in sufficient quantities for a supply of repository cover material. Bedrock or large rock was encountered at between 8 and 12 ft bgs. The results of geotechnical testing do not indicate adverse subsurface conditions, and excavated site material could be used as general fill for repository construction

Blue Creek

3.6.5 Repository Site Investigation Summary

In consideration of the geotechnical observations and data, each of the four sites was determined to be suitable for constructing a waste rock repository. From a geotechnical engineering perspective, the soil types and subsurface conditions were not significantly different among the four sites investigated. The main exception to this is that the rocks found at the Blue Creek Bench site were alluvial and therefore more rounded than the angular (residual or colluvial) rocks found at the other sites.

Bedrock depths are generally great enough to accommodate the engineering design of balanced cut/fill earthwork, with cut materials utilized as general fill for shaping the repository and surroundings. A sufficient quantity of topsoil is available at each site to cover and reclaim the surface upon completion.

A hydrogeologic investigation was not conducted as part of the geotechnical investigation, but, as noted, no groundwater was encountered during test pit excavation and no seasonal groundwater influence was evident at the point of excavator refusal (bedrock).

The topography of Road Bench Sites #1 and #2 provides the most opportunity for creation of a naturally appearing land feature for repository construction. This is because each of these sites is located on a sloping ridge into which the repository cut and fill can be contoured into the slope. At the Blue Creek Bench site and to a lesser extent the Fatman Saddle site, the repository would be a mounded landform.

Haul distance is the least to Road Bench Site #2 (approximately 0.5 miles) and potentially farthest to the Fatman Saddle Site. FR 2290, which could potentially connect the BHMS to Fatman Saddle, is discontinuous because of rock outcroppings and steep terrain. Significant road improvements would be required to use FR 2290 as a haul route. Steep grades and switchbacks on FR 2290 also create a challenging haul to the Blue Creek Bench Site.

Each site has sufficient area for repository construction (at least ¾ acres) with Road Bench Site #2 having the least usable acreage and the Blue Creek Bench Site having the most useable acreage. Potential geotechnical concerns such as exposed or excessively shallow bedrock, seeps, slumps, boggy areas, peat, unstable areas, or excessive erosion were not encountered during investigations at any of the sites.

Because no one site has an advantage over another based on geotechnical considerations, the choice of a preferred repository site is based on factors that affect cost (haul distance), environmental concerns, visual impact, and others. These factors will be fully analyzed Sections 7 and 8 of this EEE/CA for each repository site. Based on the results of the investigation, however, Portage recommended Road Bench Site #2 as the preferred repository site. This recommendation is supported by the following:

- Road Bench Site #2 is nearest the BHMS and will involve the shortest haul, reducing project construction costs and environmental impacts from truck traffic

- Road Bench Site #2 is likely to be more hydrologically isolated than either the Blue Creek Bench or Fatman Saddle sites, because it is higher in elevation and farther away from surface water

- Road Bench Site #2 will have less visual impact than other sites because the repository can be shaped into the topography of the bench, the site will require the least clearing and grubbing, and the site will require minimal road improvements.

4. RISK ASSESSMENT

Site characterization results were used to conduct a screening level human health risk analysis. The analysis was conducted using current guidance set forth in the following:

- *Risk-Based Cleanup Guidelines for Abandoned Mine Sites: Final Report* (TetraTech 1996)

- *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Interim Final)* (RAGS) (EPA 1989a).

The following sections summarize the results of the risk assessment. The detailed information and calculations used to develop the human health risk analysis are provided in Appendix F of the *Reclamation Investigation Report for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2009).

4.1 Baseline Human Health Risk Assessment

The risk assessment involved five steps: (1) hazard identification, (2) exposure assessment, (3) toxicity assessment, (4) risk characterization, and (5) calculation of risk-based cleanup goals.

4.1.1 Hazard Identification

Hazard identification is conducted to identify contaminants of potential concern (COPCs). Each COPC must meet four criteria established by the EPA (EPA 1989a): (1) the constituent is present at the site, (2) the concentrations of the constituent are significantly above background concentrations (generally 3 times), (3) 20% of the concentrations must be above the method detection limit, and (4) the analytical results for each constituent must meet quality assurance/quality control (QA/QC) criteria outlined by the *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 1994).

COPC determination also includes screening against MDEQ/MWCB RBCGs for the gold panner/rock hound scenario. The basis for choosing this exposure scenario is discussed further in Section 5.1.2. All metals identified as COPCs, either by meeting the EPA criteria and/or exceeding the MDEQ/MWCB recreational cleanup guidelines, were used to conduct the exposure assessment and determine human health risk through recreational use of the site.

4.1.2 Exposure Scenarios

The exposure assessment identifies potential human receptors, exposure routes through which receptors may come into contact with COPCs, and the parameters used to quantify the exposure to COPCs. The gold panner/rock hound scenario was selected as the exposure scenario for this assessment, because the gold panner/rock hound has the most conservative exposure parameters and therefore bounds the other exposure scenarios presented in the *Risk-Based Cleanup Guidelines for Abandoned Mine Sites:*

Final Report (TetraTech 1996). The *de minimus* risk and hazard values are exceeded using the gold panner/rock hound exposure parameters.

In examining the site data, a determination of "moderate" was made, using the Abandoned and Inactive Mines Scoring System (AIMSS) for potential recreational use. This determination is based on limited site access (the site is accessible by a United States Forest Service [USFS] road with a locked gate at the base year-round) and lack of significant surface water resources. The AIMSS ranking is used to determine the exposure frequency used in risk and hazard calculations. A moderate ranking corresponds to an exposure frequency of 25 days per year for the gold panner/rock hound scenario. The exposure frequency is supported by relatively restrictive land-use requirements, remote location, and small size of the nearby population.

Exposure point concentrations (EPCs) for use in risk and hazard calculations are generally either (a) the 95% upper confidence limit (UCL) generated from the data set or (b) the maximum concentration for each COPC. Both EPA's risk assessment guidance for Superfund (EPA 1989a) and TetraTech's risk-based cleanup guidelines for abandoned mine sites (TetraTech 1996) recommend using the 95% UCL as the EPC for a sufficiently large number of samples. Because insufficient samples were available to compute 95% UCLs, the maximum concentration for each COPC was used as the EPC in all cases. Table 13 presents the EPCs used in the risk and hazard calculations.

Table 13. Exposure point concentrations for the BHMS, total metals.

Exposure Media	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Zinc
Solid (mg/kg)	344	1,140	26	342	94,400	55,900	NA	27.2	11,400
Water (µg/L)	NA	31	2.57	2.97	69.6	107	15.2	0.044	867

Notes:
mg/kg = Milligrams per kilogram.
µg/L = Micrograms per liter.
NA = Not included as a COPC for the media shown; metal did not meet EPA COPC criteria.

4.1.3 Toxicity Assessment

The toxicity assessment summarizes the potential for each COPC to cause adverse effects in exposed populations. These effects can be categorized as carcinogenic or noncarcinogenic and are measured in terms of cancer risk and HI. Arsenic and lead exhibited either hazard levels greater than 1.0 or risk levels greater than 1×10^{-6} individually; these COPCs are the major contributors to risk and hazard levels at the BHMS. The other COPCs do not pose a significant risk to potential human receptors, so their toxicological profiles were excluded.

Chronic arsenic exposure affects in humans include weakness, general debility and lassitude, loss of appetite and energy, loss of hair, hoarseness of voice, loss of weight, and mental disorders. Primary target organs are the skin (hyperpigmentation and hyperkeratosis), nervous system (peripheral neuropathy), and vascular system. Epidemiological studies have revealed an association between arsenic concentrations in drinking water and increased incidences of skin cancers (including squamous cell carcinomas and multiple basal cell carcinomas) and cancers of the liver, bladder, and respiratory and

gastrointestinal tracts. Occupational exposure studies have shown a clear correlation between exposure to arsenic and lung cancer mortality.

The arsenic reference dose (RfD) for chronic oral exposures, 3.00×10^{-4} mg/kg/day, is based on a no-observed-effects level of 0.0008 mg/kg/day and a lowest-observed-adverse-effects level of 0.014 mg/kg/day for dermal hyperpigmentation and keratosis, and possible vascular complications in a human population consuming arsenic-contaminated drinking water. The dermal RfD of 3.00×10^{-4} is equivalent to the oral RfD.

Lead is a multitargeted toxicant, causing effects in the gastrointestinal tract, hematopoietic system, cardiovascular system, central and peripheral nervous systems, kidneys, immune system, and reproductive system. Overt symptoms of subencephalopathic central nervous system effects and peripheral nerve damage occur at blood lead levels of 40 to 60 µg/dL, and nonovert symptoms, such as peripheral nerve dysfunction, occur at levels of 30 to 50 µg/dL.

Guidance from MDEQ/MWCB uses back-calculation methods to derive lead RfDs using the EPA residential soil screening level of 400 mg/kg, the EPA drinking water action level of 15 µg/L, and the National Ambient Air Quality Standard of 1.5 $\mu g/m^3$. The RfDs calculated using this approach are 1.5×10^{-3} for soil ingestion and 4.3×10^{-4} for water ingestion and inhalation (TetraTech 1996).

4.1.4 Risk Characterization

Risk characterization combines the evaluations in the exposure and toxicity assessments to calculate quantitative carcinogenic risk and noncarcinogenic hazards for the gold panner/rock hound recreational exposure scenario. The following sections detail the quantitative human health risk assessment.

4.1.4.1 Risk Calculations. The risks and hazards to potential human receptors from the COPCs were calculated for the BHMS. Data from the BHMS were evaluated using the gold panner/rock hound exposure scenario for both an adult and child recreational user. Complete soil/waste rock exposure pathways for the gold panner/rock hound scenario evaluated in risk and hazard calculations are as follows:

- Incidental ingestion
- Dermal contact
- Particulates inhalation.

Complete adit water exposure pathways for the gold panner/rock hound scenario included:

- Incidental ingestion
- Dermal contact.

The inhalation pathway was not included in risk and hazard calculations for adit water, because the COPCs identified for this site are not volatile, making it an incomplete exposure pathway. Pathway-specific formulas used for calculating chronic daily intake values and default values used in these

formulas are from Figure 4-2 and Table 4-2, respectively, of the *Risk-Based Cleanup Guidelines for Abandoned Mine Sites: Final Report* (TetraTech 1996.)

Contaminants of concern (COC) are those COPCs with an individual hazard quotient (HQ) greater than 1.0 or an individual risk greater than 1×10^{-6}. Tables 14, 15, and 16 summarize the adult hazard, child hazard, and total estimated lifetime cancer risk (ELCR) values for all COPCs, respectively.

Table 14. Adult gold panner/rock hound hazard summary for the BHMS.

COPC	Soil/Waste Rock HQ[a]	Adit Water HQ[a]	Combined HQ[b]	% Contribution[c]
Antimony	5.27E-01	NA[d]	0.527	3.9%
Arsenic	**1.54E+00**	1.03E-01	**1.64**	12.2%
Cadmium	1.20E-02	3.13E-03	0.0151	0.1%
Copper	2.49E-03	7.37E-05	0.002567	0.0%
Iron	3.93E-02	9.87E-05	0.0394	0.3%
Lead	**1.09E+01**	2.47E-01	**11.1**	83.1%
Manganese	NA[d]	8.52E-04	0.000852	0.0%
Mercury	2.64E-02	1.46E-04	0.0266	0.2%
Zinc	1.11E-02	2.85E-03	0.0139	0.1%
Total HI			**13.4**	100.0%

a. An exposure frequency of 25 days per year exposure frequency is more representative of actual use patterns at the BHMS and was used in all risk and hazard calculations.
b. The combined HQ represents the hazard across all complete exposure pathways for both solid and liquid matrices for each COPC; it is unitless.
c. The percent contribution represents the contribution of each COPC to the total HI.
d. NA indicates the metal is not a COPC for the matrix listed.
Bold–COCs with an HQ greater than 1.

Table 15. Child gold panner/rock hound hazard summary for the BHMS.

COPC	Soil/Waste Rock HQ[a]	Adit Water HQ[a]	Combined HQ[b]	% Contribution[c]
Antimony	8.64E-01	NA[d]	0.864	3.4%
Arsenic	**2.67E+00**	4.74E-01	**3.15**	12.4%
Cadmium	2.04E-02	1.08E-02	0.0312	0.1%
Copper	4.61E-03	3.41E-04	0.00495	0.0%
Iron	7.27E-02	4.56E-04	0.0731	0.3%
Lead	**2.01E+01**	**1.14E+00**	**21.2**	83.5%
Manganese	NA[d]	3.22E-03	0.00322	0.0%
Mercury	4.89E-02	6.73E-04	0.0495	0.2%
Zinc	2.05E-02	1.32E-02	0.0337	0.1%
Total HI			**25.4**	100.0%

a. An exposure frequency of 25 days per year exposure frequency is more representative of actual use patterns at the BHMS and was used in all risk and hazard calculations.
b. The combined HQ represents the hazard across all complete exposure pathways for both solid and liquid matrices for each COPC; it is unitless.
c. The percent contribution represents the contribution of each COPC to the total HI.
d. NA indicates the metal is not a COPC for the matrix listed.
Bold–COCs with an HQ greater than 1.

Table 16. Gold panner/rock hound risk summary for the BHMS.

COPC	Soil ELCR[a]	Water ELCR[a]	Combined ELCR[b]	% Contribution[c]
Arsenic	**2.74E-04**	**3.41E-05**	**3.08E-04**	100.0%
Cadmium	3.62E-10	NA[c]	3.62E-10	0.0%
Total ELCR			**3E-04**	

a. An exposure frequency of 25 days per year exposure frequency is more representative of actual use patterns at the BHMS and was used in all risk and hazard calculations.
b. The combined adult and child ELCR represents the risk across all complete exposure pathways for both solid and liquid matrices for each COPC; it is unitless.
c. The percent contribution represents the contribution of each COPC to the total ELCR.
Bold–COCs with an ELCR greater than 1×10^{-6}.

As noted, EPA-established benchmarks for evaluating the need for a remedy are 1×10^{-6} for carcinogenic risk and 1.0 for noncarcinogenic hazards. As shown in the above tables, the gold panner/rock hound exposure scenario resulted in a total ELCR of 3×10^{-4} and HIs for the adult and child recreational user of 13.4 and 25.4, respectively. These values are well above EPA benchmark values. Arsenic accounts for all of the cancer risk at the site and approximately 20% of the hazard for both the child and adult exposure scenarios. Lead is responsible for the majority of the exposure hazard at the site (74% of total each for an adult and a child).

4.1.4.2 Uncertainty Assessment. A degree of uncertainty always exists when performing risk assessments. Elements of uncertainty associated with the assessment of potential human health risks and hazards associated with recreational use of the BHMS include the size and comparability of the sample population; uncertainty associated with RfD development and HI values for lead; and in choosing exposure point concentrations (Portage 2010a).

4.1.4.3 Human Health Risk Characterization Summary. The risk values summarized for the BHMS in Tables 15 and 16 indicate the site poses a potential risk to recreational users with both noncarcinogenic and carcinogenic endpoints. Arsenic accounts for all of the carcinogenic risk for the 25-day gold panner exposure frequency. The ELCR for this site (3×10^{-4}) exceeds the EPA threshold cancer risk value of 1×10^{-6}.

The HIs for both the adult (13.4) and child (25.4) gold panner/rock hound also exceed *de minimus* levels, with both computed to be above the EPA threshold level of 1.0. These risk and hazard values indicate that contaminants at the BHMS are present at concentrations that could potentially cause adverse human health effects for a recreational user.

4.2 Ecological Risk Assessment

An ecological risk assessment was conducted for the BHMS and considers terrestrial plant communities, aquatic life communities, and terrestrial wildlife exposure scenarios using contaminant concentrations measured during the RI. The assessment involved initial identification of COCs, development of an exposure assessment, an ecological effects assessment, and a risk characterization. The BHMS ecological risk assessment methodology was based on key federal guidance documents, including:

- *Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual (Interim Final)* (EPA 1989b)
- *Framework for Ecological Risk Assessment, Risk Assessment Forum* (EPA 1992)
- *Wildlife Exposure Factors Handbook* (EPA 1993)
- EPA's RAGS: Process for Designing and Conducting Ecological Risk Assessment (Interim Final) (EPA 1997).

The ecological risk assessment estimates the effects of the no-action alternative and involves four steps: (1) identification of COCs, ecological receptors, and ecological effects of concern; (2) exposure assessment; (3) ecological effects assessment; and (4) risk characterization. These four tasks were accomplished by evaluating data and selecting contaminants, receptors, and exposure routes of concern; estimating EPCs from the data; assessing the ecological toxicity of each COC; and characterizing the overall risk by integrating the results of the toxicity and exposure assessments.

Environmental contaminants at the BHMS potentially affecting ecological receptors include high concentrations of metals in soil, waste rock, and metals found in adit discharge water. The waste materials and vegetation in the area are easily accessible to wildlife and could result in significant ecological effects. The ecological evaluation is intended to be a qualitative screening-level ecological risk assessment because of limited available site data. The detailed information and calculations used to

develop the ecological risk analysis are provided in Appendix G of the *Reclamation Investigation Report for the Broken Hill Mine Site* (Portage 2010a).

4.2.1 Contaminants of Concern

The screening for ecological COCs is based on the following: (1) the constituent is present at the site, (2) the analytical results for each constituent must meet QA/QC criteria outlined by the *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 1994), and (3) the concentrations of the constituent are above background concentrations. The seven metals that met these criteria in solid (soil and waste rock) samples were antimony, arsenic, cadmium, iron, lead, mercury, and zinc. Eight metals that met the COC criteria for the ecological risk assessment were detected in adit water: arsenic, cadmium, copper, iron, lead, manganese, mercury, and zinc.

Ecological toxicity data are not available for several of these contaminants to evaluate potential effects. The following toxicological data are from EPA's Region 5 ecological toxicity profile (EPA 2010b) and pertain to the primary COCs identified for the ecological risk assessment (arsenic, cadmium, copper, lead, and zinc) (BLM 2002).

4.2.1.1 Arsenic. Arsenic is a carcinogen, teratogen, and possible mutagen in mammals (ATSDR 1993). In plants, arsenic has been shown to cause wilting, chlorosis, browning, dehydration, mortality, and inhibition of light activation (Eisler 1988a). In mammals, chronic exposure can result in fatigue, gastrointestinal distress, anemia, neuropathy, and skin lesions that can develop into skin cancer in mammals. Cancer-causing and genetic mutation-causing effects occur in aquatic organisms, with those effects including behavioral impairments, growth reduction, appetite loss, and metabolic failure. In birds, tolerance to arsenic varies among species, but effects include destruction of gut blood vessels, blood-cell damage, muscular incoordination, debility, slowness, jerkiness, falling, hyperactivity, fluffed feathers, drooped eyelids, immobility, seizures, and systemic growth, behavioral, and reproductive problems (Stanley et al. 1994; Whitworth et al. 1991; Camardese et al. 1990).

4.2.1.2 Cadmium. Cadmium is highly toxic to most wildlife; it is cancer-causing, teratogenic, and potentially mutation-causing, with severe sublethal and lethal effects at low environmental concentrations (Eisler 1985). Cadmium is associated with increased mortality, and it affects respiratory functions, enzyme levels, muscle contractions, growth rates, and reproduction. Cadmium can be toxic to plants at lower soil concentrations than other heavy metals and is more readily taken up than other metals (EPA 1981).

4.2.1.3 Copper. Copper is a micronutrient and toxin. Toxicity in mammals includes effects, such as liver cirrhosis, necrosis in kidneys and the brain, gastrointestinal distress, lesions, low blood pressure, and fetal mortality (ATSDR 1990; Kabata-Pendias and Pendias 1992; Ware 1983; Vymazal 1995). Copper is highly toxic in aquatic environments and causes effects in fish, invertebrates, and amphibians (Horne and Dunson 1995; Owen 1981). There is a moderate potential for bioaccumulation in plants. Toxic effects in birds include reduced growth rates, lowered egg production, and developmental abnormalities.

4.2.1.4 Lead. Lead is cancer-causing and adversely affects reproduction, liver and thyroid function, and disease resistance (Eisler 1988b). Lead adversely affects algae, invertebrates, and fish. There are also limited adverse effects in amphibians, including loss of sodium, reduced learning capacity, and developmental problems (Horne and Dunson 1995). Fish exposed to high levels of lead exhibit a wide range of effects, including muscular and neurological degeneration and destruction, growth inhibition,

mortality, reproductive problems, and paralysis (Eisler 1988b; EPA 1976). At elevated levels in plants, lead can cause reduced growth, photosynthesis, mitosis, and water absorption (Eisler 1988b). Birds and mammals suffer effects such as damage to the nervous system, kidneys, and liver; sterility; growth inhibition; developmental retardation; and detrimental effects in blood (Eisler 1988b; Amdur et al. 1991).

4.2.1.5 Zinc. In many types of aquatic plants and animals, growth, survival, and reproduction can all be adversely affected by elevated zinc levels (Eisler 1993). Elevated zinc levels can cause a wide range of problems in mammals, including cardiovascular, developmental, immunological, liver and kidney, neurological, hematological, pancreatic, and reproductive problems (Eisler 1993; Domingo 1994). Zinc is also toxic to plants at elevated levels, causing adverse effects on growth, survival, and reproduction (Eisler 1993). Terrestrial invertebrates show sensitivity to elevated zinc levels, with reduced survival, growth, and reproduction. Elevated zinc levels can cause mortality, pancreatic degradation, reduced growth, and decreased weight gain in birds (Eisler 1993; NAS 1980).

4.2.2 Ecological Receptors of Concern

A variety of plants, birds, amphibians, and mammals are part of the general food web at the BHMS. This assessment has identified three groups of receptors potentially affected by metal contamination at the BHMS. The first group of potential receptors is the terrestrial plant communities. Native plants are growing on undisturbed areas around the site, but little or no vegetation is currently growing on the waste rock piles (Portage 2010a). This may be caused by toxic and inhibitory levels of metals in the plant root zone, along with other detrimental physical and chemical properties of the soil. Plant communities are a concern, because they represent the first trophic level in the food chain and are consumed by many higher trophic level animals.

The second group of potential ecological receptors is the terrestrial wildlife, including elk and mule deer that may use the area as part of a home range. Grazing by wildlife species at this site is a concern because of the potential to consume contaminated vegetation, soil, and evaporative salts. The only terrestrial wildlife receptors evaluated quantitatively in this assessment are deer, because they are assumed to represent the highest level of exposure to site contamination, and the effects on deer are representative of other potential receptors.

The third group of potential receptors is the aquatic life communities. Although only ephemeral adit water is present at the BHMS, it is located within the watershed of an unnamed, ephemeral tributary to the East Fork of Blue Creek. The tributary lies 100 ft north of the BHMS and reaches its confluence with the East Fork of Blue Creek approximately 0.75 miles downstream from the site. The East Fork of Blue Creek provides suitable habitat for aquatic life.

4.2.3 Exposure Assessment

The exposure assessment evaluates the risk to the identified ecological receptors of concern identified above using various contaminant concentrations from samples collected at the site. The risk to terrestrial plant communities was evaluated using the EPCs for the recreational user identified in Table 13 for both solids and water. The EPCs are the maximum concentrations for each of the COCs evaluated.

4.2.3.1 Terrestrial Plant – Phytotoxicity Scenario. This scenario involves the limited ability of various plant species to grow in soils or waste with high concentrations of arsenic, cadmium, copper, lead, and zinc. Plant sensitivity to certain arsenic compounds is so great that these compounds were used as

herbicides for many years. Phytotoxic criteria reported in the literature for total arsenic in soils ranged from 15 to 50 mg/kg. Cadmium is toxic to plants at concentrations greater than 8 mg/kg. Lead is also considered toxic to plants. Numerous phytotoxic lead concentrations are reported in the literature and generally range from 100 to 1,000 mg/kg (Kabata-Pendias and Pendias 1992; CH2M Hill 1987). A moderate concentration of 400 mg/kg was chosen for the ecological risk analysis. Zinc is only moderately toxic to plants at concentrations more than 300 mg/kg (Kabata-Pendias and Pendias 1992). The upper end of the range for zinc (400 mg/kg) was used in the ecological risk analysis.

4.2.3.2 Terrestrial Wildlife – Ingestion by Deer Scenario. Estimates of total intake dosage for deer are based on reported literature values and the following assumptions: (a) the currently unvegetated areas do not provide habitat for deer, (b) native vegetation is growing across most areas of the site and would be available to deer that graze in the area, and (c) the average weight of an individual adult deer is 68.04 kg (150 lb).

The daily salt uptake for deer is based on data in *Elk of North America*, which reported an average of 6 lb in one month for an average sized herd of 63 elk.[b] Assuming deer require 50% of the salt intake of an elk, a median salt intake exposure approach would equate to an average of 3 lb per month. Using the average herd size of 63, the average individual salt uptake would equal 0.0016 lb per day (0.00072 kg/day). Beyer et al. (1994) estimated that soil ingestion accounts for less than 2% of the average Wyoming mule deer's diet of 1.39 kg/day of vegetation, which equals 0.0278 kg/day of soil.

The maximum values for metal COCs from surface soil and waste rock were used for both the salt and soil levels to calculate ecological risks to terrestrial wildlife. No vegetation samples were collected for analysis during this investigation. The concentration for copper was estimated based on data from the Kabata-Pendias and Pendias study (1992); the remaining metal concentrations were based on tolerable levels in vegetation (the lowest phytotoxic tissue levels) from an assessment performed in East Helena, Montana (CH2M Hill 1987). Approximately 1.5 acres at the BHMS are impacted by metal mining; this would represent 0.4% of an average mule deer's home range of 345 acres (i.e., 90 to 600 acres) (Beyer et al. 1994).

4.2.3.3 Aquatic Life Scenario. This scenario involves the limited ability of aquatic organisms to survive in waters contaminated with metals. Toxicity of metals to aquatic organisms depends on the concentration in the surface water and sediment as well as other conditions such as water hardness, temperature, and pH. Surface-water criteria for the ecological risk assessment were derived from the Montana DEQ-7 acute aquatic life standards (MDEQ 2008).

4.2.4 Ecological Effects Assessment

Site-specific toxicity tests were not performed to support this risk assessment. Instead, only existing and proposed toxicity-based criteria and standards were used for this assessment. The following sections detail the specific standards and data used for comparison to the analytical results of the field sampling investigation.

4.2.4.1 Terrestrial Plant – Phytotoxicity Scenario. A summary of the phytotoxicity for the primary COCs is provided in Table 17. These concentrations were used for comparison to concentrations

b. Personal communication with USFS, Helena National Forest personnel. Salt ingestion data taken from *Elk of North America*.

of metals in surface soil and waste rock. The availability of contaminants to plants and the potential for plant toxicity depend on many factors, including soil pH, soil texture, nutrients, and plant species.

Table 17. Summary of tolerable and phytotoxic soil concentrations at the BHMS.

COC	Tolerable Soil Level[a] (mg/kg)	Phytotoxic Soil Concentration Range[b] (mg/kg)	Maximum Soil Concentration[c] (mg/kg)
Arsenic	50	15 to 50	344
Cadmium	NA[d]	4 to 8	26
Copper	NA[d]	60 to 125	342
Lead	25	100 to 400	55,900
Zinc	50	70 to 400	11,400

a. Concentrations from CH2M Hill (1987).
b. Concentrations from Kabata-Pendias and Pendias (1992).
c. Maximum concentration from 1993 soil and waste rock samples.
d. Not available/not determined.

4.2.4.2 Terrestrial Wildlife – Ingestion by Deer Scenario. Adverse effects data for test animals were obtained from the ATSDR toxicological profiles (1990, 1993) and from other literature sources (Eisler 1988a, 1988b). The data consist of dose levels at either no observed adverse effects levels (NOAELs) or lowest observed adverse effects levels (LOAELs) in laboratory animals. The lethal arsenic dose of 34 mg/kg per day for deer (Eisler 1988a) is included, along with other dose levels from other species. Data for laboratory animals (primarily rats) have been adjusted for increased body weight only. These data are listed in Table 18.

Table 18. Mammalian toxicological data for inorganic metals at the BHMS.

Dose	Arsenic	Cadmium	Copper	Lead	Zinc
NOAEL[a]	3.2[b]	0.271[c]	22.5[d]	0.005[e]	55[f]
LOAEL[a]	6.4[b]	2.706[c]	90[d]	0.05[e]	571[f]
Lethal	34[g]	NA	NA	NA	NA

a. Based on studies on laboratory rats; units are (mg/kg × day).
b. From ATSDR toxicological profile (1993a).
c. From Sample et al. (1996).
d. From NAS (1980).
e. From ATSDR toxicological profile (1993b) and Eisler (1988b).
f. From Maita et al. (1981).
g. Based on 1988 deer study (Eisler 1988a); units are (mg/kg × day).
NA = Not applicable.

4.2.4.3 Aquatic Life Scenario. Montana water quality standards were compared with analytical data from adit water samples. Analytical results were adjusted for conditions such as water hardness, temperature, and pH, which can affect the toxicity of metals to aquatic organisms in surface water. Montana water quality standards for aquatic life (MDEQ 2010) are presented in Table 19. As shown in Table 19, cadmium, lead, and zinc concentrations in the adit discharge exceed both the acute and chronic aquatic life standards and copper exceeds the chronic aquatic life standard.

Table 19. Montana surface water quality aquatic life standards.[a]

Metal	Acute Toxicity	Chronic Toxicity	Broken Hill Adit Water Concentration[b]
Arsenic	340	150	31[c]
Cadmium	0.52[d]	0.097[d]	**2**[c]
Copper	3.79[d]	2.85[d]	**2.97**
Iron	NA[e]	1,000	69.6
Lead	13.98[d]	0.545[d]	**107**
Manganese	NA[e]	NA[e]	15.2
Mercury	1.7	0.91	0.044
Zinc	37[d]	37[d]	**867**

a. Toxicity values are from DEQ-7 (MDEQ 2010); all concentrations are in units of µg/L.
b. Maximum adit water concentration. Unless otherwise noted, concentrations are from 1993 sampling event.
c. Result is from the 2009 sampling event.
d. Concentration at hardness of 25 mg/L.
e. Standard currently not available.
Bold–Values exceed Aquatic Life Standard.

4.2.5 Risk Characterization

This section combines the ecological exposure estimates and concentrations presented in preceding sections and the ecological effects data presented in Section 5.2.4 to provide a screening level estimate of potential adverse ecological impacts. This estimate was achieved by generating ecological impact quotients (EQs) analogous to the HQs calculated for human exposure to noncarcinogenic metals. EQs were calculated for each COC by exposure scenario or receptor type and are summarized in Table 20; they were generated by dividing the specific intake estimate by available ecological effect values. As with HIs, adverse ecological impacts are expected if the EQs are greater than 1.0.

Table 20. Ecological impact quotients for the BHMS.

Receptor	Arsenic	Cadmium	Copper	Lead	Zinc	Total EQ by Receptor
Plant Phytotoxicity	22.8	3.25	0	140	28.5	194
Deer Ingestion	0.0035	0.0003	0.0168	181	0.0005	181
Aquatic Life – Surface Water	0.0912	3.84	18.4	1.09	23.4	46.8
Total EQ by COC	22.9	7.09	18.4	322	51.9	—

4.2.5.1 Terrestrial Plant – Phytotoxicity Scenario. Maximum concentrations of metals collected from the BHMS were compared with maximum values of the plant phytotoxicity ranges listed in Table 21. One limitation of this comparison is that the phytotoxicity ranges are not species specific and may not represent toxicity to species at this site. Additionally, other physical characteristics of the waste materials may create microenvironments that limit growth and survival of terrestrial plants directly or in combination with substrate toxicity. Concentrations of metals are likely to be elevated in waste material at the site. Further, organic content is low, nutrients are limited, and the materials may harden enough to resist root penetration.

EQs for this exposure scenario were greater than 1.0 for arsenic, cadmium, lead, and zinc. The nonconservative assumption of using the high end of the phytotoxicity range to derive the EQs may underestimate the potential phytotoxic effects to some plant communities. However, several other factors combine to adversely affect plant establishment and successful reestablishment on waste materials. In addition, the maximum metals concentrations from soil and waste rock samples were used as the plant dosage value in the EQ calculation, which adds conservatism to the EQ value.

4.2.5.2 Terrestrial Wildlife – Ingestion by Deer Scenario. Estimated deer ingestion doses were compared with LOAELs discussed earlier. This comparison is limited because of the use of effects data from rat studies that were adjusted only for increased body weight. Extrapolating these effects from rats to deer introduces some uncertainty, because each metal may be metabolized differently between these two species, making one more or less susceptible to effects than the other. The EQs for this scenario exceeded 1.0 for lead and indicate a potential risk to deer and other wildlife as a result of lead in surface soils and waste rock.

4.2.5.3 Aquatic Life Scenario. Maximum concentrations in adit water collected at the BHMS were compared with acute aquatic quality criteria and other toxicity standards derived from Long and Morgan (1991). Acute aquatic water quality criteria were more appropriate than chronic criteria for use in this scenario because of the limited data set.

The results of the EQ calculations for the aquatic life scenario indicate potential for adverse ecological impacts from adit water. The acute EQs for this scenario exceeded 1.0 for cadmium, copper, lead, and zinc.

4.2.6 Ecological Risk Characterization Summary

The calculated EQs can be used to evaluate whether ecological receptors are potentially exposed to toxic doses of site-related metals contamination via the three ecological scenarios evaluated. The EQs calculated for the BHMS indicate that lead is the primary driver for ecological risk (EQ = 322 or 76% of the overall ecological risk). The risk from lead is split among plant phytotoxicity (EQ = 140), deer ingestion (EQ = 181), and aquatic life (EQ = 1.09); lead contributes 100% of the risk to the deer ingestion scenario and 72% of the risk to plants. The primary drivers for aquatic life risks are copper and zinc (39 and 50%, respectively). The overall EQ for all COCs over all pathways is 419, indicating that contaminants at the site constitute probable adverse ecological effects for plants, terrestrial wildlife, and aquatic life.

5. SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

The State of Montana has the authority, delegated by the U.S. Office of Surface Mining, Reclamation and Enforcement, to administer the Abandoned Mines Reclamation Program in accordance with the State of Montana's Reclamation Plan. In the 1995 State of Montana Reclamation Plan, the NCP was adopted by the Abandoned Mined Land Reclamation Program. MDEQ practice has been to identify ARARs for reclamation projects and use ARARs in the evaluation of reclamation alternatives in the EEE/CA step of pre-construction activity. The method used in this evaluation is that contained in 40 CFR 333.430, which evaluates alternatives according to 9 criteria, which are divided into three categories:

threshold, primary balancing, and modifying. This is discussed in more detail in Section 8 of this EEE/CA.

ARARs are categorized as contaminant-specific requirements that define acceptable exposure limits, location-specific requirements that may set restrictions on activities within a specific location, or action-specific requirements that may set controls or restrictions for a particular treatment or disposal activity for the proposed response. ARARs assist in the development and selection of reclamation remedies.

ARARs are either applicable or relevant and appropriate. Applicable requirements address a specific hazardous substance, pollutant, or contaminant; remedial action; location; or other circumstance. Relevant and appropriate requirements address problems or situations sufficiently similar to those encountered at another site. The MDEQ/MWCB has developed a summary of federal and state ARARs for reclamation projects (MDEQ 2010). Table 21 is a list of these ARARs and indicates whether the ARAR is likely to be applicable or relevant and appropriate to the BHMS. ARARs that pertain to the BHMS reclamation and environmental media are discussed in Sections 8 and 9 of this EEE/CA. A complete description of federal and state ARARS is found in Appendix A.

Each reclamation alternative presented in Section 8 and 9 is classified as an interim or removal action and is not considered a complete remedial action. The reclamation alternatives evaluated in detail are applicable to the contaminated solid media, and no reclamation alternatives for groundwater or surface water treatment are analyzed in detail. Contaminant-specific ARARs presented for groundwater and surface water are for informational purposes only.

As noted in Section 3.2 of this EEE/CA, arsenic and lead exceed the HHS and cadmium, copper, lead, and zinc exceed the aquatic life standards listed in the “Montana Numeric Water Quality Standards” (MDEQ 2010) in surface water discharging intermittently from the lower waste rock dump adit. Also, the screening level risk assessment for the BHMS demonstrates elevated ecological risk from contaminants in the adit discharge. A screening analysis of adit discharge treatment technologies is presented in Section 7 of this EEE/CA. Treatment alternatives for surface water were ultimately rejected for reasons of feasibility and implementability. Disposal of the adit discharge in a subsurface infiltration trench in combination with removal of the contaminated waste rock was identified as an implementable alternative which would prevent humans and wildlife from contacting contamination in the adit discharge. Although this alternative does not achieve contaminant-specific ARARs for surface water, it is considered to be environmentally protective because contaminant source material (waste rock) is removed and the discharge is isolated from contact with environmental receptors.

Table 21. Summary of applicable or relevant and appropriate requirements.

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR Status
Federal Contaminant-Specific ARARs			
Safe Drinking Water Act	42 USC §§ 300f		
National Primary Drinking Water Standards	40 CFR Part 141	Establishes numeric standards for public water supply	Relevant and appropriate
National Secondary Drinking Water Standards	40 CFR Part 143	Establishes numeric standards for public water supply	Relevant and appropriate
Clean Water Act	33 USC § 1251		
Surface Water Quality Standards	40 CFR Part 131	Water quality standards based on ecological toxicity and human health	Applicable
Clean Air Act	42 USC § 6901		
National Ambient Air Quality Standards	40 CFR Part 50	Standards for air quality	Applicable
Federal Location-Specific ARARs			
National Historic Preservation Act	16 USC § 470 36 CFR Parts 63, 65, and 800	Requirements for historically significant features	Applicable
Archeological and Historic Preservation Act	16 USC § 469 40 CFR Part 6.301(c)	Requirements for preservation of archeological and historical artifacts	Applicable
Historic Sites Act of 1935	16 USC § 461 40 CFR Part 6.310(a)	Requirements for historically significant features	Applicable

Table 21. (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR Status
Protection and Enhancement of the Cultural Environment	16 USC § 470	Requirements for historically significant features	Applicable
The Archeological Resources Protection Act of 1979	16 USC § 470aa – 47011	Requirements for preservation of archeological and historical artifacts	Relevant and appropriate
American Indian Religious Freedom Act	42 USC § 1996	Requirements for Native American consultations	Applicable
Native American Graves Protection and Repatriation Act	25 USC § 3001	Requirements for Native American consultations	Applicable
Fish and Wildlife Coordination Act	16 USC §§ 661 40 CFR Part 6.302(g)	Consultation requirements for protection of fish and wildlife aquatic resources	Applicable
Endangered Species Act	16 USC §§ 1531 – 1543 50 CFR Parts 17 and 402	Protection of endangered species and critical habitat	Applicable
Floodplain management	40 CFR Part 6.302(b), Executive Order No. 11,988	Protection of floodplains	Applicable
Protection of wetlands	40 CFR Part 6, Appendix A, Executive Order No. 11,990	Protection of wetlands	Applicable
Clean Water Act	33 USC § 1251 33 CFR Part 330	Discharge of dredge and fill materials	Applicable

Table 21. (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR Status
Migratory Bird Treaty Act	16 USC §§ 703	Protection of migratory birds	Applicable
Bald Eagle Protection Act	16 USC §§ 668	Protection of Bald and Golden Eagles	Applicable
Resource Conservation and Recovery Act	40 CFR Parts 264.18(a) and (b)	Seismic and floodplain restrictions for location of waste management units	Relevant and appropriate
Federal Action-Specific ARARs			
Clean Water Act Point Source Discharge Requirements	33 USC § 1342 40 CFR Part 122	Permits for stormwater discharge (applicable portions only)	Applicable
Resource Conservation and Recovery Act Subtitle C Requirements Subpart D Requirements	42 USC § 6921 40 CFR Part 264, Subpart F 40 CFR Part 257	Subtitle C waste disposal facility requirements Subtitle D requirements for waste disposal facilities	Relevant and appropriate Applicable
Surface Mining Control and Reclamation Act	30 USC §§ 1201 – 1326 40 CFR Parts 784 and 816	Surface mining reclamation standards	Relevant and appropriate
Hazardous Materials Transportation Regulations	49 USC §§ 5101 – 5105	Standards for the transportation of hazardous wastes	Relevant and appropriate
Occupational Safety and Health Act Hazardous Waste Operations and Emergency Response	29 USC § 655 40 CFR Part 1910.120	Standards for worker safety, hazardous waste operations, and emergency response	Applicable

Table 21. (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR Status
State Contaminant-Specific ARARs			
Montana Groundwater Protection Regulations	ARM 17.30.1005	Basis and applicability	Applicable
	ARM 17.30.1006	Groundwater classifications	Applicable
	ARM 17.30.1011	Nondegredation of groundwater	Applicable
Montana Water Quality Act	MCA 75-5-101		
	ARM 17.30.637	Surface water protection regulations	Applicable
Montana Ambient Air Quality Regulations	ARM 17.8.206	Sampling, data collection, and analytical requirements	Applicable
	ARM 17.8.220, 221	Ambient air quality standards for particulate matter	Applicable
	ARM 17.8.222	Ambient air quality standard for lead	Applicable
	ARM 17.8.222	Ambient air quality standard for PM^{10}	Applicable
Occupational Health Act of Montana	MCA 50-70-101	Protection of worker health and safety	Applicable
Occupational air contaminants requirements	ARM 17.74.102	Contaminant concentration limits in air	Applicable
Occupational noise requirements	ARM 17.74.101	Occupational noise standards	Applicable
State Location-Specific ARARs			
Montana Antiquities Act	MCA 22-3-421	Consultation, registration, permits for antiquities properties	Relevant and appropriate
Montana Human Skeletal Remains and Burial Site Protection Act	MCA 22-3-801	Protection of skeletal remains and burial sites	Applicable

Table 21. (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR Status
Floodplain and Floodway Management Act	MCA 76-5-401 and 403	Floodplain protection, prohibitions, and permissible use	Applicable
Montana Natural Stream Bed and Land Protection Act of 1975	MCA 75-7-101 ARM 36.2.401	Protection and preservation of streams	Applicable
Montana Solid Waste Management Act	MCA 75-10-201 ARM 17.50.101	Solid waste disposal requirements and restrictions	Applicable
Endangered Species and Wildlife	MCA 87-5-106, 107, and 111	Protection of endangered species	Applicable
State Action-Specific ARARs			
Montana Pollutant Discharge Elimination System Requirements	ARM 17.30.1342 – 1344 ARM 17.30.1203 and 1344	Requirements for permits Treatment requirements	Applicable Applicable
Montana Water Quality Act and Regulations	MCA 75-5-605 MCA 75-5-303 ARM 17.30.637 ARM 17.30.705 ARM 17.30.1011	Pollution of state waters Nondegredation of state waters Surface water quality standards Protection of use Nondegredation of state waters	Applicable Applicable Applicable Applicable Applicable
Montana Stormwater Control Requirements	ARM 17.24.633 ARM 17.30.1341	Treatment of surface drainage General discharge permits	Applicable Applicable

Table 21. (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR Status
Montana Solid Waste Requirements	ARM 17.50.505(1) and (2)	Standards for solid waste disposal sites	Applicable
	ARM 17.50.506	Design requirements for landfills	Applicable
	ARM 17.50.511	Operation and maintenance requirements for solid waste management facilities	Applicable
	ARM 17.50.53	Solid waste transportation requirements	Applicable
	ARM 17.50.530	Final cover system requirements	Applicable
	ARM 17.50.531	Post closure care requirements	Applicable
	MCA-75-10-206	Variances from requirements	
Montana Strip and Underground Mine Reclamation Act	MCA 82-4-201	Requirements for reclamation	Relevant and appropriate
Montana Metals Mining Act	MCA 82-4-301	Requirements for reclamation	Relevant and appropriate
Montana Air Quality Regulations	ARM 17.8.308(1), (2), and (3); and ARM 17.8.304(2)	Standards for visible emissions	Applicable
	ARM 17.8.604	Open burning rules	Applicable
	ARM 17.24.761	Fugitive dust control	Relevant and appropriate
Montana Noxious Weed Requirements	MCA 7-22-2101(8)(a)	Noxious weed management and control	Applicable

6. RECLAMATION OBJECTIVES AND GOALS

The overall reclamation objective for the BHMS is to protect human health and the environment in accordance with the guidelines set forth by the MDEQ/MWCB and the NCP. Specifically, site reclamation must limit human and ecological exposure to mine-related contaminants and reduce the mobility of those contaminants through associated solid media and surface-water exposure pathways.

Two primary categories of reclamation goals are evaluated for the purpose of achieving reclamation objectives, ARAR-based goals and risk-based goals. ARARs-based goals are those promulgated as standards, and risk-based goals are those calculated to achieve HQs and EQs that are protective of human health and the environment. Risk-based goals are presented only for those contaminants that present a human health HI greater than 1 or a human health carcinogenic endpoint greater that 1×10^{-6}.

6.1 ARAR Based Reclamation Goals

6.1.1 Groundwater

Groundwater resources were not investigated during the BHMS RI, but based on location and subsurface conditions observed during repository site investigations, it is believed that groundwater is present in deep bedrock aquifers. During the 2010 repository siting investigation, no groundwater was noted in alluvium during the excavation of numerous test pits to the bedrock surface at sites near the BHMS. Groundwater resources at the BHMS are not currently used for drinking water, but because a portion of the BHMS property is private, groundwater may be used for drinking water in the future. The nearest known water supply well is located approximately 1 mile from the BHMS in the valley floor, and it is unlikely that contamination associated with the BHMS would have any impact on this or more distant groundwater wells.

The low volume intermittent adit discharge at the lower waste rock dump has the potential to impact groundwater, as the discharge water infiltrates through the waste rock and subsurface. The impact, if any to groundwater from the adit discharge is unknown.

Although groundwater treatment is not a reclamation alternative considered by this EEE/CA, potential contaminant-specific ARAR-based reclamation goals are presented herein for informational purposes only. Table 22 shows the concentration goals for metals in groundwater based on the human health standard for groundwater found in MDEQ Circular DEQ-7 (MDEQ 2010).

Table 22. ARAR based reclamation goals for groundwater.

Contaminant	Concentration (µg/L)
Antimony	6
Arsenic	10
Cadmium	5
Copper	1,300
Iron	300

Table 22. (continued)

Contaminant	Concentration (µg/L)
Lead	15
Manganese	50
Mercury	2
Silver	100
Zinc	2,000

6.1.2 Surface Water

The only known BHMS impacted surface water is the low-volume, intermittent, lower waste rock adit discharge. Although surface water treatment is not being considered as a reclamation alternative in this EEE/CA, potential contaminant-specific ARAR-based reclamation goals are presented herein for informational purposes only. ARAR-based reclamation goals for surface water are based on the more stringent of the aquatic life standards or human health standards for surface water found in MDEQ Circular DEQ-7 (MDEQ 2010) and are shown in Table 23.

Table 23. ARAR based reclamation goals for surface water.

Contaminant	Concentration (µg/L)
Antimony	5.6
Arsenic	10
Cadmium[a]	0.097
Copper[a]	2.85
Iron	300
Lead[a]	0.545
Manganese	50
Mercury	0.05
Silver[b]	0.374
Zinc[a]	37

a. Chronic aquatic life standard @ 25 mg/L hardness.
b. Acute aquatic life standard @ 25 mg/L hardness.

6.1.3 Soil

Currently, there are no promulgated standards for metal concentrations in soil that may be used as a chemical-specific reclamation-based ARAR. The MDEQ has developed a conservative set of RBCGs that are calculated for different contaminants using a recreational visitor exposure pathway scenario. The RBCGs have been used to calculate risk-based cleanup goals as discussed in Section 6.2 of this EEE/CA.

6.2 Risk-Based Cleanup Goals

Risk-based cleanup goals for the BHMS have been determined based on RBCGs and risk calculations for the recreational user. Arsenic and lead are the COCs that exceed a calculated HI of one for both the adult and child recreational user. Arsenic also exceeds the EPA cancer risk threshold of 1×10^{-6}. Table 24 lists the cleanup goals for soil and water based on the gold panner/rock hound recreational user scenario. Because reclamation/treatment of water resources is beyond the scope of this EEE/CA, the risk based cleanup goals for water are shown for informational purposes only. These cleanup goals are taken from Table 7-1 of the *Risk-Based Cleanup Guidelines for Abandoned Mine Sites: Final Report* (TetraTech 1996), with the exposure frequency adjusted from 50 days/year to 25 days/year to be consistent with the moderate use ranking and site-specific use factors for the BHMS. An exception is arsenic in soil. Background sampling conducted during the RI showed that arsenic concentration in undisturbed surface soils near the BHMS exceeds the calculated risk-based carcinogenic endpoint. Therefore, the risk-based reclamation goal for arsenic in soil will default to the mean background arsenic concentration for area soils.

Table 24. Recreational user risk-based cleanup goals for the BHMS.

COC	Soil (mg/kg)[a]	Water (µg/L)[b]
Arsenic[c]	44	1.32
Lead	4,400	440

a. Soil cleanup goals include both ingestion and dermal contact pathways.
b. Water cleanup goals shown are for water ingestion, because they are more conservative than dermal contact values.
c. The cleanup goal for arsenic in soil is the mean arsenic background concentration for area soils.

7. DEVELOPMENT AND SCREENING OF RECLAMATION ALTERNATIVES

This section provides a process for identification and screening of reclamation alternatives for the BHMS. While not inclusive of every potential technological option and alternative, the process analyzes a reasonable array of potential reclamation solutions based on effectiveness, implementability, and cost. Reclamation alternatives that meet effectiveness, implementability, and cost screening criteria are retained for detailed analysis in Section 8 of this EEE/CA. The no-action alternative assumes that no reclamation is performed and that site conditions remain unchanged. The no-action alternative provides the baseline against which other alternatives are evaluated.

7.1 Identification and Screening of Reclamation Technologies

The purpose of identification and screening of reclamation technologies options is to assess reclamation technology feasibility. Each technology identified has been implemented effectively at sites with contamination and reclamation issues similar to the BHMS. The number of technologies considered is not exhaustive because many are unproven, cost prohibitive, and/or require extensive study. The following subsections discuss each reclamation technology considered for reclamation of the BHMS waste rock and adit discharge, and Table 25 provides a summary of the reclamation technology screening process. Reclamation technologies that are not feasible and have been eliminated from further analysis

are shaded in Table 25. Reclamation technologies retained for initial screening are presented in Table 26 and discussed in Section 7.2 of this EEE/CA.

7.1.1 No Action

The no-action alternative is the basis against which other reclamation alternatives are compared. Under this alternative, no additional reclamation, treatment, controls, or assessment would be required at the BHMS. The waste rock dumps would remain in place, and site contamination would continue to be a source of ecological and human health risk. The risk-based site cleanup goals presented in Section 6.2 of this EEE/CA are not achieved under the no-action alternative.

Table 25. Reclamation technology screening summary.

General Response Action	Remedial Technology	Process Option	Description	Screening Comment
No Action	None	Not applicable	No action	Baseline alternative for comparison purposes
Institutional Controls	Restrict land use	Land-use restrictions	Legal restrictions to control current and future land use (development, access, etc.)	Private land ownership issues. Does not achieve reclamation objective.
	Access control	Fencing, signs	Install fencing and post signs at contaminated areas and HMOs.	Private land ownership issues. Does not achieve reclamation objective. May be effective in combination with other alternatives.
Engineering Controls	Containment	Waste capping, disposal in repository	Cap in place or excavate and dispose of in a repository with multilayer cap.	Moderate to good effectiveness. Private land ownership issues with cap in place alternative. Readily implementable.
	Surface controls	Grading, shaping, stormwater management, waste consolidation, revegetation	Grade site features to prevent surface water run-on and erosion; construct stormwater run-off controls to prevent offsite contaminant transport; consolidate waste into single area; and revegetate disturbed areas to reduce surface-water infiltration.	Does not achieve reclamation objective as a stand-alone response. Effective when used in combination with other alternatives. Readily implementable.
	Disposal at the BHMS	Disposal in repository	Complete excavation of waste and disposal in a repository constructed onsite.	Private land ownership issues. Access issues.
	Disposal on USFS lands	Disposal in repository	Complete excavation of waste and disposal in a repository constructed on nearby USFS property.	Effective and readily implementable.

Table 25. Reclamation technology screening summary.

General Response Action	Remedial Technology	Process Option	Description	Screening Comment
	Offsite disposal	Disposal in repository	Offsite disposal in a permitted solid waste facility.	Effective and readily implementable.
Excavation and Treatment	Reprocessing	Ship to mill for processing	Excavate waste and ship to mill for processing and beneficiation.	Insignificant mineral value. Cost prohibitive.
	Fixation and stabilization	Additives, amendments, binders	In situ mixing with lime or cement. Application of surface binders.	Treatability study required, potential for incomplete mixing of amendments, and degradation of surface binders.
In situ Treatment – Stabilization	Chemical or thermal treatment	Stabilization	Treat waste in place with chemical injection or thermal treatment.	Treatability study required. Cost prohibitive.
Adit Discharge Mitigation	Source controls	Mine flooding, mine dewatering, chemical treatment of mineralized source, adit plug, waste rock removal	Source controls within the historic mine workings to treat/isolate the mineralized source and/or prevent the adit water from discharging from the mine workings. Removal of the waste rock source below the adit.	The mine openings are significantly collapsed and the condition of the inner mine workings is unknown. Significant expense would be required to determine feasibility of source controls. Waste rock removal is effective in combination with other controls.
	Physical/chemical treatment	Flocculent application, pH adjustment, adsorption, filtration	Active treatment of the water to remove/reduce contaminants in the discharge through precipitation and/or adsorption.	Additive, chemical, and long term maintenance costs. Disposal of concentrated contaminants. Treatability/technology feasibility study and demonstration required. Long term operation and maintenance of the system would be required.

Table 25. Reclamation technology screening summary.

General Response Action	Remedial Technology	Process Option	Description	Screening Comment
	Wetlands treatment	Artificial wetlands construction, treatment through natural processes	Treatment of the adit discharge water through natural media in a constructed wetland.	Lack of suitable land space for construction. Winter climate limits effectiveness. Eventual disposal of contaminants required. Eventual replacement required.
	Subsurface disposal	Subsurface disposal in infiltration trench without active treatment	Rout water to the subsurface in a constructed infiltration trench. Limited passive treatment.	Effective in combination with waste rock removal. Eliminates direct contact with humans and wildlife.

7.1.2 Institutional Controls

Institutional controls are controls that restrict site use, restrict site access, or otherwise restrict human and/or ecological exposure to site wastes through legal and/or administrative means. As a stand-alone alternative for BHMS reclamation, institutional controls do not achieve the risk-based site cleanup goals presented in Section 6.2 of this EEE/CA and would not be protective of the environment. Existing contaminant transport mechanisms and pathways would remain unaffected, and the potential for unacceptable human and ecological exposure would remain.

7.1.2.1 Restrict Land Use. Land use restrictions include land-use and development restriction through deed restriction or other legal means. As a stand-alone alternative for BHMS reclamation, land use control does not achieve risk-based site cleanup goals presented in Section 6.2 of this EEE/CA and would not be protective of the environment. Existing contaminant transport mechanisms and pathways would remain unaffected, and the potential for unacceptable human and ecological exposure would remain. The primary applicability of site access controls is to complement administrative controls or other onsite engineering controls (i.e., onsite disposal). Because portions of the BHMS are located on private land, land use restriction would also impact present and future owners of the private parcel.

7.1.2.2 Access Control. Site access control alternatives include posting signs warning the public of site health risks and fencing. As a stand-alone alternative for BHMS reclamation, access control does not achieve risk-based site cleanup goals presented in Section 6.2 of this EEE/CA and would not be protective of the environment. Existing contaminant transport mechanisms and pathways would remain unaffected, and the potential for unacceptable human and ecological exposure would remain. The primary applicability of site access controls is to complement administrative controls or other onsite engineering controls (i.e., onsite disposal).

7.1.3 Engineering Controls

Engineering controls are controls that isolate and reduce the mobility of contamination through physical solutions. The complexity of engineering solutions applicable to the BHMS ranges from posting signs and site fencing, limiting site access, and constructing a waste repository for waste disposal. Several subcategories or engineering controls are detailed in the following subsections.

7.1.3.1 Containment. Containment technologies are designed to limit the mobility of contamination and to limit human and ecological receptor contact with contamination. Containment options appropriate to the BHMS may include the following:

- Cap in place
- Removal and placement of waste in a repository constructed within the BHMS property boundary
- Removal and placement of waste in a repository constructed on nearby USFS land.

Waste containment alternatives vary greatly in complexity. They can be as simple as a vegetated soil cover and as complex as a multilayer top and bottom geosynthetic lining system with leachate collection. All are designed to provide a positive gradient for surface water run-off, limit surface water

run-on and infiltration, and eliminate direct contact with waste. Contaminant mobility is reduced, because contaminants may no longer be entrained by wind, eroded by surface water, or leached by surface water.

The degree of complexity of a capping system is determined by location, waste characteristics, and the severity of associated hazards. Suitable repository sites near the BHMS exist that are relatively isolated from the public. The investigation of potential repository sites also showed that groundwater is not present in alluvial and colluvial overburden. Groundwater is likely found in deeper bedrock faulting and it is unlikely that a waste rock repository would have any significant impact on local groundwater. There are no groundwater wells in the immediate vicinity of potential repository sites and groundwater near the BHMS is unlikely to be used as a significant potable water resource in the future. Testing of the BHMS waste rock has shown that metals in the waste are not easily mobilized by contact with water and that the waste rock is not acid generating. Although metals contamination in the waste rock poses a significant direct contact risk to human and the environment, laboratory analysis has shown that it is unlikely that the waste would be characteristic of a hazardous waste under the Resource Conservation and Recovery Act (RCRA) (42 USC 6901).

Performance standards for RCRA landfills include top and bottom liner systems with leachate collection. Long term monitoring of the leachate collection sump is required. Because disposal of the BHMS waste rock at the potential repository sites identified would likely not have a significant impact on groundwater, and because waste rock characterization has demonstrated that the waste rock is relatively unsusceptible to leaching and contaminant disassociation, achieving RCRA performance standards for waste containment would add unnecessary expense for construction, inspection, maintenance and long term monitoring. A top cover containment system consisting of a low permeability earthen layer or geosynthetic lining system, and a top layer of growth medium would be environmentally protective and cost effective. Capping of mine/mill wastes is a common and effective reclamation practice that utilizes standard engineering design and construction practices.

7.1.3.2 Surface Controls. Surface controls are engineering controls designed to control contaminant entrainment by wind and surface water. These controls, by themselves or in combination, may include waste consolidation, site grading, revegetation, and stormwater controls. The primary applicability of surface controls is to complement other onsite engineering controls (i.e., onsite containment and disposal). As a standalone alternative, surface controls do not achieve risk-based site cleanup goals presented in Section 6.2 of this EEE/CA.

As applicable to the BHMS, waste consolidation would involve combining the upper and lower waste rock dumps into one pile. Consolidation may be beneficial if one waste rock dump is more susceptible to contaminant transport, is more accessible to the public, is unstable, or supports another engineering control (i.e., containment).

Site grading is used to create positive drainage in areas of surface water ponding and to flatten steep slopes that may be susceptible to erosion by surface water run-off. Site grading may also be used to reduce the overall surface area of land impacted by site wastes.

Revegetation is the process of establishing vegetation on areas where little or no vegetation exists because of the impacts of site wastes. Revegetation helps to mitigate surface water erosion and infiltration by slowing the velocity of surface water run-off, increasing the water holding capacity of soils, decreasing

the surface area of bare soil available for wind and surface water erosion, and minimizing infiltration of surface water through the process of evapotranspiration (plant root uptake).

Stormwater controls are engineering controls designed to exclude stormwater run-on onto the contaminated waste and to control stormwater run-off from the contaminated waste. These controls are often used in combination and may complement other engineering controls (i.e., surface controls). Stormwater controls are also common requirements during construction. They include silt fencing; straw mat and bales; riprap or armoring; sedimentation basins; and channels, french drains, or other stormwater drainage controls.

7.1.3.3 Disposal Within the BHMS Property Boundary. This disposal alternative consists of excavation of contaminated materials and placement of those materials in a repository constructed within the BHMS private property boundary. The engineered complexity of the repository would be based on the waste characteristics and the severity of associated hazards. The BHMS waste is not a hazardous waste as defined by RCRA (42 USC 6901), because the waste falls under the RCRA exemption of solid waste associated with the beneficiation of ores and minerals [40 CFR 261.4(b)(7)]. Laboratory analysis also shows that the BHMS waste would not be characteristic of a hazardous waste, and therefore the construction and performance standards for RCRA hazardous waste landfills are not applicable. Laboratory analysis of the BHMS waste does, however, show that contamination is present at levels which pose an unacceptable risk to human health and the environment. A repository cover system would be engineered and constructed to be sufficiently protective and to achieve the project reclamation objective presented in Section 6.2 of this EEE/CA. As applicable to the BHMS, the repository cover system would consist of a low permeability earthen material layer or geosynthetic lining system, overlain by an earthen cap for growth medium.

7.1.3.4 Disposal on USFS Property. This disposal alternative includes excavation of contaminated materials and placement of those materials in a nearby constructed repository on USFS lands. Similar to the alternative for disposal on the BHMS property, the engineered complexity of the repository would be based on the waste characteristics and the severity of associated hazards. A repository liner system and cap would be engineered and constructed to be sufficiently protective and to achieve the project reclamation objective presented in Section 6.2 of this EEE/CA. As applicable to the BHMS, the repository cover system would consist of a low permeability earthen material layer or geosynthetic lining system, overlain by an earthen cap for growth medium.

7.1.3.5 Offsite Disposal. Because the BHMS waste rock is not a listed or characteristic hazardous waste as defined by RCRA, offsite disposal may include excavation of contaminated material and transport of the material for disposal in an existing permitted solid waste landfill. Prior to offsite disposal in a solid waste landfill, the toxicity characteristic leaching procedure (TCLP) analysis would be performed on representative waste rock samples to insure the waste is not characteristic of a hazardous waste under RCRA. Based on the concentrations of total metals in the waste rock and on SPLP analysis results, it is unlikely that the BHMS waste rock would fail TCLP standards.

7.1.4 Excavation and Treatment

Excavation and treatment alternatives involve removal of the waste and either onsite or offsite waste treatment through chemical, physical, or thermal treatment. The objective of treatment is to reduce toxicity by removal of toxic constituents or by reducing the mobility of toxic constituents in the

environment. Excavation and treatment alternatives include reprocessing and fixation/stabilization technologies as described in the following subsections.

7.1.4.1 Reprocessing. Reprocessing involves using milling and/or leaching technologies to liberate and concentrate toxic metals from the host rock. These technologies encompass many mineral processing technologies, including acid leaching, cyanide leaching, roasting, floatation, and concentration. Reprocessing technologies are normally only utilized if the residual metals value in the waste is high enough to significantly offset the cost of reprocessing. In the case of the BHMS waste rock, the residual value of recoverable minerals is insignificant, and reprocessing would be a very high-cost treatment alternative.

7.1.4.2 Fixation/Stabilization. Fixation technologies are treatment processes that chemically alter the waste to reduce toxicity and/or contaminant mobility. These technologies are often used in combination with stabilization or the process of physically encapsulating the waste. Amending mine waste rock with lime or cement are examples of fixation/stabilization technologies. The effectiveness of fixation/stabilization technologies is dependent on the chemical makeup of the waste and resultant chemical mobility and on options for final waste disposal. Fixation/stabilization technologies are often used in conjunction with containment or other remedies.

Stabilization technologies that simply limit contaminant mobility include application of surface binders or surfactants. These applications are generally temporary and require repeated applications to maintain effectiveness. Also, even minor disturbance of the waste (i.e., foot traffic) can degrade the effectiveness of surface stabilization technologies.

7.1.5 In Situ Treatment – Stabilization

In situ treatment and stabilization is the in-place treatment of waste to reduce toxicity and/or contaminant mobility. These technologies vary in complexity and effectiveness and as applied to the BHMS may include in-place soil mixing with lime, cement or other chemical additives to stabilize waste rock contaminants. In situ treatment may be used in combination with in-place containment. In situ treatment and stabilization are generally considered to be less effective for contaminant fixation and stabilization when compared to waste removal and fixation/stabilization because of incomplete additive mixing.

7.1.6 Water Treatment (Adit Discharge)

As previously discussed in this EEE/CA, treatment of surface water is not considered under the reclamation alternatives analyzed for the BHMS and is beyond the scope of the removal action. However, the lower waste rock dump adit discharge does represent elevated risk to the environment. Contaminant-specific ARARs are applicable to the environmental medium (surface water). This section presents technologies and controls which have been successfully employed to reduce the risk posed by mining related contamination in surface water. The controls and technologies are then screened in Section 7.2 to determine if a cost effective and implementable means of mitigating the adit discharge environmental risk may be used to complement the removal action.

7.1.6.1 Source Controls As applicable to the BHMS, source controls would limit the contact of groundwater and surface water with ore and mine waste rock. The purpose of source controls is to limit

the mobilization of contaminants in site waters through oxidation of the rock and the subsequent dissolution of contaminants in the water. The groundwater within the mine workings presumably contacts the rocks (ore) within the workings that were once disturbed by mining operations. It is unknown if the origin of the groundwater is infiltration of precipitation and snowmelt through the mine workings above the lower waste rock dump adit, groundwater existing within undisturbed bedrock faults which seeps into the historic mine workings, or both. The adit discharge has been observed to be low volume and intermittent. Once the groundwater emerges from the adit as surface water is percolates through the lower waste rock dump and does not reappear at the surface.

Source controls may include controls within the mine workings including: bulkhead construction and the intentional flooding of mine workings; adit plugging; chemical and/or physical treatment of exposed mineralization; and, mine pool drawdown. Source control of the mine waste rock may include waste rock removal; rerouting the adit discharge in a lined trench or pipe away from the mine waste rock; and, disposal of the adit discharge in the subsurface.

Because the lower waste rock dump adit (and all other mine openings noted in site history reports) are at least partially collapsed, the inner mine workings are not accessible and their condition is unknown. The condition of the mine openings makes source control options within the mine workings impracticable since significant cost would be expended simply to determine if the mine could be reopened and what rehabilitation of the inner workings would be required for safe implementation of the controls.

Adit plugging may be an effective control for stopping or reducing the seepage but, the lower waste rock dump adit is presently collapsed and extensive excavation/rehabilitation of the opening would be required before the feasibility of adit plugging could be determined. The success of adit plugs is generally based on extensive knowledge of site specific mine geology, hydrogeology, and rock mechanics. Relatively little is known about the inner workings of the BHMS and the work required to prove the feasibility of adit plugging as a control technology appropriate to the BHMS would likely be cost prohibitive.

Routing the adit discharge away from the waste rock would effectively isolate the water from contaminants present within the waste but, the contaminated discharge would still be available for contact with humans and wildlife as surface water. As a standalone control, this would not achieve risk-based site cleanup goals presented in Section 6.2 of this EEE/CA and would not be protective of the environment.

As discussed previously in Section 7.1, removal and disposal of the waste rock is an effective control when combined with other reclamation technologies. In the context of the adit discharge, removal of the waste rock would eliminate adit discharge contact with the major contaminant source present at the BHMS. However, the issue of risk associated with direct human and ecological contact with the adit discharge would remain after waste rock removal unless additional controls are implemented. Because technologies for source control within the mine workings are impractical, technologies evaluated for controlling the adit discharge external to the mine include physical/chemical treatment, wetlands treatment, and subsurface disposal.

7.1.6.2 Physical/Chemical Treatment Physical and chemical treatments are used to remove contaminants from water media and to stabilize them. Physical treatment processes include flocculation and adsorption to remove contaminants from the water and to concentrate those contaminants into reduced volumes for disposal or further treatment. Chemical treatment is used to adjust water pH to

promote contaminant precipitation. Chemical treatment is often used in combination with physical treatment to bind and collect precipitates. These treatments may include flocculent addition; pH adjustment with sodium hydroxide, lime, or another chemical agent; carbon adsorption; and iron filtration. These treatment systems often require extensive infrastructure and maintenance. Additional costs include the cost of chemicals or treatment additives and the cost of concentrated contaminant disposal.

7.1.6.3 Wetland Treatment As applicable to the BHMS, wetland treatment of the adit discharge would involve routing the discharge to a constructed artificial wetland where the water would be treated through natural processes. Wetlands may remove contaminants from water through precipitation, settling, and adsorption. This is accomplished by designing a wetland with a large retention time during which water infiltrating through a oxygen reducing environment of decaying organic matter allows for precipitate formation, settlement, and adsorption within the organic matter. The effectiveness of wetland treatment would be limited during the cold winter months at the BHMS. Also, wetlands have a design life and eventually require replacement. During replacement, the metals laden sediments and organic matter in the wetland would require disposal. A limiting factor for wetlands treatment at the BHMS is the limited amount of relatively flat land space available for wetlands construction.

7.1.6.4 Subsurface Disposal Subsurface disposal would involve routing the BHMS adit discharge to a constructed infiltration trench in which the water would be allowed to drain through the vadose zone. Although there is no direct treatment associated with this control, passive treatment may occur as contaminants are absorbed in organic matter in vadose zone soils and through the process of evapotranspiration (plant root uptake) once vegetation was reestablished in the infiltration trench area. This control would effectively remove the adit discharge as a direct source of contaminant contact with humans and wildlife. This control could be readily implemented in combination with removal of the waste rock contaminant source and would require minimal long term maintenance.

7.2 Identification and Evaluation of Alternatives

This section presents the initial screening of reclamation alternatives for the BHMS. The alternatives are based on the technologies presented in Section 7.1 and are presented in Table 26. The objective of initial screening is to define preliminary reclamation alternatives and to determine which preliminary alternatives will be retained for detailed analysis. For the purpose of achieving this objective, each preliminary alternative is evaluated on the basis of effectiveness, implementability, and cost.

Table 26. Preliminary reclamation alternatives.

ADIT DISCHARGE	
Alternative 1	Subsurface Disposal
WASTE ROCK	
Alternative 1	No action
Alternative 2	Administrative controls and site fencing
Alternative 3	Stabilize waste in-place

Table 26. (continued)

WASTE ROCK	
Alternative 4	Disposal in a constructed repository within the BHMS property boundary
Alternative 5	Disposal in a constructed repository on nearby USFS land
Alternative 6	Offsite disposal in a permitted solid waste disposal facility

Effectiveness is a measure of how completely the alternative achieves the reclamation objective and cleanup goals in both the short and long terms. To be effective, an alternative must be protective of human health and the environment and must comply with ARARs. Site-specific factors, contaminant toxicity reduction, contaminant mobility reduction, waste volume minimization, and permanence are considerations in determining the effectiveness of an alternative.

Implementability is the feasibility of an alternative based on technical and administrative issues. Technical considerations that may affect the implementability of an alternative include geology, topography, or other site specific factors; the availability of resources to complete the alternative; and alternative maintenance and reliability considerations. Administrative issues which may affect the implementability of an alternative include logistics, schedule, and land ownership issues.

Each alternative is screened for cost by developing engineer's estimates for design, construction, operation, and maintenance of the alternative. The estimates are based on the engineer's experience with costs incurred for similar projects, unit cost data from RSMeans® or other standardized sources, and material quotes from local suppliers. Administrative costs and contingencies are included in each estimate. For the purpose of directly comparing the cost of alternatives which may have differing implementation schedules, all costs are presented in present value. The engineer's estimates are for planning purposes and should be considered "order of magnitude" costs.

7.2.1 Adit Discharge

As discussed in Section 7.1.5 of this EEE/CA the adit discharge poses an environmental risk and will be mitigated to complement the waste rock removal action. Many of the conventional technologies applicable to mine adit water discharges are not practicable to implement at the BHMS. Only one adit discharge alternative was retained from the screening of reclamation alternatives for additional initial screening and evaluation. With the exception of the no-action alternative, this alternative will be presented as a common element of all BHMS waste rock alternatives discussed in Section 7.2.2 and all BHMS waste rock alternatives retained for detailed analysis in Section 8.0 of this EEE/CA.

7.2.1.1 Alternative 1: Subsuface Disposal

Alternative 1 includes the subsurface disposal of the adit discharge. This adit discharge alternative in combination with removal of the waste rock is an effective control that would be protective of both human health and the environment. This alternative may be implemented with standard construction techniques at reasonable cost. The discharge will be routed to a constructed infiltration trench and buried so that there is no surface expression of the water. Construction of the infiltration trench will provide an effective human and wildlife contact barrier with the adit discharge. Removal of the waste rock will

eliminate waste rock contaminant contact with the adit discharge and subsequent contaminant mobility. Passive treatment/removal of contaminants in the adit discharge (contaminants mobilized from mineralization found in rock in the inner mine workings) would likely occur through adsorption in the vadose zone sediments and through the process of evapotranspiration.

Impacts to groundwater from the adit discharge are unknown but are considered to be insignificant. The adit discharge is low volume and intermittent. Geotechnical investigation of subsurface conditions in the area of the BHMS has shown that there is no significant alluvial aquifer present near the BHMS and that groundwater is likely found in deep bedrock fractures. Because there are no wells or other data regarding groundwater in the vicinity of the BHMS, the quantity and quality of site groundwater is unknown. Treatment of groundwater would require additional investigation and is not being considered by this EEE/CA.

Effectiveness. Alternative 1 provides protection of human health by eliminating the adit discharge as a direct source of exposure through dermal contact and/or ingestion. It would also be protective of large wildlife species (deer), which may otherwise come into direct contact with the adit discharge. The reclamation goals and risk-based site cleanup goals presented in Section 6.2 of this EEE/CA would be achieved through implementation of this alternative.

Implementability. Alternative 1 may be implemented with a minimum of technical and administrative considerations. No site features would eliminate subsurface disposal as an option for addressing the adit discharge, and resources and materials are readily available to implement the alternative. Reliability would be good and the alternative would require minimal maintenance.

Cost. The total present worth cost of alternative 1 when implemented in conjunction with waste rock disposal alternatives is $2,469.

Screening Summary. Alternative 1 is a low cost, effective means of eliminating the human health and ecological risks associated with contamination in the adit discharge. Alternative 1 is a common element of all waste rock restoration alternatives with the exception of the no-action alternative.

7.2.2 Waste Rock

HMO mitigation and elimination of the lower waste rock dump adit discharge are common element of all BHMS waste rock restoration alternatives with the exception of the no-action alternative. Two HMOs are present at the BHMS: the collapsed adit above the lower waste rock dump and the collapsed adit above the upper waste rock dump. These features would be filled, graded, and/or contoured as appropriate.

7.2.2.1 Alternative 1: No Action

The no-action alternative is the basis against which other reclamation alternatives are compared. Under this alternative no additional reclamation, treatment, controls, or assessment would be required at the BHMS. The waste rock dumps would remain in place, and site contamination would continue to be a source of ecological and human health risk.

Effectiveness. Toxicity, mobility, and/or volume of contaminants would not be reduced under the no-action alternative. The no-action alternative would not protect against the human health and ecological risks associated with metals in the BHMS waste rock. The reclamation goal and risk-based site cleanup goals presented in Section 6.2 of this EEE/CA are not achieved under the no-action alternative.

Implementability. Because the no-action alternative does not change the current status of the BHMS, technical and administrative feasibility considerations do not apply.

Cost. Because the no-action alternative does not change the current status of the BHMS, no capital or operating costs would be incurred under the no-action alternative. The future costs of no action (environmental, human health, and ecological impacts from contamination) are unknown.

Screening Summary. the no-action alternative is the basis against which other reclamation alternatives are compared. The no-action alternative is therefore retained for detailed evaluation in Section 8 of this EEE/CA.

7.2.2.2 Alternative 2: Administrative Controls and Site Fencing

Alternative 2 includes land-use restrictions to prevent development in the area of the two BHMS waste rock dumps and permanently fencing the area around each waste rock dump. The two BHMS HMOs would be closed by filling them with general fill and regrading the surrounding areas to blend them into the local topography. The intermittent seep from the lower waste rock dump adit would be eliminated so that there is no surface expression of the water by the filling and recontouring of the adit and by routing the discharge into a constructed infiltration trench. Reclaimed areas would be revegetated with a blend of native shrubs and grasses to stabilize site soils.

Effectiveness. Alternative 2 provides protection of human health by limiting future site development and by creating a barrier around site wastes. It would also be protective of large wildlife species (deer), which may otherwise come into direct contact with site wastes. However, with the exception of surface water, Alternative 2 does not reduce toxicity, mobility, and/or volume of contaminants, and it does not achieve the project cleanup goals. Furthermore, the potential for direct human contact with site wastes cannot be adequately eliminated with this alternative. Fencing may be vandalized or degraded by natural events over time. Maintaining site fencing and signage would be a long-term cost.

Implementability. Alternative 2 engineering controls (adit closure and fencing) can be readily implemented with a minimum of technical and administrative considerations. No site features would eliminate fencing as an option, and resources and materials are readily available to implement the alternative. Reliability would be good, but fencing would require long-term maintenance. Fencing and land-use restrictions do pose administrative challenges because of the divided ownership status of the property on which the waste is located. The entire upper waste rock dump, a portion of the lower waste rock dump, and site HMOs are located on private property. Current and future land owners would likely oppose restrictions on use of the private parcel.

Cost. Table 27 presents the engineer's cost estimate for Alternative 2. The total estimated present worth cost of this alternative is $34,815. The costs of Alternative 2 are low compared to the other

alternatives presented, because no removal and/or capping of site wastes would be performed. Included in the cost estimate is the present value of 30 years of maintaining site fencing and site control.

Screening Summary. Although low in cost, Alternative 2 provides limited effectiveness for protection of human health and the environment. Furthermore, it does not achieve the risk-based site cleanup goals presented in Section 6.2 of this EEE/CA. Based on this limited effectiveness, Alternative 2 will not be considered further for detailed analysis in this EEE/CA.

Table 27. Alternative 2 cost estimate.

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost ($)	Sum ($)
Land-Use Control (note to deed)	1	LS	250	250	
Mobilization, Including Bonding, Insurance, and General Costs	1	LS	2,175	2,175	
Site Reclamation					
Fence Around Waste Rock Dumps	1,200	LF	7.50	9,000	
Infiltration Trench	1	LS	2,500	2,500	
HMO Closures	1	LS	3,000	3,000	
Subtotal Capital Costs				16,925	
Contingency	10%	of subtotal capital cost		1,693	
Total Capital Cost					**18,618**
Post-Removal Site Control (PRSC) Annual Cost				660	
Present Value of Capital Cost	1	Year		18,388	
Present Value of Annual Cost	30	Year		16,427	
Total Present Value Cost					**34,815**

LS = Lump sum
LF= Linear foot

7.2.2.3 Alternative 3: Stabilize Waste in-Place

Alternative 3 includes shaping and capping the waste in place. Limited shaping would be performed to reduce side-slope grades, and a soil cover cap would be constructed over the waste rock piles. The cap would consist of a soil cover for growth media. A mix of native grasses would be established on the growth media to reduce erosion and limit precipitation infiltration into the waste. Temporary fencing would be installed around the covered dumps to exclude wildlife until vegetation is established on the cover material.

The two BHMS HMOs would be closed by filling them with general fill and regrading the surrounding areas to blend them into the local topography. The intermittent seep from the lower waste rock dump adit would be eliminated so that there is no surface expression of the water by the filling and recontouring of the adit, and by routing the discharge into a constructed infiltration trench. These areas would also be revegetated with a blend of native shrubs and grasses. Best management practices (BMPs) for stormwater control and erosion control would be required at all reclaimed areas to ensure soil stability and to promote revegetation.

Effectiveness. Alternative 3 provides some protection of human health and the environment by isolating site wastes under an earthen cap. It is unlikely, however, that a soil cover alone will eliminate contaminant transport pathways at the BHMS. Annual precipitation at the BHMS is relatively high for Montana, and it is unlikely that evaporation and evapotranspiration would be sufficient to stop infiltration of precipitation through the waste. Animals could easily burrow in the soil cover and create preferential pathways for water infiltration. Also, Alternative 3 would still require administrative controls to ensure that a portion of the reclaimed lower waste rock dump and the entire upper waste rock dump are not disturbed by future site development and use. Current and future land owners would likely oppose restrictions on use of the private parcel. Also, access agreements for performing the work and for performing monitoring/maintenance of the reclamation would be required. In addition, Alternative 3 would be less effective than other alternatives that involve waste capping, because the waste material will not be consolidated in a single repository under this alternative. Multiple reclamation features will require additional post-construction monitoring and maintenance.

Implementability. The construction components of Alternative 3 can be readily implemented with standard construction techniques. No site features would eliminate Alternative 3 as an option, and resources and materials are readily available to implement the alternative. Land-use restrictions do, however, pose administrative challenges to implementing this alternative because of the divided ownership status of the property on which the waste is located. The entire upper waste rock dump and a portion of the lower waste rock dump are located on private property. Current and future land owners would likely oppose restrictions on use of the private parcel. Access agreements for performing the work and for performing monitoring/maintenance of the reclamation would be required.

Cost. Table 28 presents the engineer's cost estimate for Alternative 3. The total estimated present worth cost of this alternative is $185,278. The costs of Alternative 3 are less than other alternatives presented that involve waste capping, because the cap would only consist of soil cover. In addition to the present worth of capital costs, the estimate assumes 30 years of performance monitoring of the covered dumps.

Screening Summary. Alternative 3 would not be fully protective of human health and the environment, and it is less implementable than other alternatives because of the divided land ownership at the BHMS. Based on this limited effectiveness and implementability, Alternative 3 will not be considered further in the detailed analysis of reclamation alternatives.

Table 28. Alternative 3 cost estimate.

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost ($)	Sum ($)
Land-Use Control (note to deed)	1	LS	250	250	
Mobilization, Including Bonding, Insurance, and General Costs	1	LS	14,098	14,323	
Roads, Access, and Site Preparation	1	LS	10,520	10,520	
Excavation and Earthwork (soil cover)	1	LS	62,420	62,420	
Site Reclamation					
Final Grading	1	LS	5,547	5,547	
Seeding, Fertilizer, Mulch on All Disturbed Areas	2	AC	4,000	8,000	
Infiltration trench	1	LS	2,500	2,500	
HMO Closures	1	LS	3,000	3,000	
Temporary Fence Around Dumps	1200	LF	2	3,000	
Gate	1	LS	500	500	
Subtotal Capital Costs				110,060	
Contingency	10%	of subtotal capital cost		11,006	
Total Capital Cost					**121,066**
PRSC Annual Cost					2,640
Present Value of Capital Cost	1	Year		119,571	
Present Value of Annual Cost	30	Year		65,707	
Total Present Value Cost					**185,278**

AC = Acre
LF = Linear feet
LS = Lump sum

7.2.2.4 Alternative 4: Disposal in a Constructed Repository within the BHMS Property Boundary

Alternative 4 includes complete removal of waste rock from the upper and lower waste rock dumps, construction of a repository at the BHMS, and disposal of the waste in the repository. The repository would likely be located on the bench between the two waste rock dumps or within an existing roadway cut. Overexcavation of the waste rock dump areas would be performed to ensure that the risk-based cleanup goals presented in Section 6.2 of this EEE/CA are achieved.

The waste rock dump areas would be reclaimed and revegetated after waste rock removal. The two BHMS HMOs would be closed by filling them with general fill and regrading the surrounding areas to blend them into the local topography. The intermittent seep from the lower waste rock dump adit would be eliminated so that there is no surface expression of the water by filling and recontouring of the adit and by routing the water to a constructed subsurface infiltration trench. These areas would also be revegetated with a blend of native shrubs and grasses.

The engineered repository would consist of a balanced cut-and-fill, belowgrade impoundment with a low-permeability cap. The cap would consist of either a geosynthetic liner system or a low-permeability earthen material overlain by growth media. A mix of native grasses would be established on the growth media to reduce erosion and limit precipitation infiltration into the cap. Temporary fencing would be installed around the new repository to exclude wildlife until vegetation is established. BMPs for stormwater control and erosion control would be required at all reclaimed areas and at the repository to ensure cover stability, reduce erosion, and promote revegetation.

Effectiveness. Alternative 4 provides protection of human health and the environment by isolating site wastes from human and ecological contact. It would effectively mitigate the risks that site wastes pose to human health and the environment. However, Alternative 4 would still require administrative controls to ensure that the onsite repository is not disturbed by future site development and use. Current and future land owners would likely oppose restrictions on use of the private parcel. Also, access agreements for performing the work and for performing monitoring/maintenance of the reclamation and repository would be required.

Implementability. The construction components of Alternative 4 can be readily implemented with standard construction techniques. No site features would eliminate Alternative 4 as an option, and resources and materials are readily available to implement the alternative. Land-use restrictions do, however, pose administrative challenges to implementing this alternative, because the repository would be located on private property. Current and future land owners would likely oppose restrictions on use of the private parcel. In addition, access agreements for performing the work and for performing monitoring/maintenance of the reclamation would be required.

Cost. Table 29 presents the engineer's cost estimate for Alternative 4. The total estimated present worth cost of this alternative is $246,867. The costs of Alternative 4 are estimated to be slightly higher than those associated with disposal in a constructed repository on USFS land because it is anticipated that topsoil would need to be imported for Alternative 4 construction. In addition to the present worth of the capital cost, the estimate includes the present worth of 30 years of performance monitoring for the repository.

Screening Summary. Although Alternative 4 would be protective of human health and the environment, it is less implementable than other alternatives, because of the requirement for land-use controls on private property. Based on this limited implementability, Alternative 4 will not be considered further in the detailed analysis of reclamation alternatives.

Table 29. Alternative 4 cost estimate.

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost ($)	Sum ($)
Land-Use Control (note to deed)	1	LS	250	250	
Mobilization, Including Bonding, Insurance, and General Costs	1	LS	21,717	21,717	
Roads, Access, and Site Preparation	1	LS	11,220	11,220	
General Excavation and Earthwork	1	LS	10,583	10,583	
Waste Haul and Disposal	1	LS	38,524	38,524	
Repository Cover (assume geosynthetic)	1	LS	39,898	39,898	
Site Reclamation					
Final Earthwork and Grading	1	LS	25,058	25,058	
Seeding, Fertilizer, Mulch on All Disturbed Areas	3	AC	4,000.00	12,000	
Infiltration trench	1	LS	2,500.00	2,500	
HMO Closures	1	LS	3,000.00	3,000	
Temporary Fence Around Repository	600	LF	2.50	1,500	
Gate	1	LS	500.00	500	
Subtotal of Capital Costs				166,750	
Contingency	10%	of subtotal capital cost		16,675	
Total Capital Cost					**183,425**
PRSC Annual Cost				2,640	
Present Value of Capital Cost				111,160	
Present Value of Annual Cost				65,707	
Total Present Value Cost					**246,867**
AC = Acre LF = Linear feet LS = Lump sum					

7.2.2.5 Alternative 5: Disposal in a Constructed Repository on USFS Lands

Alternative 5 includes complete removal of waste rock from the upper and lower waste rock dumps, construction of a repository on USFS land, and disposal of the waste in the repository. Over-excavation of the waste rock dump areas would be performed to ensure that the risk-based cleanup goals presented in Section 6.2 of this EEE/CA are achieved.

The waste rock dump areas would be reclaimed and revegetated after waste rock removal. The two BHMS HMOs would be closed by filling them with general fill and regrading the surrounding areas to blend them into the local topography. The intermittent seep from the lower waste rock dump adit would be eliminated so that there is no surface expression of the water by the filling and recontouring of the adit, and a subsurface infiltration trench would be constructed. These areas would be revegetated with a blend of native shrubs and grasses to stabilize reclaimed surfaces.

The engineered repository would consist of a balanced cut-and-fill, belowgrade impoundment with a low-permeability multilayer cap. The cap would consist of a geosynthetic liner system or a low-permeability earthen material overlain by growth media. A mix of native grasses would be established on the growth media to reduce erosion and limit precipitation infiltration into the cap. Temporary fencing would be installed around the new repository to exclude wildlife until vegetation is established. BMPs for stormwater control and erosion control would be required at all reclaimed areas and at the repository to ensure cover stability, reduce erosion, and promote revegetation.

Effectiveness. Alternative 5 provides protection of human health and the environment by isolating site wastes from contact with human and ecological receptors. It would effectively mitigate the risks that site wastes pose to human health and the environment. Alternative 5 would also eliminate long-term administrative issues with associated with waste disposal on private land. Future management of the repository would be under the control of the USFS and MDEQ.

Implementability. The construction components of Alternative 5 can be readily implemented with standard construction techniques. No site features would eliminate Alternative 5 as an option, and resources and materials are readily available to implement the alternative. Several sites nearby the BHMS on USFS lands are suitable for repository construction and are readily accessible by construction equipment. The suitability of these sites is detailed in the *Repository Investigation Report for the Broken Hill Mine Site, Sanders County, Montana* (Portage 2010a).

Cost. Table 30 presents the engineer's cost estimate for Alternative 5. The total estimated present worth cost of this alternative is $245,507. The costs of Alternative 5 are estimated to be less than onsite disposal in a constructed repository, because there would be no costs associated with legally enforceable land-use controls. The estimate assumes construction of a repository at a nearby site located entirely on land controlled by the USFS. A load and haul operation with conventional equipment would transport waste from the BHMS to the repository. The estimate includes 30 years of repository performance monitoring.

Screening Summary. Alternative 5 would be protective of human health and the environment and may be readily implemented with standard construction techniques. Administrative controls would not be required to implement Alternative 5. Based on effectiveness and implementability, Alternative 5 will be retained for further consideration and detailed analysis.

Table 30. Alternative 5 cost estimate.

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost ($)	Sum ($)
Mobilization, Including Bonding, Insurance, and General Costs	1	LS	21,586	21,587	
Roads, Access, and Site Preparation	1	LS	15,920	15,920	
Excavation and Earthwork	1	LS	12,163	12,163	
Waste Handling, Haul and Disposal	1	LS	43,302	43,302	
Repository Cover (assume geosynthetic)	1	LS	43,093	43,093	
Site Reclamation					
Final Earthwork and Grading	1	LS	21,933	21,933	
Infiltration Trench	1	LS	2,500.00	2,500	
HMO Closures	1	LS	3,000.00	3,000	
Temporary Fence Around Repository	600	LF	2.50	1,500	
Gate	1	LS	500.00	500	
Subtotal of Capital Costs				165,498	
Contingency	10%	of subtotal capital cost		16,550	
Total Capital Cost					**182,048**
PRSC Annual Cost					2,640
Present Value of Capital Cost	1			179,800	
Present Value of Annual Cost	30			65,707	
Total Present Value Cost					**245,507**

LF = Linear feet
LS = Lump sum

7.2.2.6 Alternative 6: Offsite Disposal in a Permitted Solid Waste Disposal Facility

Alternative 6 includes complete removal of waste rock from the upper and lower waste rock dumps and disposal of the waste in an offsite permitted solid waste disposal facility. Over-excavation of the waste rock dump areas would be performed to ensure that the risk-based cleanup goals presented in Section 6.2 of this EEE/CA are achieved. Contaminated materials would be loaded into dump trucks and hauled to a nearby permitted solid waste disposal facility, where the waste would be disposed of under the provisions of the Montana Solid Waste Management Act at MCA 75-10-201.

The waste rock dump areas would be reclaimed and revegetated after waste rock removal. The two BHMS HMOs would be closed by filling them with general fill and regrading the surrounding areas to

blend them into the local topography. The intermittent seep from the lower waste rock dump adit would be eliminated so that there is no surface expression of the water by filling and recontouring of the adit, and by routing the discharge to a constructed infiltration trench. These areas would also be revegetated with a blend of native shrubs and grasses to stabilize the reclamation.

Effectiveness. Alternative 6 provides protection of human health and the environment by isolating site wastes from human and ecological contact. It would effectively mitigate the risks that site wastes pose to human health and the environment. Alternative 6 would also eliminate long-term administrative issues associated with disposal of the waste on private land.

Implementability. The construction components of Alternative 6 can be readily implemented with standard construction techniques. No site features would eliminate Alternative 6 as an option, and resources and materials are readily available to implement the alternative.

Cost. Table 31 presents the engineer's cost estimate for Alternative 6. The total estimated present worth cost of this alternative is $645,769. The estimate assumes a conventional load-and-haul operation performed with an excavator, bulldozer, loader, and dump trucks. The capital costs of Alternative 6 are high compared to the other alternatives presented. This is because of the high cost of trucking the waste to a municipal landfill and waste disposal tipping fees (charged per ton of waste) associated with the municipal landfill. The present value of cost annual monitoring is less than other alternatives, because only 3 years of reclamation monitoring is assumed (versus 30 years of performance monitoring for waste capping alternatives).

Screening Summary. Alternative 6 would be protective of human health and the environment and may be readily implemented with standard construction techniques. Administrative controls would not be required to implement Alternative 6. Based on effectiveness and implementability, Alternative 6 will be retained for further consideration and detailed analysis.

Table 31. Alternative 6 cost estimate.

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost ($)	Sum ($)
Mobilization, Including Bonding, Insurance, and General Costs	1	LS	77,221	77,221	
Roads, Access, and Site Preparation	1	LS	6,260	6,260	
Excavation and Earthwork	1	LS	3,580	3,580	
Waste Handling, Haul and Disposal	1	LS	485,923	485,923	
Site Reclamation					
Final Earthwork and Grading	1	LS	5,547	5,547	
Seeding, Fertilizer, Mulch on All Disturbed Areas	2	AC	4,000	8,000	
Infiltration Trench	1	LS	2,500	2,500	
HMO Closures	1	LS	3,000	3,000	

Table 31. (continued)

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost ($)	Sum ($)
Subtotal of Capital Costs				592,031	
Contingency	10%	of subtotal capital cost		59,203	
Total Capital Cost					**651,234**
PRSC Annual Cost	1	LS	$880	880	
Present Value of Capital Cost	1	Year		643,194	
Present Value of Annual Cost	3	Year		2,575	
Total Present Value Cost					**645,769**
AC = Acre LS = Lump sum					

7.3 Alternatives Screening Summary

Table 32 summarizes the results of the BHMS reclamation alternatives screening process. As shown in Table 32, the alternatives were ranked according to their effectiveness and implementability. The costs shown in Table 32 include the present worth value of construction, monitoring, and maintenance. Monitoring and maintenance are assumed for a 30-year period except for Alternative 6, which assumes 3 years. The cost estimates are engineer's estimates generated for planning and alternative comparison purposes and are considered "order of magnitude" estimates.

As a result of the screening process, three alternatives have been retained for detailed analysis in Chapter 8 of this EEE/CA:

- Alternative 1 – No-Action Alternative
- Alternative 5 – Disposal in a Constructed Repository on USFS Land
- Alternative 6 – Offsite Disposal at a Permitted Solid Waste Disposal Facility.

Table 32. Alternatives screening summary.

Alternative	Effectiveness	Implementability	Cost ($)	Retained for Detailed Analysis
1. No Action	NA	NA	0	Yes
2. Administrative Controls and Site Fencing	Low	Low	34,815	No
3. Stabilize Waste In-Place	Medium	Low	185,278	No
4. Disposal in a Constructed Repository Within the	High	Low	246,867	No

Table 32. (continued)

Alternative	Effectiveness	Implementability	Cost ($)	Retained for Detailed Analysis
BHMS Property Boundary				
5. Disposal in a Constructed Repository on USFS Land	High	High	245,507	Yes
6. Offsite Disposal at a Permitted Solid Waste Disposal Facility	High	High	645,769	Yes
NA = Not applicable				

Alternative 5 will be further parsed into four sub-alternatives based on the results of the BHMS repository siting investigation performed in 2010 (Portage 2010b):

- Alternative 5a – Disposal in a Constructed Repository at Road Bench Site #1
- Alternative 5b – Disposal in a Constructed Repository at Road Bench Site #2
- Alternative 5c – Disposal in a Constructed Repository at Blue Creek Bench
- Alternative 5d – Disposal in a Constructed Repository at Fatman Saddle.

Alternatives 2, 3, and 4 will not be considered further, because they are ineffective, are not reasonably implementable, or do not achieve the project reclamation objective.

8. DETAILED ANALYSIS OF RECLAMATION ALTERNATIVES

The purpose of the detailed analysis of reclamation alternatives is to examine the relative effectiveness, implementability, and cost of each alternative not eliminated from further consideration by the screening analysis. For reference clarity, the alternatives retained for detailed analysis are identified by the same numbering system used in Section 7.3 of this EEE/CA.

Each reclamation alternative currently being considered for implementation at the BHMS is classified as an interim or removal action and is not considered a complete remedial action. The reclamation alternatives evaluated in detail are applicable to the contaminated solid media, and no reclamation alternatives for groundwater or surface water are analyzed in detail. The rationale for not directly developing reclamation alternatives for these environmental media is based primarily on the presumption that reclaiming the contaminant source will subsequently reduce or eliminate issues associated with groundwater and surface water at a significantly reduced cost. As discussed in Section 7, surface water discharging from the lower waste rock dump adit will be routed to a constructed subsurface infiltration trench for the purpose of eliminating it as a source of direct human and ecological contaminant exposure.

Per the NCP, each reclamation alternative retained after initial screening must be evaluated against the following criteria:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- Agency acceptance
- Community acceptance.

Agency acceptance and community acceptance are modifying criteria that will be evaluated after the MDEQ and the public have reviewed and commented on the EEE/CA. The criteria address requirements and considerations (EPA 1988) and are further categorized into three groups, each with distinctive functions in selecting the preferred alternative:

- Threshold criteria – overall protection of human health and the environment and compliance with ARARs
- Primary balancing criteria – long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost
- Modifying criteria – agency and community acceptance.

Overall protection of human health and the environment and compliance with ARARs are threshold criteria that must be satisfied for an alternative to be eligible for selection as the preferred alternative. Long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost are the primary balancing factors used to weigh major advantages and disadvantages between reclamation alternatives. Threshold and primary balancing criteria are the basis of the detailed analysis and selection of the preferred reclamation alternative. Agency and community acceptance are modifying considerations that are formally considered after public comment is received on the proposed plan (Federal Register, No 245, 51394-50509, December 1988). Each criterion is briefly described in the following paragraphs.

Overall Protection of Human Health and the Environment. This criterion evaluates how the alternative as a whole protects and maintains human health and the environment. The overall assessment of protection is based on a combination of factors assessed under other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Compliance with ARARs. This criterion assesses how each alternative complies with applicable or relevant and appropriate standards, criteria, advisories, or other guidelines. Waivers are identified if necessary. Factors that will be addressed for each alternative during the detailed analysis of ARARs are shown in Table 33.

A comprehensive list of federal and state ARARs has been developed for the BHMS, is summarized in Section 4 of this EEE/CA, and is presented in detail in Appendix A. The ARARs are divided into contaminant-specific, location-specific, and action-specific requirements. Contaminant-specific ARARs are waste-related requirements which effect how a waste must be managed, treated, and/or disposed depending on classification of the waste material. Location-specific ARARs specify how the remedial activities must take place depending on where the wastes are physically located (i.e., in a stream or floodplain, wilderness area, sensitive environment, etc.) or where the wastes may be treated and or disposed of and what authorizations (permits) may be required. Action-specific ARARs do not determine the preferred reclamation alternative but indicate how the selected alternative must be achieved (protection of site workers, etc.).

Long-Term Effectiveness and Permanence. This criterion evaluates the alternatives effectiveness in protecting human health and the environment after the reclamation objectives have been achieved. Factors that will be addressed for each alternative during the detailed analysis of long-term effectiveness and permanence are shown in Table 33.

Reduction of Toxicity, Mobility, or Volume through Treatment. This criterion evaluates anticipated performance of specific treatment technologies. Factors that will be addressed for each alternative during the detailed analysis of reduction of toxicity, mobility, or volume through treatment and permanence are shown in Table 33.

Short-Term Effectiveness. This criterion evaluates alternative effectiveness in protecting human health and the environment during the construction and implementation period of the reclamation alternative. Factors that will be addressed for each alternative during the detailed analysis of short-term effectiveness are shown in Table 33.

Implementability. This criterion evaluates the technical and administrative feasibility of alternatives and the availability of required resources. Factors that will be addressed for each alternative during the detailed analysis of implementability are shown in Table 33.

Cost. This criterion evaluates the estimated capital, operation, and maintenance costs of each reclamation alternative. Factors that will be addressed for each alternative during the detailed analysis of cost are shown in Table 33.

Agency Acceptance. This criterion evaluates the technical and administrative issues and concerns of the MDEQ in relation to the preferred reclamation alternative. The evaluation focuses on factors shown in Table 33 that will be addressed for each alternative during the detailed analysis of agency acceptance. The evaluation of agency acceptance is considered after agency and public comment on the proposed plan.

Community Acceptance. This criterion evaluates public concerns with the reclamation alternatives with an emphasis on the preferred alternative. The evaluation focuses on factors shown in Table 33 that

will be addressed for each alternative during the detailed analysis of community acceptance. The evaluation of community acceptance is considered after agency and public comment on the proposed plan.

The final step of the detailed analysis is to conduct a comparative analysis of the alternatives. The analysis will include a discussion of each reclamation alternatives relative strengths and weaknesses with respect to each of the evaluation criteria and how reasonable key uncertainties could change expectations of their relative performance.

Once completed, the detailed evaluation of reclamation alternatives will be used to select the preferred alternative. A public meeting will be held to present the preferred and other reclamation alternatives evaluated by this EEE/CA. Oral and written public comments will be addressed in writing by MDEQ before the Final Draft EEE/CA and the Action Memorandum (AM) are issued. The selection of the preferred alternative will be documented in an AM by MDEQ.

Table 33. Summary of reclamation alternative evaluation criteria.

Threshold Criteria				
Overall Protection of Human Health and the Environment • How the alternative as a whole protects human health and the environment		Compliance with ARARs • Compliance with chemical-specific ARARs • Compliance with action-specific ARARs • Compliance with location-specific ARARs • Compliance with appropriate criteria, advisories, and guidelines		
Primary Balancing Criteria				
Long-Term Effectiveness and Permanence • Magnitude of residual risk • Adequacy of controls • Reliability of controls	Reduction of Toxicity, Mobility, or Volume through Treatment • Treatment process used and materials tested • Amount of hazardous materials destroyed or treated • Degree of expected reductions in toxicity, mobility, and volume • Degree to which treatment is irreversible • Type and quantity of residuals remaining after treatment	Short-Term Effectiveness • Human health impacts during implementation • Environmental impacts during construction • Time until reclamation objective is achieved	Implementability • Technical feasibility • Administrative feasibility	Cost • Capital cost • Operation and maintenance cost • Current worth of all costs

Table 33. (continued)

Modifying Criteria[a]	
Supporting Agency Acceptance	Community Acceptance
• Features of the alternative that are supported by the MDEQ • Features of the alternative that the MDEQ question • Features of the alternative that the MDEQ oppose	• Features of the alternative that are supported by the community • Features of the alternative that the community questions • Features of the alternative that the community opposes
a. These criteria are assessed after public and agency comment on the EEE/CA	

8.1 Quantitative Evaluation of Threshold Criteria

With the exception of the no-action alternative, each reclamation alternative selected for detailed evaluation is designed to achieve the risk reduction required to meet the reclamation objective and risk-based cleanup goals. No additional calculation or modeling of relative risk reduction between the reclamation alternatives will be performed in this evaluation.

8.2 Alternative 1: No Action

Evaluation of the no-action alternative is required by the NCP and is used to provide the baseline against which all other alternatives are compared. Under the no-action alternative, no reclamation would be performed and the BHMS conditions would remain unchanged. Consequently, the site contamination would continue to pose an unacceptable risk to human health and the environment and site reclamation objectives would not be achieved.

8.2.1 Overall Protection of Human Health and the Environment

The no-action alternative provides no control of site wastes and contaminant transport and therefore it is not protective of human health and the environment. Under the no-action alternative, the human recreational user would continue to be exposed to arsenic and lead through the ingestion and dermal exposure pathways. Terrestrial wildlife would continue to be exposed to contaminants in site wastes through dermal contact and ingestion, and plant phytotoxicity due to arsenic, cadmium, lead, and zinc would continue. Table 34 presents a risk reduction achievement matrix for the exposure pathways and contaminants identified in the baseline human health risk assessment and the ecological risk assessment for the BHMS. Only contaminants with an EQ or HI greater than 1 are evaluated in the matrix.

Table 34. Risk reduction achievement matrix for Alternative 1.

Arsenic	Cadmium	Copper	Lead	Zinc
Human health exposure pathway: recreational user soil ingestion				
None	NA	NA	None	NA
Human health exposure pathway: recreational user surface water ingestion				
None	NA	NA	None	NA
Ecological exposure pathway: deer ingestion				
NA	NA	NA	None	NA
Ecological exposure pathway: aquatic life				
NA	None	None	None	None
Ecological exposure pathway: plant phytotoxicity				
None	None	NA	None	None

Table 34. (continued)

Arsenic	Cadmium	Copper	Lead	Zinc
None = No risk reduction achieved Yes = Risk reduction achieved NA = Not applicable; risk reduction not required				

8.2.2 Compliance with ARARS

Under the no-action alternative, no contaminated materials would be treated, removed, or actively managed. Consequently, the no-action alternative would not satisfy any federal or state contaminant-specific ARARs. Contaminant-specific ARARs are applicable to surface and groundwater quality at the BHMS. The BHMS surface water (adit discharge) exceeds contaminant-specific ARARs for the following:

- Human health standards for arsenic
- Chronic aquatic life standards for cadmium, lead, and zinc
- Acute aquatic life standards for cadmium, lead, and zinc.

The status of contaminant-specific ARARs for groundwater is unknown, because groundwater was not characterized during the BHMS RI. It is believed that groundwater at the BHMS is found in fractures in the deep bedrock aquifer. Multiple test pits excavated to the bedrock surface at potential repository sites near the BHMS (Portage 2010b) showed no evidence of an alluvial groundwater system.

8.2.3 Long-Term Effectiveness and Permanence

No administrative or engineering controls would be implemented as a result of the no-action alternative. Protection of human health and the environment would not be achieved, and site risks would remain to the human recreational user and to biota as described in the baseline risk assessments. Therefore, the alternative does not offer long-term effectiveness or permanence.

8.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

The no-action alternative will not achieve any reduction of toxicity, mobility, or volume of contaminants through treatment.

8.2.5 Short-Term Effectiveness

No administrative or engineering controls would be implemented as a result of the no-action alternative. Protection of human health and the environment would not be achieved, and site risks would remain to the human recreational user and to wildlife as described in the baseline risk assessments. Therefore, the alternative does not offer short-term effectiveness.

8.2.6 Implementability

Because no action is taken and site conditions remain unchanged under this alternative, there are no technical or administrative feasibility criteria that apply.

8.2.7 Costs

Because no action is taken and site conditions remain unchanged under this alternative, no capital, operating, or monitoring costs are incurred. The future costs of no action (environmental, human health, and ecological impacts from contamination) are unknown.

8.3 Alternative 5a: Disposal in a Constructed Repository at Road Bench Site #1

Alternative 5a involves complete removal and disposal of waste rock from the upper and lower waste rock dumps and disposal of the waste in a constructed repository at Road Bench Site #1. Figure 3 shows Road Bench Site #1 in relation to the BHMS. Reclamation work at the BHMS would consist of overexcavation of mine waste rock; closure of two HMOs; elimination of the intermittent surface water discharge from the adit opening at the lower waste rock dump; regrading and recontouring of reclaimed features; site revegetation; BMP implementation to reduce surface erosion on reclaimed features; and temporary fencing.

The engineered repository at Road Bench Site #1 would consist of a balanced cut-and-fill, belowgrade impoundment with a low-permeability multilayer cap. The cap would consist of a geosynthetic liner system or low-permeability earthen material overlain by growth media. Figure 4 shows a conceptual plan view (Road Bench Site #2 shown on plan), and Figures 5 and 6 show cross sections of a generic constructed repository. The plan view is conceptual, and the actual repository cap would be curved and rounded in appearance, blending with original topography. The cap would be revegetated with a mix of native grasses to reduce erosion and limit precipitation infiltration into the cap. Temporary fencing would be installed around the new repository to exclude wildlife until vegetation is established. BMPs for stormwater control and erosion control would be implemented to ensure cover stability, reduce erosion, and promote revegetation.

The intermittent seep discharging from the lower waste rock dump adit would be eliminated by constructing a shallow infiltration trench where the adit discharge would infiltrate into the alluvium. The infiltration trench would be buried with clean fill, effectively eliminating any surface expression of the adit discharge.

The volume of waste to be disposed of is approximately 4,100 yd^3, requiring at least ¾ acres of useable surface area for repository construction. Although it has the second smallest useable acreage of the four potential repository sites, there is adequate area for repository construction. Road Bench Site #1 is located on a sloping ridge accessed by FR 2290 approximately ¾ miles from the BHMS at an elevation of approximately 3,740 ft amsl. The topography of the ridge provides sufficient useable surface area for repository construction and provides opportunity to contour the repository into the ridge side slope. This would help create a naturally appearing landform.

8.3.1 Overall Protection of Human Health and the Environment

Alternative 5a provides control of site wastes and contaminant transport by the complete removal and encapsulation of BHMS waste rock in a constructed repository. Exposure by ingestion, dermal contact, and/or plant uptake to the adit discharge would be eliminated by the constructed infiltration trench. Under Alternative 5a, the human recreational user would be protected from arsenic and lead exposure in site waste rock and surface water through the ingestion and dermal exposure pathways. Terrestrial wildlife would also be protected from contaminant exposure by dermal contact and ingestion. Plant phytotoxicity due to arsenic, cadmium, lead, and zinc would be mitigated by removing the contaminant source material. Table 35 presents the Alternative 5a risk reduction achievement matrix for the exposure pathways and contaminants identified in the BHMS baseline human health risk assessment and the ecological risk assessment. Only contaminants with an EQ or HI greater than 1 are evaluated in the matrix.

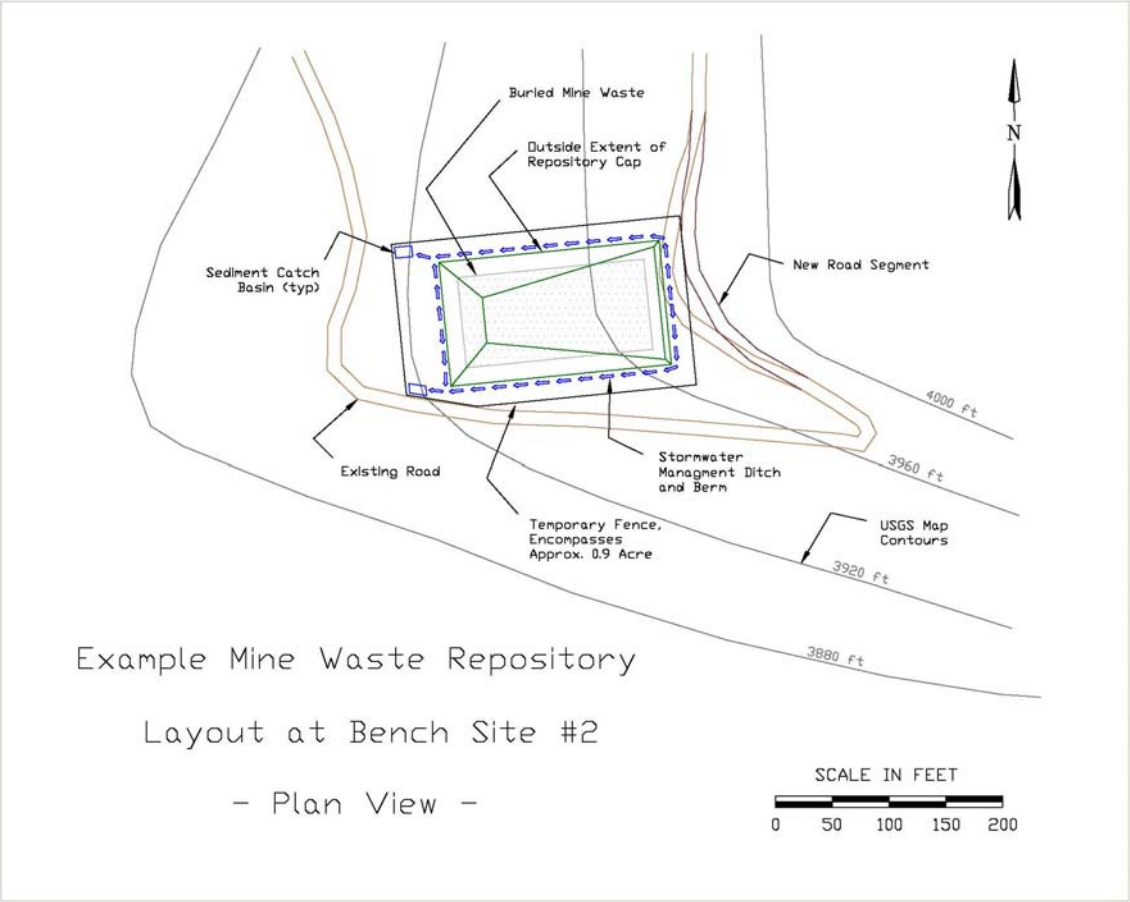

Figure 4. Plan view of conceptual repository.

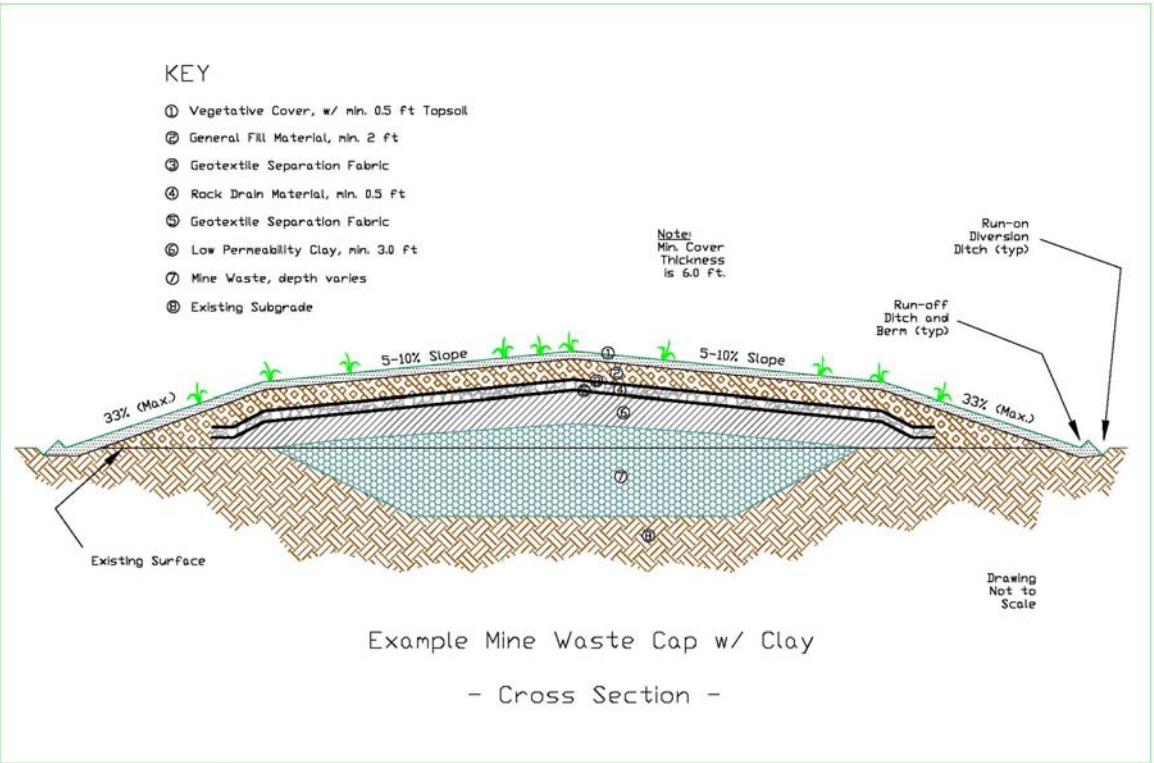

Figure 5. Typical repository cross section with clay cap.

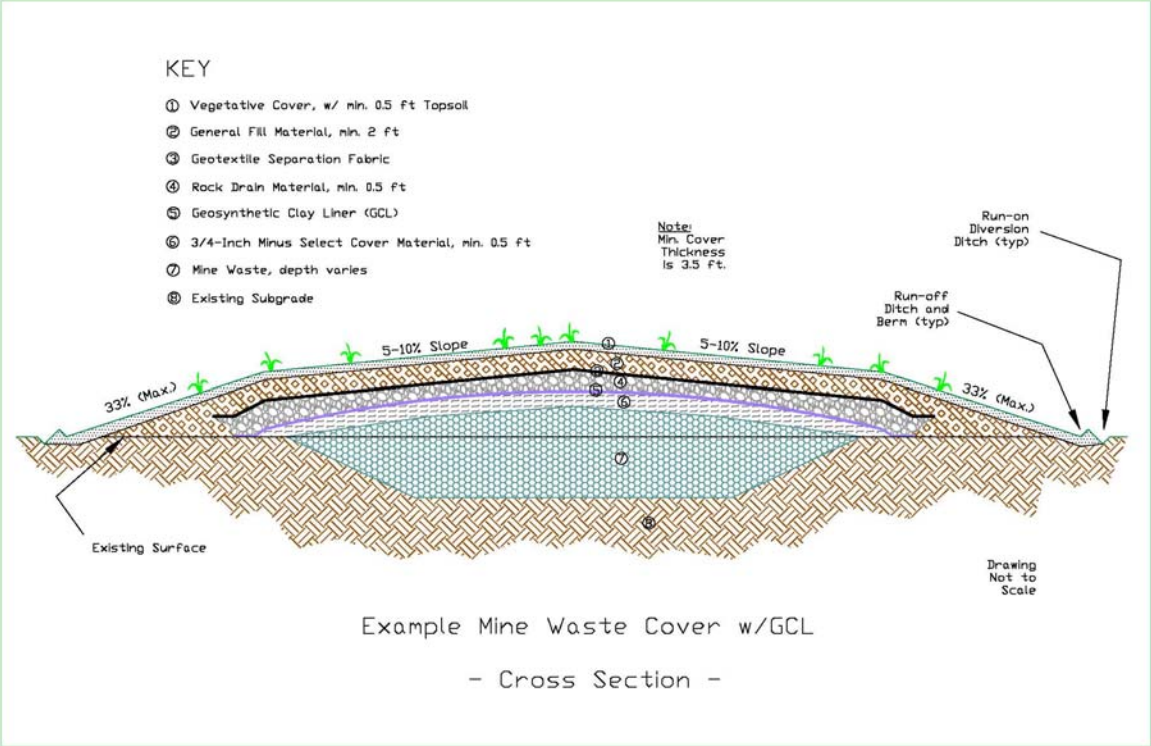

Figure 6. Typical repository cross section with geosynthetic cap.

Table 35. Risk reduction achievement matrix for Alternative 5a.

Arsenic	Cadmium	Copper	Lead	Zinc
Human health exposure pathway: recreational user soil ingestion				
Yes	NA	NA	Yes	NA
Human health exposure pathway: recreational user surface water ingestion				
Yes	NA	NA	Yes	NA
Ecological exposure pathway: deer ingestion				
NA	NA	NA	Yes	NA
Ecological exposure pathway: aquatic life				
NA	Yes	Yes	Yes	Yes
Ecological exposure pathway: plant phytotoxicity				
None	Yes	NA	Yes	Yes
None = No risk reduction achieved Yes = Risk reduction achieved NA = Not applicable; risk reduction not required				

8.3.2 Compliance with ARARS

Implementation of Alternative 5a would meet all location and action-specific ARARs including:

- Evaluation of culturally and historically significant site features has been performed by MDEQ and documented to satisfy the requirements of the National Historic Preservation Act (NHPA), the Montana Antiquities Act, and other historic preservation laws; the USFS will be responsible for final cultural clearance of historic features located on USFS property

- The alternative complies with the Surface Mining Control and Reclamation Act (SMCRA) requirements for revegetation and soil cover protection requirements

- Consultation will be performed by MDEQ and documented to comply with the Endangered Species Act (ESA), and administrative controls designed to be protective of threatened and endangered species are enforced by the USFS

- Occupational Safety and Health Administration (OSHA) requirements for appropriate training, certification, personal protective equipment, and site safety controls will be met by requiring the contractors to comply will all 29 CFR 1910.120 requirements during all construction phases at the BHMS.

Contaminant-specific ARARs are applicable to air quality, surface water, and groundwater quality at the BHMS. State and federal numeric air quality standards would be met by controlling construction-generated dust. Under this alternative, the adit discharge at the lower waste rock dump will be routed to an infiltration trench, effectively eliminating the surface water as an exposure source. This will eliminate

the direct-contact exposure pathway for human recreational users and wildlife. As discussed in the no-action alternative, the status of contaminant-specific ARARs for groundwater is unknown, because groundwater was not characterized during the RI. It is believed that groundwater at the BHMS is found in fractures in the deep bedrock aquifer. Multiple test pits excavated to the bedrock surface at potential repository sites near the BHMS (Portage 2010b) showed no evidence of an alluvial groundwater system.

8.3.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence of Alternative 5a would be ensured by proper design and construction of the repository. The repository would be shaped to promote surface water run-off and to eliminate surface water run-on. The waste would be placed and compacted to minimize settlement over time. The multilayer low-permeability cap would be designed to minimize surface water infiltration and degradation of the cap by root penetration and/or burrowing animals. The soil cover would be designed to promote revegetation of native plant species, further stabilizing the cap and inhibiting surface water infiltration. After the site reclamation is fully vegetated, minimal long-term site monitoring and maintenance will be required

8.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 5a would achieve a major reduction in contaminant mobility by removing the source of contamination and by placing the waste in an engineered repository. The waste would no longer be susceptible to the mobilization of contaminants through the processes of surface water leaching; surface water erosion and contaminant transport; wind erosion and contaminant entrainment; and human disturbance. Waste volume would not be significantly reduced by this alternative and no waste treatment would occur. The toxicity of the waste would not be affected, but the waste would be effectively isolated from the human environment.

8.3.5 Short-Term Effectiveness

Alternative 5a would be implemented in less than 1 year. Implementation steps would include final engineering and preparation of a construction bid package; construction bidding and contracting; construction; and, performance monitoring. Construction would be accomplished in one summer/fall field season. Construction would utilize standard techniques with readily available human, equipment, and material resources.

Short-term environmental impacts from construction would include air-quality and surface-water impacts. These impacts would be effectively mitigated by using water spray for dust suppression during construction and by constructing BMPs for stormwater control. BMPs applicable to Alternative 5a include installing silt fencing; temporary ditch and sedimentation pond construction; utilizing straw bales; installing erosion control matting; construction of berms and other surface water run-on/run-off controls; minimizing reclamation slopes; and, revegetation of disturbed areas.

The BHMS is located in a remote, low-population area and implementation of Alternative 5a would involve a relatively small, short duration construction project. Short-term impacts to the local population are expected to be contained to a slight increase in local vehicle traffic on public roadways and associated public safety impacts; and a slight increase in local economic activity from providing goods and services to construction workers.

8.3.6 Implementability

Alternative 5a is both technically and administratively feasible. The construction methods used to remove the waste, construct a repository, and reclaim site disturbance are considered conventional. Design methods and specifications are well documented and have been implemented successfully at similar sites. Materials, equipment, and human resources are readily available to implement the alternative.

8.3.7 Costs

The total present worth cost of implementing Alternative 5a is estimated to be $250,078. Table 36 presents the details of this estimate. The present worth value of 30 years of annual maintenance and monitoring costs are included in addition to capital costs. The major components of the work on which the costs are based include:

- Contractor mobilization, bonding and insurance
- Repository site clearing, grubbing, excavation, and preparation
- Load and haul waste to the constructed repository
- Place, compact, and shape waste in the constructed repository
- Construct multilayer cap and soil cover (assumes geosynthetic)
- Fill, shape, and regrade HMOs and waste rock excavation areas
- Construct subsurface infiltration trench for adit discharge
- Reseed and mulch final reclaimed areas
- Install temporary fencing around repository perimeter (four strand wire and t-posts)
- Annual inspection and maintenance (30 years).

Table 36. Alternative 5a costs.

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost ($)	Sum
Contractor Mobilization Costs					$22,135
Mobilization, Including Bonding, Insurance, and General Administrative	1	LS	22,135.00	22,135	
Roads, Access, and Site Preparation					$14,420
Stormwater/Sediment BMPs (Straw Bales or Silt Fence)	1	LS	1,000.00	1,000	
Run-on/Run-off Control Ditches and Berms	250	LF	6.00	1,500	
Clearing and Grubbing Mine Waste Areas	2	AC	1,500.00	3,000	
Road and Access Improvements at Mine Site	200	LF	8.00	1,600	
Clearing and Grubbing Repository Site	1	AC	5,000.00	5,000	
General Earthwork (medium bulldozer or excavator)	16	HR	145.00	2,320	
Excavation and Earthwork					$12,163
Remove, Salvage, and Stockpile Topsoil (6 in. at mine site)	1,613	CY	1.50	2,420	
Remove, Salvage, and Stockpile Topsoil (12 in. at repository)	1,613	CY	1.50	2,420	
Excavate Repository	2,465	CY	2.50	6,163	
General Earthwork (medium bulldozer or excavator)	8	HR	145.00	1,160	
Waste Handling, Haul and Disposal					$48,461
Excavate and Load Waste on Haul Trucks	4,127	CY	1.50	6,191	
Special Waste Handling: Timbers and Debris	1	LS	1,000.00	1,000	
Haul Waste to Repository	4,127	CY	4.00	16,508	
Place and Compact Waste Materials	4,127	CY	6.00	24,762	
Repository Cover					$43,093
Furnish and Haul Select	495	CY	15.00	7,422	

Table 36. (continued)

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost ($)	Sum
Fill and Drain Rock					
Place, Grade, and Compact Select Fill Over Waste	247	CY	6.00	1,484	
Furnish and Install Geosynthetic Liner	13,360	SF	1.20	16,032	
Place and Grade Drainage Layer Above Geosynthetic Liner	247	CY	4.00	990	
Furnish and Install Geotextile Separation Layer	13,360	SF	0.40	5,344	
Place and Compact General Fill Soil	1,970	CY	6.00	11,821	
Site Reclamation					$29,433
Replace and Grade Topsoil	3,227	CY	2.00	6,453	
Seeding, Fertilizer, Mulch on All Disturbed Areas	3	AC	4,000.00	12,000	
Final Earthwork and Grading (medium bulldozer or excavator)	24	HR	145.00	3,480	
Infiltration Trench	1	LS	2,500.00	2,500	
HMO Closures	1	LS	3,000.00	3,000	
Temporary Fence Around Repository	600	LF	2.50	1,500	
Gate	1	LS	500.00	500	
Subtotal of Capital Costs				$169,705	
Contingency	10%	of subtotal capital cost		$16,971	
TOTAL CAPITAL COST					$186,676
PRSC Annual Cost					$2,640
Administration and Inspection	1	LS	500.00	500	
Signs and Site Security	1	LS	100.00	100	
Weed Management	1	LS	300.00	300	
Erosion Prevention and Maintenance	1	LS	1,500.00	1,500	
Contingency	10%	of	2,400.00	240	
Present Value Analysis (2010 Dollars)					
Time Before Start of	1	Year			

Table 36. (continued)

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost ($)	Sum
Construction					
Annual Discount Rate	1.25%	APR (Based on OMB Circular No. A-94, Appendix C)			
Single Payment Present Worth Factor, (P/F, i, n)	0.9877				
Annual PRSC Duration	30	Year			
Uniform Series Present Worth Factor, (P/A, i, n)	24.8889				
Present Value of Capital Cost				184,371	
Present Value of Annual Cost				65,707	
TOTAL PRESENT VALUE COST					**$250,078**

AC = Acre
CY = Calendar year
HR = Hour
LF = Linear feet
LS = Lump sum
SF = Square foot

8.4 Alternative 5b: Disposal in a Constructed Repository at Road Bench Site #2

Alternative 5b involves complete removal and disposal of waste rock from the upper and lower waste rock dumps and disposal of the waste in a constructed repository at Road Bench Site #2. Figure 3 shows Road Bench Site #2 in relation to the BHMS. The reclamation work scope for Alternative 5b would be identical to that of Alternative 5a, except that the waste repository would be constructed at Road Bench Site #2. The predicted volume of waste is the same, HMO mitigation would be performed, and the intermittent seep associated with the lower waste rock dump adit would be eliminated in a subsurface infiltration trench.

Road Bench Site #2 is located on a sloping ridge accessed by FR 2290 and, at approximately ¼ mile, is the nearest potential repository site to the BHMS. Although it has the smallest useable acreage of the four potential repository sites, there is adequate area for repository construction. At an elevation of approximately 3,920 ft amsl, Road Bench Site #2 is the potential repository site with the highest elevation and it is likely the most hydrologically isolated. The topography of the ridge provides sufficient useable surface area for repository construction and provides the opportunity to contour the repository into the ridge side slope. This would help create a naturally appearing landform.

8.4.1 Overall Protection of Human Health and the Environment

Alternative 5b provides control of site wastes and contaminant transport by the complete removal and encapsulation of BHMS waste rock in a constructed repository. Exposure by ingestion, dermal contact, and/or plant uptake to the adit discharge would be eliminated by the constructed infiltration trench. Under Alternative 5b, the human recreational user would be protected from arsenic and lead

exposure in site waste rock and surface water through the ingestion and dermal exposure pathways. Terrestrial wildlife would also be protected from contaminant exposure by dermal contact and ingestion. Plant phytotoxicity due to arsenic, cadmium, lead, and zinc would be mitigated by removing the contaminant source material. Table 37 presents the Alternative 5b risk reduction achievement matrix for the exposure pathways and contaminants identified in the BHMS baseline human health risk assessment and the ecological risk assessment. Only contaminants with an EQ or HI greater than 1 are evaluated in the matrix.

Table 37. Risk reduction achievement matrix for Alternative 5b.

Arsenic	Cadmium	Copper	Lead	Zinc
Human health exposure pathway: recreational user soil ingestion				
Yes	NA	NA	Yes	NA
Human health exposure pathway: recreational user surface water ingestion				
Yes	NA	NA	Yes	NA
Ecological exposure pathway: Deer ingestion				
NA	NA	NA	Yes	NA
Ecological exposure pathway: Aquatic life				
NA	Yes	Yes	Yes	Yes
Ecological exposure pathway: Plant phytotoxicity				
None	Yes	NA	Yes	Yes
None = No risk reduction achieved Yes = Risk reduction achieved NA = Not applicable; risk reduction not required				

8.4.2 Compliance with ARARS

Implementation of Alternative 5b would meet all location and action-specific ARARs including:

- Evaluation of culturally and historically significant site features has been performed by MDEQ and documented to satisfy the requirements of the NHPA, the Montana Antiquities Act, and other historic preservation laws; the USFS will be responsible for final cultural clearance of historic features located on USFS property

- The alternative complies with the SMCRA requirements for revegetation and soil cover protection requirements

- Consultation will be performed by MDEQ and documented to comply with the ESA, and administrative controls designed to be protective of threatened and endangered species are enforced by the USFS

- OSHA requirements for appropriate training, certification, personal protective equipment, and site safety controls will be met by requiring the contractors to comply will all 29 CFR 1910.120 requirements during all construction phases at the BHMS.

Contaminant-specific ARARs are applicable to air quality, surface water, and groundwater quality at the BHMS. State and federal numeric air quality standards would be met by controlling construction-generated dust. Under this alternative, the adit discharge at the lower waste rock dump will be routed to an infiltration trench, effectively eliminating the surface water. This will eliminate the direct-contact exposure pathway for human recreational users and wildlife. As discussed in the no-action alternative, the status of contaminant specific ARARs for groundwater is unknown because groundwater was not characterized during the RI. It is believed that groundwater at the BHMS is found in fractures in the deep bedrock aquifer. Multiple test pits excavated to the bedrock surface at potential repository sites near the BHMS (Portage 2010b) showed no evidence of an alluvial groundwater system.

8.4.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence of Alternative 5b would be ensured by proper design and construction of the repository. The repository would be shaped to promote surface water run-off and to eliminate surface water run-on. The waste would be placed and compacted to minimize settlement over time. The multilayer low-permeability cap would be designed to minimize surface water infiltration and degradation of the cap by root penetration and/or burrowing animals. The soil cover would be designed to promote revegetation of native plant species, further stabilizing the cap and inhibiting surface water infiltration. After the site reclamation is fully vegetated, minimal long-term site monitoring and maintenance will be required

8.4.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 5b would achieve a major reduction in contaminant mobility by removing the source of contamination and by placing the waste in an engineered repository. The waste would no longer be susceptible to the mobilization of contaminants through the processes of surface water leaching; surface water erosion and transport; wind erosion and entrainment; and human disturbance. Waste volume would not be significantly reduced by this alternative, and no waste treatment would occur. The toxicity of the waste would not be affected, but the waste would be effectively isolated from the human environment.

8.4.5 Short-Term Effectiveness

Alternative 5b would be implemented in less than 1 year. Implementation steps would include final engineering and preparation of a construction bid package; construction bidding and contracting; construction; and performance monitoring. Construction would be accomplished in one summer/fall field season. Construction would utilize standard techniques with readily available human, equipment, and material resources.

Short-term environmental impacts from construction would include air-quality and surface-water impacts. These impacts would be effectively mitigated by using water spray for dust suppression during construction and by constructing BMPs for stormwater control. BMPs applicable to Alternative 5b include installing silt fencing; temporary ditch and sedimentation pond construction; utilizing straw bales;

installing erosion control matting; construction of berms and other surface water run-on/run-off controls; minimizing reclamation slopes; and revegetation of disturbed areas.

The BHMS is located in a remote, low-population area, and implementation of Alternative 5b would involve a relatively small, short-duration construction project. Short-term impacts to the local population are expected to be contained to a slight increase in local vehicle traffic on public roadways and associated public safety impacts and a slight increase in local economic activity from providing goods and services to construction workers.

8.4.6 Implementability

Alternative 5b is both technically and administratively feasible. The construction methods used to remove the waste, construct a repository, and reclaim site disturbance are considered conventional. Design methods and specifications are well documented and have been implemented successfully at similar sites. Materials, equipment, and human resources are readily available to implement the alternative.

8.4.7 Costs

The total present worth cost of implementing Alternative 5b is estimated to be $245,507. Table 38 presents the details of this estimate. The present worth value of 30 years of annual maintenance and monitoring costs are included in addition to capital costs. The major components of the work on which the costs are based are identical to Alternative 5a. Alternative 5b costs are less than those of Alternative 5a because of the shorter distance required for waste hauling to the newly constructed repository.

Table 38. Alternative 5b costs.

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost ($)	Sum
Contractor Mobilization Costs					$21,587
Mobilization, Including Bonding, Insurance, and General Administration Costs	1	LS	21,587.00	21,587	
Roads, Access, and Site Preparation					$15,920
Stormwater/Sediment BMPs (Straw Bales or Silt Fence)	1	LS	1,000.00	1,000	
Run-on/Run-off Control Ditches and Berms	100	LF	6.00	600	
Clearing and Grubbing Mine Waste Areas	2	AC	1,500.00	3,000	
Road and Access Improvements at Mine Site	200	LF	8.00	1,600	
Clearing and Grubbing Repository Site	1	AC	5,000.00	5,000	
Re-align Existing Road at Repository Site	300	LF	8.00	2,400	
General Earthwork (medium	16	HR	145.00	2,320	

Table 38. (continued)

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost ($)	Sum
bulldozer or excavator)					
Excavation and Earthwork					$12,163
Remove, Salvage, and Stockpile Topsoil (6 in. at mine site)	1,613	CY	1.50	2,420	
Remove, Salvage, and Stockpile Topsoil (12 in. at repository)	1,613	CY	1.50	2,420	
Excavate Repository	2,465	CY	2.50	6,163	
General Earthwork (medium bulldozer or excavator)	8	HR	145.00	1,160	
Waste Handling, Haul and Disposal					$43,302
Excavate and Load Waste on Haul Trucks	4,127	CY	1.50	6,191	
Special Waste Handling: Timbers and Debris	1	LS	1,000.00	1,000	
Haul Waste to Repository	4,127	CY	2.75	11,349	
Place and Compact Waste Materials	4,127	CY	6.00	24,762	
Repository Cover					$43,093
Furnish and Haul Select Fill and Drain Rock	495	CY	15.00	7,422	
Place, Grade, and Compact Select Fill Over Waste	247	CY	6.00	1,484	
Furnish and Install Geosynthetic Liner	13,360	SF	1.20	16,032	
Place and Grade Drainage Layer Above Geosynthetic Liner	247	CY	4.00	990	
Furnish and Install Geotextile Separation Layer	13,360	SF	0.40	5,344	
Place and Compact General Fill Soil	1,970	CY	6.00	11,821	
Site Reclamation					$29,433
Replace and Grade Topsoil	3,227	CY	2.00	6,453	
Seeding, Fertilizer, Mulch on All Disturbed Areas	3	AC	4,000.00	12,000	
Final Earthwork and Grading (medium bulldozer or excavator)	24	HR	145.00	3,480	
Infiltration Trench	1	LS	2,500.00	2,500	
HMO Closures	1	LS	3,000.00	3,000	

Table 38. (continued)

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost ($)	Sum
Temporary Fence Around Repository	600	LF	2.50	1,500	
Gate	1	LS	500.00	500	
Subtotal of Capital Costs				$165,498	
Contingency	10%	of subtotal capital cost		$16,550	
TOTAL CAPITAL COST					$182,048
PRSC Annual Cost					$2,640
Administration and Inspection	1	LS	500.00	500	
Signs and Site Security	1	LS	100.00	100	
Weed Management	1	LS	300.00	300	
Erosion Prevention and Maintenance	1	LS	1,500.00	1,500	
Contingency	10%	Of	2,400.00	240	
Present Value Analysis (2010 Dollars)					
Time Before Start of Construction	1	Year			
Annual Discount Rate	1.25%	APR (Based on OMB Circular No. A-94, Appendix C)			
Single Payment Present Worth Factor, (P/F, i, n)	0.9877				
Annual PRSC Duration	30	Years			
Uniform Series Present Worth Factor, (P/A, i, n)	24.8889				
Present Value of Capital Cost				179,800	
Present Value of Annual Cost				65,707	
TOTAL PRESENT VALUE COST					**$245,507**

AC = Acre
CY = Calendar year
HR = Hour
LF = Linear feet
LS = Lump sum
SF = Square foot

8.5 Alternative 5c: Disposal in a Constructed Repository at Blue Creek Bench

Alternative 5c involves complete removal and disposal of waste rock from the upper and lower waste rock dumps and disposal of the waste in a constructed repository at Blue Creek Bench. Figure 3 shows the Blue Creek Bench site in relation to the BHMS. The reclamation work scope for Alternative 5c would be identical to that of Alternative 5a, except that the waste repository would be constructed at Blue Creek Bench. The predicted volume of waste is the same, HMO mitigation would be performed, and

the intermittent seep associated with the lower waste rock dump adit would be eliminated in a subsurface infiltration trench.

Blue Creek Bench is located in the valley floor approximately one mile southwest of the BHMS near the East Fork of Blue Creek. At an elevation of approximately 2,660 ft amsl, Blue Creek Bench is the potential repository site at the lowest elevation and the nearest to a significant surface water feature. The Blue Creek Bench site is the second farthest from the BHMS at approximately 1 mile from the BHMS. The topography of the bench is relatively flat, and a balanced cut-and-fill repository would appear as a mounded feature on the landscape. The Blue Creek Bench site has the most useable acreage of all the repository sites investigated.

8.5.1 Overall Protection of Human Health and the Environment

Alternative 5c provides control of site wastes and contaminant transport by the complete removal and encapsulation of BHMS waste rock in a constructed repository. Exposure by ingestion, dermal contact, and/or plant uptake to the adit discharge would be eliminated by the constructed infiltration trench. Under Alternative 5c, the human recreational user would be protected from arsenic and lead exposure in site waste rock and surface water through the ingestion and dermal exposure pathways. Terrestrial wildlife would also be protected from contaminant exposure by dermal contact and ingestion. Plant phytotoxicity due to arsenic, cadmium, lead, and zinc would be mitigated by removing the contaminant source material. Table 39 presents the Alternative 5c risk reduction achievement matrix for the exposure pathways and contaminants identified in the BHMS baseline human health risk assessment and the ecological risk assessment. Only contaminants with an EQ or HI greater than 1 are evaluated in the matrix.

Table 39. Risk reduction achievement matrix for Alternative 5c.

Arsenic	Cadmium	Copper	Lead	Zinc
Human health exposure pathway: recreational user soil ingestion				
Yes	NA	NA	Yes	NA
Human health exposure pathway: recreational user surface water ingestion				
Yes	NA	NA	Yes	NA
Ecological exposure pathway: Deer ingestion				
NA	NA	NA	Yes	NA
Ecological exposure pathway: Aquatic life				
NA	Yes	Yes	Yes	Yes
Ecological exposure pathway: Plant phytotoxicity				
None	Yes	NA	Yes	Yes
None = No risk reduction achieved Yes = Risk reduction achieved NA = Not applicable; risk reduction not required				

8.5.2 Compliance with ARARS

Implementation of Alternative 5c would meet all location and action-specific ARARs including:

- Evaluation of culturally and historically significant site features has been performed by MDEQ and documented to satisfy the requirements of the NHPA, the Montana Antiquities Act, and other historic preservation laws; the USFS will be responsible for final cultural clearance of historic features located on USFS property
- The alternative complies with the SMCRA requirements for revegetation and soil cover protection requirements
- Consultation will be performed by MDEQ and documented to comply with the ESA, and administrative controls designed to be protective of threatened and endangered species are enforced by the USFS
- OSHA requirements for appropriate training, certification, personal protective equipment, and site safety controls will be met by requiring the contractors to comply will all 29 CFR 1910.120 requirements during all construction phases at the BHMS.

Contaminant-specific ARARs are applicable to air quality, surface-water quality, and groundwater quality at the BHMS. State and federal numeric air quality standards would be met by controlling construction-generated dust. Under this alternative, the adit discharge at the lower waste rock dump will be routed to an infiltration trench, effectively eliminating the surface water. This will eliminate the direct contact exposure pathway for human recreational users and wildlife. As discussed in the no-action alternative, the status of contaminant specific ARARs for groundwater is unknown, because groundwater was not characterized during the RI. It is believed that groundwater at the BHMS is found in fractures in the deep bedrock aquifer. Multiple test pits excavated to the bedrock surface at potential repository sites near the BHMS (Portage 2010a) showed no evidence of an alluvial groundwater system.

8.5.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence of Alternative 5c would be ensured by proper design and construction of the repository. The repository would be shaped to promote surface water run-off and to eliminate surface water run-on. The waste would be placed and compacted to minimize settlement over time. The multilayer low-permeability cap would be designed to minimize surface water infiltration and degradation of the cap by root penetration and/or burrowing animals. The soil cover would be designed to promote revegetation of native plant species, further stabilizing the cap and inhibiting surface water infiltration. After the site reclamation is fully vegetated, minimal long-term site monitoring and maintenance will be required

8.5.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 5c would achieve a major reduction in contaminant mobility by removing the source of contamination and by placing the waste in an engineered repository. The waste would no longer be susceptible to the mobilization of contaminants through the processes of surface water leaching; surface water erosion and contaminant transport; wind erosion and contaminant entrainment; and human

disturbance. Waste volume would not be significantly reduced by this alternative, and no waste treatment would occur. The toxicity of the waste would not be affected, but the waste would be effectively isolated from the human environment.

8.5.5 Short-Term Effectiveness

Alternative 5c would be implemented in less than 1 year. Implementation steps would include final engineering and preparation of a construction bid package; construction bidding and contracting; construction; and performance monitoring. Construction would be accomplished in one summer/fall field season. Construction would utilize standard techniques with readily available human, equipment, and material resources.

Short-term environmental impacts from construction would include air-quality and surface-water impacts. These impacts would be effectively mitigated by using water spray for dust suppression during construction and by constructing BMPs for stormwater control. BMPs applicable to Alternative 5c include installing silt fencing; temporary ditch and sedimentation pond construction; utilizing straw bales; installing erosion control matting; construction of berms and other surface water run-on/run-off controls; minimizing reclamation slopes; and revegetation of disturbed areas.

The BHMS is located in a remote, low-population area, and implementation of Alternative 5c would involve a relatively small, short-duration construction project. Short-term impacts to the local population are expected to be contained to a slight increase in local vehicle traffic on public roadways and associated public safety impacts and a slight increase in local economic activity from providing goods and services to construction workers.

8.5.6 Implementability

Alternative 5c is both technically and administratively feasible. The construction methods used to remove the waste, construct a repository, and reclaim site disturbance are considered conventional. Design methods and specifications are well documented and have been implemented successfully at similar sites. Materials, equipment, and human resources are readily available to implement the alternative.

8.5.7 Costs

The total present worth cost of implementing Alternative 5c is estimated to be $268,662. Table 40 presents the details of this estimate. The present worth value of 30 years of annual maintenance and monitoring costs are included in addition to capital costs. The major components of the work on which the costs are based are identical to Alternative 5a. Alternative 5c costs are more than those of Alternative 5a and 5b, because of the longer distance required for waste hauling to the newly constructed repository.

Table 40. Alternative 5c costs.

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost ($)	Sum
Contractor Mobilization Costs					$24,367
Mobilization, Including Bonding, Insurance, and	1	LS	24,366.66	24,367	

Table 40. (continued)

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost ($)	Sum
General Administrative Costs					
Roads, Access, and Site Preparation					$15,320
Stormwater/Sediment BMPs (Straw Bales or Silt Fence)	1	LS	1,000.00	1,000	
Run-on/Run-off Control Ditches and Berms	400	LF	6.00	2,400	
Clearing and Grubbing Mine Waste Areas	2	AC	1,500.00	3,000	
Road and Access Improvements at Mine Site	200	LF	8.00	1,600	
Clearing and Grubbing Repository Site	1	AC	5,000.00	5,000	
General Earthwork (medium bulldozer or excavator)	16	HR	145.00	2,320	
Excavation and Earthwork					$11,793
Remove, Salvage, and Stockpile Topsoil (6 in. at mine site)	1,613	CY	1.50	2,420	
Remove, Salvage, and Stockpile Topsoil (12 in. at repository)	1,613	CY	1.50	2,420	
Excavate Repository	2,317	CY	2.50	5,793	
General Earthwork (medium bulldozer or excavator)	8	HR	145.00	1,160	
Waste Handling, Haul and Disposal					$66,000
Excavate and Load Waste on Haul Trucks	4,127	CY	1.50	6,191	
Special Waste Handling: Timbers and Debris	1	LS	1,000.00	1,000	
Haul Waste to Repository	4,127	CY	8.25	34,048	
Place and Compact Waste Materials	4,127	CY	6.00	24,762	

Table 40. (continued)

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost ($)	Sum
Repository Cover					$39,898
Furnish and Haul Select Fill and Drain Rock	454	CY	15.00	6,817	
Place, Grade, and Compact Select Fill Over Waste	227	CY	6.00	1,363	
Furnish and Install Geosynthetic Liner	12,271	SF	1.20	14,725	
Place and Grade Drainage Layer Above Geosynthetic Liner	227	CY	4.00	909	
Furnish and Install Geotextile Separation Layer	12,271	SF	0.40	4,908	
Place and Compact General Fill Soil	1,863	CY	6.00	11,175	
Site Reclamation					$29,433
Replace and Grade Topsoil	3,227	CY	2.00	6,453	
Seeding, Fertilizer, Mulch on All Disturbed Areas	3	AC	4,000.00	12,000	
Final Earthwork and Grading (medium bulldozer or excavator)	24	HR	145.00	3,480	
Infiltration Trench	1	LS	2,500.00	2,500	
HMO Closures	1	LS	3,000.00	3,000	
Temporary Fence Around Repository	600	LF	2.50	1,500	
Gate	1	LS	500.00	500	
Subtotal of Capital Costs				$186,811	
Contingency	10%	of subtotal capital cost		$18,681	
TOTAL CAPITAL COST					$205,492
PRSC Annual Cost					$2,640
Administration and Inspection	1	LS	500.00	500	
Signs and Site Security	1	LS	100.00	100	
Weed Management	1	LS	300.00	300	
Erosion Prevention and Maintenance	1	LS	1,500.00	1,500	
Contingency	10%	of	2,400.00	240	

Table 40. (continued)

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost ($)	Sum
Present Value Analysis (2010 Dollars)					
Time Before Start of Construction	1	year			
Annual Discount Rate	1.25%	APR (Based on OMB Circular No. A-94, Appendix C)			
Single Payment Present Worth Factor, (P/F, i, n)	0.9877				
Annual PRSC Duration	30	Years			
Uniform Series Present Worth Factor, (P/A, i, n)	24.8889				
Present Value of Capital Cost				202,995	
Present Value of Annual Cost				65,707	
TOTAL PRESENT VALUE COST					**$268,662**

AC = Acre
CY = Calendar year
HR = Hour
LF = Linear feet
LS = Lump sum
SF = Square foot

8.6 Alternative 5d: Disposal in a Constructed Repository at Fatman Saddle

Alternative 5d involves complete removal and disposal of waste rock from the upper and lower waste rock dumps and disposal of the waste in a constructed repository at Fatman Saddle. Figure 3 shows the Fatman Saddle Site in relation to the BHMS. The reclamation work scope for Alternative 5d would be identical to that of Alternative 5a, except that the waste repository would be constructed at Fatman Saddle. The predicted volume of waste is the same, HMO mitigation would be performed, and the intermittent seep associated with the lower waste rock dump adit would be eliminated in a subsurface infiltration trench.

Fatman Saddle is a prominent saddle off the northeastern flank of Fatman Mountain approximately 1 mile south of the BHMS at an elevation of approximately 3,480 ft amsl. The Fatman Saddle site has the farthest haul distance from the BHMS, and significant road improvements would have to be performed for waste hauling to be feasible. The topography of the saddle is relatively flat, and a balanced cut-and-fill repository would appear as a somewhat mounded feature on the landscape.

8.6.1 Overall Protection of Human Health and the Environment

Alternative 5d provides control of site wastes and contaminant transport by the complete removal and encapsulation of BHMS waste rock in a constructed repository. Exposure by ingestion, dermal contact, and/or plant uptake to the adit discharge would be eliminated by the constructed infiltration

trench. Under Alternative 5d, the human recreational user would be protected from arsenic and lead exposure in site waste rock and surface water through the ingestion and dermal exposure pathways. Terrestrial wildlife would also be protected from contaminant exposure by dermal contact and ingestion. Plant phytotoxicity due to arsenic, cadmium, lead, and zinc would be mitigated by removing the contaminant source material. Table 41 presents the Alternative 5d risk reduction achievement matrix for the exposure pathways and contaminants identified in the BHMS baseline human health risk assessment and the ecological risk assessment. Only contaminants with an EQ or HI greater than 1 are evaluated in the matrix.

Table 41. Risk reduction achievement matrix for Alternative 5d.

Arsenic	Cadmium	Copper	Lead	Zinc
Human health exposure pathway: recreational user soil ingestion				
Yes	NA	NA	Yes	NA
Human health exposure pathway: recreational user surface water ingestion				
Yes	NA	NA	Yes	NA
Ecological exposure pathway: Deer ingestion				
NA	NA	NA	Yes	NA
Ecological exposure pathway: Aquatic life				
NA	Yes	Yes	Yes	Yes
Ecological exposure pathway: Plant phytotoxicity				
None	Yes	NA	Yes	Yes
None = No risk reduction achieved Yes = Risk reduction achieved NA = Not applicable; risk reduction not required				

8.6.2 Compliance with ARARS

Implementation of Alternative 5d would meet all location and action-specific ARARs including:

- Evaluation of culturally and historically significant site features has been performed by MDEQ and documented to satisfy the requirements of the NHPA, the Montana Antiquities Act, and other historic preservation laws; the USFS will be responsible for final cultural clearance of historic features located on USFS property
- The alternative complies with the SMCRA requirements for revegetation and soil cover protection requirements
- Consultation will be performed by MDEQ and documented to comply with the ESA, and administrative controls designed to be protective of threatened and endangered species are enforced by the USFS

- OSHA requirements for appropriate training, certification, personal protective equipment, and site safety controls will be met by requiring the contractors to comply will all 29 CFR 1910.120 requirements during all construction phases at the BHMS.

Contaminant-specific ARARs are applicable to air quality, surface-water quality, and groundwater quality at the BHMS. State and federal numeric air quality standards would be met by controlling construction-generated dust. Under this alternative the adit discharge at the lower waste rock dump will be routed to an infiltration trench, effectively eliminating the surface water. This will eliminate the direct exposure pathway for human recreational users and wildlife. As discussed in the no-action alternative, the status of contaminant-specific ARARs for groundwater is unknown, because groundwater was not characterized during the RI. It is believed that groundwater at the BHMS is found in fractures in the deep bedrock aquifer. Multiple test pits excavated to the bedrock surface at potential repository sites near the BHMS (Portage 2010b) showed no evidence of an alluvial groundwater system.

8.6.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence of Alternative 5d would be ensured by proper design and construction of the repository. The repository would be shaped to promote surface water run-off and to eliminate surface water run-on. The waste would be placed and compacted to minimize settlement over time. The multilayer low-permeability cap would be designed to minimize surface water infiltration and degradation of the cap by root penetration and/or burrowing animals. The soil cover would be designed to promote revegetation of native plant species, further stabilizing the cap and inhibiting surface water infiltration. After the site reclamation is fully vegetated, minimal long-term site monitoring and maintenance will be required.

8.6.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 5d would achieve a major reduction in contaminant mobility by removing the source of contamination and by placing the waste in an engineered repository. The waste would no longer be susceptible to the mobilization of contaminants through the processes of surface water leaching; surface water erosion and contaminant transport; wind erosion and contaminant entrainment; and human disturbance. Waste volume would not be significantly reduced by this alternative and no waste treatment would occur. The toxicity of the waste would not be affected, but the waste would be effectively isolated from the human environment.

8.6.5 Short-Term Effectiveness

Alternative 5d would be implemented in less than 1 year. Implementation steps would include final engineering and preparation of a construction bid package; construction bidding and contracting; construction; and performance monitoring. Construction would be accomplished in one summer/fall field season. Construction would utilize standard techniques with readily available human, equipment, and material resources.

Short-term environmental impacts from construction would include air-quality and surface-water impacts. These impacts would be effectively mitigated by using water spray for dust suppression during construction and by constructing BMPs for stormwater control. BMPs applicable to Alternative 5d include installing silt fencing; temporary ditch and sedimentation pond construction; utilizing straw bales;

installing erosion control matting; construction of berms and other surface water run-on/run-off controls; minimizing reclamation slopes; and revegetation of disturbed areas.

The BHMS is located in a remote, low-population area and implementation of Alternative 5d would involve a relatively small, short duration construction project. Short-term impacts to the local population are expected to be contained to a slight increase in local vehicle traffic on public roadways and associated public safety impacts and a slight increase in local economic activity from providing goods and services to construction workers.

8.6.6 Implementability

Alternative 5d is both technically and administratively feasible. The construction methods used to remove the waste, construct a repository, and reclaim site disturbance are considered conventional. Design methods and specifications are well documented and have been implemented successfully at similar sites. Materials, equipment, and human resources are readily available to implement the alternative.

8.6.7 Costs

The total present worth cost of implementing Alternative 5d is estimated to be $303,520. Table 42 presents the details of this estimate. The present worth value of 30 years of annual maintenance and monitoring costs are included in addition to capital costs. The major components of the work on which the costs are based are identical to Alternative 5a. Alternative 5d costs are the highest of all of the USFS land repository alternatives because of the required road improvements and the long waste hauling distance to the newly constructed repository.

Table 42. Alternative 5d costs.

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost($)	Sum
Contractor Mobilization Costs					$28,552
Mobilization, Including Bonding, Insurance, and General Administration Costs	1	LS	28,551.66	28,552	
Roads, Access, and Site Preparation					$43,220
Stormwater/Sediment BMPs (Straw Bales or Silt Fence)	1	LS	1,000.00	1,000	
Run-on/Run-off Control Ditches and Berms	400	LF	6.00	2,400	
Clearing and Grubbing Mine Waste Areas	2	AC	1,500.00	3,000	
Road and Access Improvements at Mine Site	200	LF	8.00	1,600	
Clearing and Grubbing Repository Site	1	AC	5,000.00	5,000	
Restore Existing Road to Repository Site	6,300	LF	3.00	18,900	

Table 42. (continued)

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost($)	Sum
Forest Road Completion (construction in rocky ground)	300	LF	30.00	9,000	
General Earthwork (medium bulldozer or excavator)	16	HR	145.00	2,320	
Excavation and Earthwork					$11,793
Remove, Salvage, and Stockpile Topsoil (6 in. at mine site)	1,613	CY	1.50	2,420	
Remove, Salvage, and Stockpile Topsoil (12 in. at repository)	1,613	CY	1.50	2,420	
Excavate Repository	2,317	CY	2.50	5,793	
General Earthwork (medium bulldozer or excavator)	8	HR	145.00	1,160	
Waste Handling, Haul and Disposal					$66,000
Excavate and Load Waste on Haul Trucks	4,127	CY	1.50	6,191	
Special Waste Handling: Timbers and Debris	1	LS	1,000.00	1,000	
Haul Waste to Repository	4,127	CY	8.25	34,048	
Place and Compact Waste Materials	4,127	CY	6.00	24,762	
Repository Cover					$39,898
Furnish and Haul Select Fill and Drain Rock	454	CY	15.00	6,817	
Place, Grade, and Compact Select Fill Over Waste	227	CY	6.00	1,363	
Furnish and Install Geosynthetic Liner	12,271	SF	1.20	14,725	
Place and Grade Drainage Layer Above Geosynthetic Liner	227	CY	4.00	909	
Furnish and Install Geotextile Separation Layer	12,271	SF	0.40	4,908	
Place and Compact General Fill Soil	1,863	CY	6.00	11,175	
Site Reclamation					$29,433
Replace and Grade Topsoil	3,227	CY	2.00	6,453	
Seeding, Fertilizer, Mulch on All Disturbed Areas	3	AC	4,000.00	12,000	

Table 42. (continued)

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost($)	Sum
Final Earthwork and Grading (medium bulldozer or excavator)	24	HR	145.00	3,480	
Infiltration Trench	1	LS	2,500.00	2,500	
HMO Closures	1	LS	3,000.00	3,000	
Temporary Fence Around Repository	600	LF	2.50	1,500	
Gate	1	LS	500.00	500	
Subtotal of Capital Costs				$218,896	
Contingency	10%	of subtotal capital cost		$21,890	
TOTAL CAPITAL COST					$240,786
PRSC Annual Cost					$2,640
Administration and Inspection	1	LS	500.00	500	
Signs and Site Security	1	LS	100.00	100	
Weed Management	1	LS	300.00	300	
Erosion Prevention and Maintenance	1	LS	1,500.00	1,500	
Contingency	10%	of	2,400.00	240	
Present Value Analysis (2010 Dollars)					
Time Before Start of Construction	1	Year			
Annual Discount Rate	1.25%	APR (Based on OMB Circular No. A-94, Appendix C)			
Single Payment Present Worth Factor, (P/F, i, n)	0.9877				
Annual PRSC Duration	30	Year			
Uniform Series Present Worth Factor, (P/A, i, n)	24.8889				
Present Value of Capital Cost				237,813	
Present Value of Annual Cost				65,707	
TOTAL PRESENT VALUE COST					**$303,520**

AC = Acre
CY = Cubic yard
HR = Hour
LF = Linear feet
LS = Lump sum
SF = Square foot

8.7 Alternative 6: Offsite Disposal in Permitted Solid Waste Disposal Facility

Alternative 6 involves complete removal and disposal of waste rock from the upper and lower waste rock dumps and disposal of the waste in an offsite permitted solid waste disposal facility (municipal landfill). The excavated waste would be hauled by dump truck to a nearby municipal landfill that would accept the waste (i.e., Libby or Missoula, Montana). A tipping fee would be paid to the landfill owner on a cubic yard basis for waste disposal. Once accepted by the landfill, the waste would be disposed of according to Montana solid waste disposal regulations.

The reclamation work scope for Alternative 6 would be identical to that of Alternative 5a, except that the waste would be hauled to the nearest municipal landfill that would accept the waste, and no repository would be constructed. The predicted volume of waste is the same, HMO mitigation would be performed, and the intermittent seep associated with the lower waste rock dump adit would be eliminated in a subsurface infiltration trench.

8.7.1 Overall Protection of Human Health and the Environment

Alternative 6 provides control of site wastes and contaminant transport by the complete removal and encapsulation of BHMS waste rock in an offsite municipal landfill. Exposure by ingestion, dermal contact, and/or plant uptake to the adit discharge would be eliminated by the constructed infiltration trench. Under Alternative 6, the human recreational user would be protected from arsenic and lead exposure from contact with site waste rock and surface water through ingestion and dermal exposure pathways. Terrestrial wildlife would also be protected from contaminant exposure by ingestion. Plant phytotoxicity due to arsenic, cadmium, lead, and zinc would be mitigated by removing the contaminant source material.

Alternative 6 provides the most overall protection of human health and the environment of all alternatives evaluated, because the waste would be disposed of in a fully contained facility with a bottom liner, multilayer cap, and leachate collection system. The facility would also be subject to the design, operation, and closure standards of the Montana Solid Waste Management Act and EPA Subpart D regulations at 40 CFR 258. Table 43 presents the Alternative 6 risk reduction achievement matrix for the exposure pathways and contaminants identified in the BHMS baseline human health risk assessment and ecological risk assessment. Only contaminants with an EQ or HI greater than 1 are evaluated in the matrix.

Table 43. Risk reduction achievement matrix for Alternative 6.

Arsenic	Cadmium	Copper	Lead	Zinc
Human health exposure pathway: recreational user soil ingestion				
Yes	NA	NA	Yes	NA
Human health exposure pathway: recreational user surface water ingestion				
Yes	NA	NA	Yes	NA

Table 43. (continued)

Arsenic	Cadmium	Copper	Lead	Zinc
Ecological exposure pathway: deer ingestion				
NA	NA	NA	Yes	NA
Ecological exposure pathway: aquatic life				
NA	Yes	Yes	Yes	Yes
Ecological exposure pathway: plant phytotoxicity				
None	Yes	NA	Yes	Yes
None = No risk reduction achieved Yes = Risk reduction achieved NA = Not applicable, risk reduction not required				

8.7.2 Compliance with ARARS

Implementation of Alternative 6 would meet all location and action-specific ARARs including:

- Evaluation of culturally and historically significant site features has been performed by MDEQ and documented to satisfy the requirements of the NHPA, the Montana Antiquities Act, and other historic preservation laws; the USFS will be responsible for final cultural clearance of historic features located on USFS property
- The alternative complies with the SMCRA requirements for revegetation and soil cover protection requirements
- Consultation will be performed by MDEQ and documented to comply with the ESA, and administrative controls designed to be protective of threatened and endangered species are enforced by the USFS
- OSHA requirements for appropriate training, certification, personal protective equipment, and site safety controls will be met by requiring the contractors to comply will all 29 CFR 1910.120 requirements during all construction phases at the BHMS.

Contaminant-specific ARARs are applicable to air quality, surface-water quality, and groundwater quality at the BHMS. State and federal numeric air quality standards would be met by controlling construction-generated dust. Under this alternative the adit discharge at the lower waste rock dump will be routed to an infiltration trench, effectively eliminating the surface water. This will eliminate the direct contamination exposure pathway for human recreational users and wildlife. As discussed in the no-action alternative, the status of contaminant-specific ARARs for groundwater is unknown, because groundwater was not characterized during the RI. It is believed that groundwater at the BHMS is found in fractures in the deep bedrock aquifer. Multiple test pits excavated to the bedrock surface at potential repository sites near the BHMS (Portage 2010a) showed no evidence of an alluvial groundwater system.

8.7.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence of Alternative 6 would be ensured by the design, construction, operation, and closure standards of the Montana Solid Waste Management Act and EPA Subpart D regulations at 40 CFR 258 for municipal solid waste landfills. Reclaimed features at the BHMS would be revegetated, and once vegetative cover is established, minimal long-term site monitoring and maintenance will be required

8.7.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 6 would achieve a major reduction in contaminant mobility by removing the source of contamination and by placing the waste in an offsite municipal landfill. The waste would no longer be susceptible to the mobilization of contaminants through the processes of surface water leaching; surface water erosion and contaminant transport; wind erosion and contaminant entrainment; and human disturbance. Waste volume would not be significantly reduced by this alternative, and no waste treatment would occur. The toxicity of the waste would not be affected, but the waste would be effectively isolated from the human environment.

8.7.5 Short-Term Effectiveness

Alternative 6 would be implemented in less than 1 year. Implementation steps would include final engineering and preparation of a construction bid package; construction bidding and contracting; construction; and performance monitoring. Construction would be accomplished in one summer/fall field season. Construction would utilize standard techniques with readily available human, equipment, and material resources.

Short-term environmental impacts from construction would include air-quality and surface-water impacts. These impacts would be effectively mitigated by using water spray for dust suppression during construction and by constructing BMPs for stormwater control. BMPs applicable to Alternative 6 include installing silt fencing; temporary ditch and sedimentation pond construction; utilizing straw bales; installing erosion control matting; construction of berms and other surface water run-on/run-off controls; minimizing reclamation slopes; and revegetation of disturbed areas.

The BHMS is located in a remote, low-population area, and implementation of Alternative 6 would involve a relatively small, short-duration construction project. Short-term impacts to the local population are expected to be contained to a slight increase in local vehicle traffic on public roadways and associated public safety impacts and a slight increase in local economic activity from providing goods and services to construction workers.

8.7.6 Implementability

Alternative 6 is both technically and administratively feasible. The construction methods used to remove the waste, transport the waste, and reclaim site disturbance are considered conventional. Design methods and specifications are well documented and have been implemented successfully at similar sites. Materials, equipment, and human resources are readily available to implement the alternative.

8.7.7 Costs

The total present worth cost of implementing Alternative 6 is estimated to be $645,769. Table 44 presents the details of this estimate. The present worth value of 3 years of annual maintenance and monitoring costs are included in addition to capital costs. The major components of the work on which the costs are based are as follows:

- Mobilization, bonding, and insurance
- Load and haul waste to the offsite municipal landfill
- Fill, shape, and regrade HMOs and waste rock excavation areas
- Construct subsurface infiltration trench for adit discharge
- Reseed and mulch final reclaimed areas
- Annual inspection and maintenance (3 years).

Alternative 6 costs are the highest of all of the alternatives considered because of the long waste hauling distance and tipping fees at the municipal landfill.

Table 44. Alternative 6 costs.

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost($)	Sum
Contractor Mobilization Costs					$77,221
Mobilization, Including Bonding, Insurance, and General Administrative Costs	1	LS	38,840.28	38,840	
Roads, Access, and Site Preparation					$6,260
Stormwater/Sediment BMPs (Straw Bales or Silt Fence)	1	LS	500.00	500	
Clearing and Grubbing Mine Waste Areas	2	AC	1,500.00	3,000	
Road and Access Improvements at Mine Site	200	LF	8.00	1,600	
General Earthwork (medium bulldozer or excavator)	8	HR	145.00	1,160	
Excavation and Earthwork					$3,580
Remove, Salvage, and Stockpile Topsoil (6 in. at mine site)	1,613	CY	1.50	2,420	
General Earthwork (medium bulldozer or excavator)	8	HR	145.00	1,160	
Waste Handling, Haul and Disposal					$485,923
Excavate and Load Waste on	4,127	CY	1.50	6,191	

Table 44. (continued)

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost($)	Sum
Haul Trucks					
Special Waste Handling: Timbers and Debris	1	LS	1,000.00	1,000	
Haul Waste to Permitted Landfill	4,127	CY	81.00	334,287	
Landfill Disposal Fee	4,127	CY	35.00	144,445	
Site Reclamation					$19,047
Replace and Grade Topsoil	1,613	CY	2.00	3,227	
Seeding, Fertilizer, Mulch on All Disturbed Areas	2	AC	4,000.00	8,000	
Infiltration Trench	1	LS	2,500.00	2,500	
HMO Closures	1	LS	3,000.00	3,000	
Final Earthwork and Grading (medium bulldozer or excavator)	16	HR	145.00	2,320	
Subtotal of Capital Costs				$592,031	
Contingency	10%	of subtotal capital cost		$59,203	
TOTAL CAPITAL COST					$3651,234
PRSC Annual Cost					$880
Administration and Inspection	1	LS	500.00	500	
Signs and Site Security	1	LS	100.00	100	
Weed Management	1	LS	200.00	200	
Contingency	10%	of	800.00	80	
Present Value Analysis (2010 Dollars)					
Time Before Start of Construction	1	Year			
Annual Discount Rate	1.25%	APR (Based on OMB Circular No. A-94, Appendix C)			
Single Payment Present Worth Factor, (P/F, i, n)	0.9877				
Annual PRSC Duration	3	Year			
Uniform Series Present Worth Factor, (P/A, i, n)	2.9265				
Present Value of Capital Cost				643,194	
Present Value of Annual Cost				2,575	
TOTAL PRESENT VALUE COST					**$645,769**

AC = Acre
CY = Cubic yard
HR = Hour

Table 44. (continued)

Activity/Material/Description	Quantity	Unit	Unit Price ($)	Cost($)	Sum
LF = Linear feet LS = Lump sum					

9. COMPARATIVE ANALYSIS OF RECLAMATION ALTERNATIVES

The purpose of this section is to summarize the results of the detailed analysis of reclamation alternatives and to provide a direct comparison of the retained alternatives to the threshold and primary balancing criteria. The threshold criteria are (1) protectiveness of human health and the environment and (2) compliance with ARARs. The retained reclamation alternatives are:

- Alternative 1 – no action
- Alternative 5a – disposal in a constructed repository at Road Bench Site #1
- Alternative 5b – disposal in a constructed repository at Road Bench Site #2
- Alternative 5c – disposal in a constructed repository at Blue Creek Bench
- Alternative 5d – disposal in a constructed repository at Fatman Saddle
- Alternative 6 – offsite disposal at a permitted solid waste disposal facility.

Table 45 presents a summary of the alternatives with respect to the evaluation criteria.

9.1 Threshold Criteria

Alternative 1, the no-action alternative, would not be protective of human health and the environment nor would it achieve compliance with ARARs. The contaminant exposure pathways would remain and risks to human health, and ecological receptors would remain at unacceptable levels. Because there is no contaminant-specific ARARs applicable to the mine waste rock at the BHMS, the cleanup goal for site reclamation is of solid media is risk based. These risk-based goals would not be achieved under the no-action alternative.

Alternatives 5a through 5d, removal of waste rock and disposal of waste rock in a constructed repository on USFS lands, are almost identical in terms of the comparative analysis, since the primary difference between the alternatives is the location of the repository. Each of these alternatives is protective of human health and the environment, since they effectively isolate site waste rock from environmental receptors in an engineered repository with a multilayer low-permeability cap. The repository would have no bottom liner or leachate collection sump, but contaminant mobility would likely be completely eliminated, because the repository cap would prevent surface water infiltration through the waste rock and subsequent leaching of contaminants into the subsurface.

Each of these alternatives is compliant with contaminant, location, and action-specific ARARs. Each alternative would protect human and ecological receptors from COCs in surface water associated with the lower waste rock dump adit seep. Each alternative is compliant with applicable historic preservation laws and regulations. The BHMS is located in a special management area for grizzly bears, a threatened species. During construction of an repository on USFS land alternative, compliance with management area administrative rules would be ensured through coordination with the USFS.

In the context of environmental protectiveness, Alternative 5d (the Blue Creek Bench Site) is the least desirable of these alternatives because of its proximity to a significant surface water feature (the East Fork of Blue Creek). The Blue Creek Bench site is also likely to be the one with the shallowest groundwater, because the site is located in the valley floor at the lowest elevation of the four sites considered. The distance to these environmental receptors makes the site less desirable than the others considered in the unlikely event that the repository integrity is degraded at some future time. Blue Creek Bench is also the potential repository site most easily accessed by recreational and other forest users, because motorized vehicle travel is permitted on the segment of FR 2290 adjacent to the Blue Creek Bench site. Motorized vehicle access to the other repository sites is restricted by the USFS.

Table 45. Comparative analysis of reclamation alternatives.

Assessment Criteria	Alternative 1. No Action	Alternative 5a. Disposal at Road Bench Site #1	Alternative 5b. Disposal at Road Bench Site #2	Alternative 5c. Disposal at Blue Creek Bench Site	Alternative 5d. Disposal at Fatman Saddle	Alternative 6. Offsite Disposal at Permitted Solid Waste Disposal Facility
Threshold Criteria						
Overall protection of human health	Not protective. No human health risk reduction	Protective. Achieves project reclamation objective and risk-based cleanup goals. Site access controlled by USFS	Protective. Achieves project reclamation objective and risk-based cleanup goals. Site access controlled by USFS	Protective. Achieves project reclamation objective and risk-based cleanup goals. Site easily accessed by public	Protective. Achieves project reclamation objective and risk-based cleanup goals. Site access controlled by USFS	Protective. Achieves project reclamation objective and risk-based cleanup goals. Most protective – waste isolated in fully contained facility
Overall protection of environment	Not protective. No ecological risk reduction	Protective. Achieves project reclamation objective and risk-based cleanup goals. Site isolated from groundwater and surface-water resources	Protective. Achieves project reclamation objective and risk-based cleanup goals. Site isolated from groundwater and surface-water resources	Protective. Achieves project reclamation objective and risk-based cleanup goals. Site is nearer groundwater and surface-water resources	Protective. Achieves project reclamation objective and risk-based cleanup goals	Protective. Achieves project reclamation objective and risk-based cleanup goals. Most protective – waste isolated in fully contained facility
Compliance with ARARs						
Contaminant specific	Does not comply with ARARs for surface water	Complies with ARARs for surface water	Complies with ARARs for surface water	Complies with ARARs for surface water	Complies with ARARs for surface water	Complies with ARARs for surface water
Location specific	None apply	Complies with applicable ARARs. Coordination with USFS to ensure compliance with administrative requirements within grizzly bear protection zone during construction	Complies with applicable ARARs. Coordination with USFS to ensure compliance with administrative requirements within grizzly bear protection zone during construction	Complies with applicable ARARs. Coordination with USFS to ensure compliance with administrative requirements within grizzly bear protection zone during construction	Complies with applicable ARARs. Coordination with USFS to ensure compliance with administrative requirements within grizzly bear protection zone during construction	Complies with applicable ARARs. Coordination with USFS to ensure compliance with administrative requirements within grizzly bear protection zone during construction
Action specific	None apply	Complies with applicable ARARs	Complies with applicable ARARs	Complies with applicable ARARs	Complies with applicable ARARs	Complies with applicable ARARs
Primary Balancing Criteria						
Long-term effectiveness and permanence	Not effective. Exposure hazards, pathways, and transport mechanisms will continue to exist	Effective. High overall risk reduction. Site wastes will be reliably isolated from human and ecological receptors	Effective. High overall risk reduction. Site wastes will be reliably isolated from human and ecological receptors	Effective. High overall risk reduction. Site wastes will be reliably isolated from human and ecological receptors. Site most easily accessed and susceptible to human disturbance	Effective. High overall risk reduction. Site wastes will be reliably isolated from human and ecological receptors	Most effective. High overall risk reduction. Site wastes will be reliably isolated from human and ecological receptors in fully contained facility
Reduction of toxicity, mobility, and volume through treatment	No reduction of toxicity, mobility, and volume	No treatment. However, site waste will be consolidated and isolated from human and ecological receptors	No treatment. However, site waste will be consolidated and isolated from human and ecological receptors	No treatment. However, site waste will be consolidated and isolated from human and ecological receptors	No treatment. However, site waste will be consolidated and isolated from human and ecological receptors	No treatment. However, site waste will be consolidated and isolated from human and ecological receptors. Fully contained facility offers the most environmental isolation

Table 45. (continued)

Assessment Criteria	Alternative 1. No Action	Alternative 5a. Disposal at Road Bench Site #1	Alternative 5b. Disposal at Road Bench Site #2	Alternative 5c. Disposal at Blue Creek Bench Site	Alternative 5d. Disposal at Fatman Saddle	Alternative 6. Offsite Disposal at Permitted Solid Waste Disposal Facility
Short-term effectiveness	Not applicable	Minimal impacts to community, environmental impacts from construction effectively mitigated by dust suppression and stormwater BMPs. Site workers to have appropriate training. Reclamation objective achieved in one construction season	Minimal impacts to community, environmental impacts from construction effectively mitigated by dust suppression and stormwater BMPs. Site nearest the BHMS; offers the minimum construction-related environmental impacts. Site workers to have appropriate training. Reclamation objective achieved in one construction season	Minimal impacts to community, environmental impacts from construction effectively mitigated by dust suppression and stormwater BMPs. Site workers to have appropriate training. Reclamation objective achieved in one construction season	Minimal impacts to community, environmental impacts from construction effectively mitigated by dust suppression and stormwater BMPs. Site farthest from the BHMS; results in the most construction-related environmental impacts. Site workers to have appropriate training. Reclamation objective achieved in one construction season	Minimal impacts to community, environmental impacts from construction effectively mitigated by dust suppression and stormwater BMPs. Site workers to have appropriate training. Highest increase in local truck traffic and associated hazards. Reclamation objective achieved in one construction season
Implementability	Not applicable	Implemented with standard construction techniques and equipment. Labor, equipment, and materials are readily and locally available.	Implemented with standard construction techniques and equipment. Labor, equipment, and materials are readily and locally available.	Implemented with standard construction techniques and equipment. Labor, equipment, and materials are readily and locally available.	Implemented with standard construction techniques and equipment. Labor, equipment, and materials are readily and locally available.	Implemented with standard construction techniques and equipment. Labor, equipment, and materials are readily and locally available.
Cost	$0	$250,078	$245,507	$268,662	$303,520	$645,769

Alternative 6, the removal of BHMS waste rock and disposal in an offsite permitted solid waste disposal facility is also protective of human health and the environment. It effectively isolates site waste rock from environmental receptors and eliminates contaminant mobility. Furthermore, this alternative is compliant with ARARs. Similar to Alternatives 5a through 5d, Alternative 6 would protect human and ecological receptors from COCs in surface water associated with the lower waste rock dump adit seep.

Comparatively, Alternative 6 is the alternative which provides the maximum protection to human health and the environment. This is because the BHMS wastes would be disposed of in a fully contained facility with a bottom liner, multilayer cap, and leachate collection system. The facility would also be subject to the design, operation, and closure standards of the Montana Solid Waste Management Act and EPA Subpart D regulations at 40 CFR Part 258.

USFS gate at the bottom of FR 2290 access to the BHMS

9.2 Primary Balancing Criteria

Alternative 1, the no-action alternative, has no applicability to the primary balancing criteria because:

1. It has no long-term effectiveness or permanence

2. It does not achieve reduction of toxicity through mobility or reduction of volume through treatment

3. It has no short-term effectiveness

4. It would not be implemented

5. There would be no cost associated with it.

Alternatives 5a through 5d compare almost identically in terms of the primary balancing criteria with the exception of cost and minor differences in short-term effectiveness. Each has long-term effectiveness and permanence; achieves reduction of contaminant mobility; is effective short-term; and may be readily implemented with conventional construction techniques. The cost differential of implementing one of these alternatives is primarily driven by the cost of hauling waste rock from the BHMS to the repository. Because Road Bench Site #2 is the shortest haul distance, it is the least costly of the alternatives considered. Conversely, Fatman Saddle is the farthest haul distance, would require significant road improvements to implement, and would be the most costly to implement. Because Road Bench #2 is the shortest haul distance, it would also have the least amount of short-term environmental impact from construction-related fugitive dust and land disturbance. With the farthest haul distance, Fatman Saddle would have comparatively more short-term environmental impacts from construction-related fugitive dust and land disturbance. Worker safety can be ensured during construction for all alternatives through required training, dust suppression, protective clothing, and other appropriate site controls.

Alternative 6 is also effective long term; is permanent; achieves reduction of contaminant mobility; is effective short term; and may be readily implemented with conventional construction techniques. Alternative 6, however, is the most costly of all of the alternatives considered. The long haul and tipping fees at the municipal landfill elevate the costs of this alternative. Alternative 6 would also result in the highest increase in local truck traffic and associated hazards, because dump trucks would be hauling multiple loads of waste on local highways.

10. PREFFERED ALTERNATIVE

Reclamation of the BHMS will consist of complete removal and disposal of the two waste rock dumps; closing two HMOs; elimination of the intermittent surface water seep at the lower waste rock dump adit; site regrading and contouring; and site revegetation. These actions are designed to achieve the project reclamation objective of limiting human and ecological exposure to mine-related contaminants and reducing the mobility of those contaminants through associated solid media and surface water exposure pathways by:

- Achieving risk-based cleanup goals for metals in site waste rock and surface water

- Eliminating the arsenic and lead ingestion and dermal contact contamination pathways to the recreational site user and wildlife through contact with site waste rock and surface water

- Eliminating the contaminant transport pathways associated with site waste rock erosion and leaching and surface water transport.

Based on the detailed analysis of alternatives and on the conclusions of the comparative analysis of alternatives, each of the alternatives analyzed with the exception of the no-action alternative would achieve the project reclamation objective.

Alternative 6, offsite disposal in a permitted solid waste disposal facility, is the most protective of human health and the environment but only slightly more so than alternatives for disposal of waste in a constructed repository on USFS land. Alternative 6 however, is cost prohibitive in comparison to the other disposal alternatives. The long haul distance and tipping fees associated with waste disposal at a municipal landfill elevate the costs of Alternative 6.

Alternatives 5a through 5d, disposal in a constructed repository on USFS land, are protective of human health and the environment and are cost effective. The primary difference between these alternatives is the location of the repository on USFS lands. All of the potential repository sites are located on land entirely under the control of the USFS. Of these alternatives, Alternative 5b, disposal of waste in a constructed repository at Road Bench Site #2, is the lowest cost because of the short haul distance from the BHMS.

Road Bench Site #2 also offers environmental protection advantages over other sites analyzed. Because it offers the shortest haul distance from the BHMS, construction activities will generate less fugitive dust. Road Bench Site #2 is the highest elevation site and is potentially the most hydrologically isolated. The local topography of the site will allow for shaping the repository into the slope of the bench, creating a more naturally appearing landform. Road Bench Site #2 is also one of the least publicly accessible sites analyzed, because motor vehicle travel is limited to individuals authorized by the USFS.

Based on the comparative analysis summarized above, disposal of waste rock in a constructed repository at Road Bench Site #2 (Alternative 5b) is the preferred alternative for reclamation of the BHMS. This alternative is considered the most cost effective while providing an appropriate level of protection to human health and the environment. In summary, the BHMS reclamation work that would be performed under Alternative 5b includes complete removal of waste rock at the upper and lower waste rock dumps and disposal of the waste in a repository constructed at Road Bench Site #2; closure of two HMOs; routing the lower waste rock dump adit discharge to a constructed infiltration trench; site grading and contouring; and revegetation. The waste repository will consist of a below grade, balanced, cut-and-fill impoundment with a multilayer low-permeability cap and soil cover.

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APPENDIX A
DESCRIPTION OF FEDERAL AND STATE ARARs

(MDEQ 2010)

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

(ARARS)

FOR

ABANDONED MINE LANDS RECLAMATION PROJECTS

DECEMBER, 2010

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ARARS FOR ABANDONED MINE LANDS RECLAMATION PROJECTS

1.0 INTRODUCTON- HISTORY OF ARARS AT ABANDONED MINE LANDS RECLAMATION SITES

After the enactment of the Federal Surface Mining Control and Reclamation Act in 1977 ("SMCRA", 30 USC §§ 1201-1238), the State of Montana (State) was delegated the authority to implement the Abandoned Mine Lands Reclamation ("AMLR") program and was granted funding for implementation of that program, by the Federal Office of Surface Mining, Reclamation, and Enforcement ("OSM"). The State enacted necessary legislation to implement the AMLR program according to State law and developed a plan ("Reclamation Plan") to do so, which was approved by OSM. Delegation of exclusive authority for the program would follow. Montana passed necessary legislation for reclamation of coal mines (*The Montana Strip and Underground Reclamation Act,* 82-4-201, *et seq.*, MCA), as well as legislation for reclamation of other types of mines (*The Metal Mine Reclamation* Act, 82-4-301, *et seq.*, MCA and *The Opencut Mining Act,* 82-4-401, *et seq.*, MCA).

Satisfaction of the requirements of SMCRA by the State resulted in delegation by OSM to the State the exclusive authority to implement the Reclamation Plan on November 24, 1980. While the delegation of the program in 1980 was limited to abandoned coal mine reclamation, it was expanded by Montana's showing it had reclaimed all eligible abandoned coal mines, whereupon OSM approved the 1995 amendments to the State's Reclamation Plan to include non-coal abandoned mines. This approval resulted in additional delegation of authority to the State to implement reclamation of abandoned hardrock mines as well as quarries.

In the 1995 Amendments to its Reclamation Plan, the State of Montana stated that the AMLR program would comply with the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"). 40 Code of Federal Regulations (CFR) Part 300 (1990). Among other things, the NCP provides a procedure for evaluating alternative cleanup methods for hazardous wastes. The NCP also establishes cleanup standards for hazardous wastes, referred to as Applicable or Relevant and Appropriate Requirements ("ARARs"). By requiring compliance with the NCP, the State adopted the NCP procedures for evaluation of alternatives in addressing AMLR Reclamation Projects, as well as ARARS. In addition, the evaluation of alternatives procedures found in the NCP satisfy the requirements of the National Environmental Policy Act ("NEPA", 42 USC 4321 – 4370) to
evaluate alternatives where actions undertaken could have a significant effect on the environment.

AMLR, which is based upon SMCRA, is one of several legal authorities available in the State for cleanup of mine wastes, the others being the Federal Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA" or "Superfund", 42 USC 9601 – 9675) and the State's counterpart to the Federal Superfund law, the Comprehensive Environmental Cleanup and Responsibility Act ("CECRA," §§ 75-10-701 - 752 MCA).

The ARARs described below are, by necessity, generic because they are to be used as part of the evaluation process developed by the AMLR program for analysis of alternatives for AMLR Projects. This evaluation results in the Expanded Engineering Evaluation/Cost Analysis ("EEE/CA") which precedes selection of a Reclamation alternative.

2.0 TYPES OF ARARS

ARARs are either "applicable" or "relevant and appropriate." Both types of requirements are mandatory under the NCP. Applicable requirements are those cleanup standards, standards of control, requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, or contaminant, remedial action, location or other circumstances found at a abandoned mine reclamation site.

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to hazardous substances, pollutants, contaminants, remedial actions, locations, or other circumstances at a mining reclamation site, address problems or situations sufficiently similar to those found at the mining reclamations site that their use is well suited to the particular site.

The determination that a requirement is relevant and appropriate is a two-step process: (1) determination if a requirement is relevant; and (2) determination if a requirement is appropriate. In general, this involves a comparison of a number of site-specific factors, including an examination of the purpose of the requirement and the purpose of the proposed CERCLA action; the medium and substances regulated by the requirement and the proposed requirement; the actions or activities regulated by the requirement and the remedial action; and the potential use of resources addressed in the requirement and the remedial action. When the analysis results in a determination that a requirement is both relevant and appropriate, such a requirement must be complied with to the same degree as if it were an applicable requirement.

ARARs are divided into contaminant specific, location specific, or action specific requirements, as described in the NCP and EPA Guidance. Contaminant specific requirements address chemical or physical characteristics of compounds or substances on sites. These values establish acceptable amounts or concentrations of chemicals which may be found in or discharged to the ambient environment. Location specific requirements are restrictions placed upon the concentrations of hazardous substances or the conduct of cleanup activities because they are in specific locations. Location specific ARARs relate to the geographical or physical positions of sites, rather than to the nature of contaminants at sites. Action specific requirements are usually technology based or activity based requirements or limitations on actions taken with respect to hazardous substances, pollutants or contaminants. A given cleanup activity will trigger an action specific requirement. Such requirements do not themselves determine the cleanup alternative, but define how chosen cleanup methods should be performed.

Each ARAR or group of related ARARs indentified herein is followed by a specific statutory or regulatory citation, a classification describing whether the ARAR is applicable or relevant and appropriate, and a description which summarizes the requirements.

Many requirements listed as ARARs are promulgated as identical or nearly identical requirements in both federal and state law, usually pursuant to delegated environmental programs administered by both EPA and the states, such as many of the requirements of the federal Clean Water Act and the Montana Water Quality Act. The Preamble to the NCP states that such a situation results in citation to the state provision as the appropriate standard, but treatment of the provisions is a federal requirement. ARARs and other laws which are unique to state law are identified as state ARARs.

As noted previously, the 1995 Reclamation Plan provides that the NCP was adopted for Reclamation activities. Reclamation activities are directly analogous to "removal actions" under CERCLA. As stated in the NCP at 55 Federal Register (Fed. Reg.) 8695 (March 8, 1990):

> The purpose of removal actions generally is to respond to a release…so as to prevent, minimize, or mitigate harm to human health and the environment. Although all removals must be protective…removals are distinct from remedial actions in that they may mitigate or stabilize the threat rather than comprehensively address all the threats at a site. Consequently, removal actions cannot be expected to attain all ARARs. Remedial actions, in contrast, must comply with all ARARs or obtain a waiver. (emphasis added).

Consequently, the NCP, at 40 CFR 300.410 provides that ARARS at removal actions:

> …shall, to the extent practicable, considering the exigencies of the situation, attain…[ARARs]. In determining whether compliance with ARARs is practicable, the lead agency may consider appropriate factors, including:
>
> a) the urgency of the situation; and
>
> b) the scope of the removal action to be conducted.

Therefore, based upon the NCP, after an ARAR has been identified for a Reclamation activity, the EEE/CA should evaluate how the alternatives will attain ARARs and select an alternative that complies with ARARs to the extent practicable. If an ARAR cannot be complied with, the EEE/CA should indicate why, utilizing the two part test set out above, attainment is not practicable.

3.0 CONTAMINANT-SPECIFIC ARARs

3.1 Federal

3.1.1 Safe Drinking Water Act

Safe Drinking Water Act, 42 U.S.C. ' 300f, et seq., National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141 and 142 (relevant and appropriate). The National Primary and Secondary Drinking Water Regulations (40 CFR Parts 141 and 143) establish maximum contaminant levels (MCL) for chemicals in drinking water distributed in public water systems. These are enforceable in Montana under the Public Water Supplies, Distribution, and Treatment Act and corresponding regulations, MCA ' 75-6-101, *et seq.*, and ARM ' 17.38.203. Safe Drinking Water Act MCLs are relevant and appropriate for reclamation projects because the groundwater in a reclamation project area is a potential source of drinking water.

The determination that the drinking water standards are relevant and appropriate for reclamation projects is supported by the regulations and guidance. The Preamble to the NCP clearly states that the MCLs are relevant and appropriate for ground or surface water that is a current or potential source of drinking water. *See* 55 Fed. Reg. 8750, March 8, 1990, and 40 CFR ' 300.430(e)(2)(I)(B). MCLs developed under the Safe Drinking Water Act generally are ARARs for current or potential drinking water sources. *See EPA Guidance On Remedial Action For Contaminated Groundwater at Superfund Sites*, OSWER Dir. #9283.1-2, December 1988.

In addition, maximum contaminant level goals (MCLG) may also be relevant and appropriate. *See* 55 Fed. Reg. 8750-8752. MCLGs are health-based goals that are established at levels at which no known or anticipated adverse effects on the health of persons occur and which allow an adequate margin of safety. According to the NCP, MCLGs that are set at levels above zero must be attained for ground or surface waters that are current or potential sources of drinking water. Where the MCLG for a contaminant has been set at a level of zero, the MCL promulgated for that contaminant must be attained.

The MCLs and MCLGs for contaminants of concern are:

Contaminant	MCL (mg/L)	MCLG[a] (mg/L)
Antimony	0.006	0.006
Arsenic	0.01	NE
Cadmium	0.005[b]	0.005[b]
Copper	1.3[c]	1.3[c]
Iron	0.3[d]	NE
Lead	0.015[c]	0
Manganese	0.05[d]	NE
Mercury	0.002[b]	0.002[b]
Silver	0.10[d]	NE
Thallium	0.002[b]	0.0005
Zinc	5.0[d]	NE

NE - Not Established

[a] 40 CFR ' 141.51(b)
[b] 40 CFR ' 141.62(c)
[c] 40 CFR ' 141.80(c) B No MCL, but specifies BAT to be applied.
[d] 40 CFR ' 143.3 B Secondary MCL

ARM 17.38.203 incorporates by reference into State law the MCLs for inorganic substances set forth in 40 CFR Part 141 (Primary Drinking Water Standards).

3.1.2 Clean Water Act

Federal Surface Water Quality Requirements, Clean Water Act, 33 USC ' 1251, *et seq.* (applicable). As provided under Section 303 of the Clean Water Act, 33 U.S.C. ' 1313, the State of Montana has promulgated water quality standards. See the discussion concerning State surface water quality requirements.

3.1.3 National Ambient Air Quality Standards

National Ambient Air Quality Standards, 40 CFR ' 50.6 (PM-10); 40 CFR ' 50.12 (lead) (applicable). These provisions establish standards for PM-10 and lead emissions to air. (Corresponding state standards are found at ARM ' 17.8.222 [lead] and ARM ' 17.8.223 [PM-10].

3.2 State

3.2.1 Groundwater Protection

Application of Groundwater Standards and Basis for Classificaitons, ARM 17.30.1005 (applicable). Explains the applicability and basis for the groundwater standards in ARM ' 17.30.1006, which establish the maximum allowable changes in groundwater quality and may limit discharges to groundwater.

Classification, Beneficial Uses and Specific Standards for Groundwater, ARM 17.30.1006 (applicable). Provides that groundwater is classified into Classes I through IV based on its specific conductance and establishes the applicable groundwater quality standards with respect to each groundwater classification.

Concentrations of dissolved substances in Class I or II groundwater may not exceed the human health standards listed in department Circular DEQ-7.[3] These levels are listed below for the primary contaminants of concern.

[3] Montana Department of Environmental Quality, Water Quality Division, Circular DEQ-7, Montana Numeric Water Quality Standards (August 2010).

Contaminant	DEQ-7 Standard (µg/L)[a]
Antimony	6
Arsenic	10
Cadmium	5
Copper	1,300
Iron	NE[b]
Lead	15
Manganese	NE[b]
Mercury	2
Silver	100
Thallium	2
Zinc	2,000

NE- Not Established

[a] DEQ-7 standards for metals and arsenic in ground water are based on the dissolved portion of the sample (after filtration through a 0.45 Φm membrane filter).

[b] Concentrations of iron and manganese must not reach values that interfere with the uses specified in the surface and groundwater standards (ARM 17.30.601 et seq. and ARM 17.30.1001 et seq.). The secondary maximum contaminant levels of 300 Φg/L for iron and 50 Φg/L for manganesemay be considered guidance to determine levels that will interfere with the specified uses.

Reclamation activities must meet the DEQ-7 standards for all contaminants at a site. In addition, for Class I and Class II groundwater, no increase of a parameter may cause a violation of Section 75-5-303, MCA (nondegradation).

ARM 17.30.1006 requires that concentrations of other dissolved or suspended substances must not exceed levels that render the waters harmful, detrimental or injurious to public health. Maximum allowable concentrations of these substances also must not exceed acute or chronic problem levels that would adversely affect existing or designated beneficial uses of groundwater of that classification.

Nondegredation, ARM 17.30.1011 (applicable).

Provides that any groundwater whose existing quality is higher than the standard for its classification must be maintained at that high quality in accordance with Section 75-5-303, MCA, and ARM Title 17, Chapter 30, Subchapter 7.

An additional concern with respect to ARARs for groundwater is the impact of groundwater upon surface water. If significant loadings of contaminants from groundwater sources to any surface water within a Reclamation Project contribute to the inability of the stream to meet classification standards, then alternatives to alleviate such groundwater loading must be evaluated and, if appropriate, implemented. Groundwater in certain areas may have to be remediated to levels

more stringent than the groundwater classification standards in order to achieve the standards for affected surface water. *See* Compliance with Federal Water Quality Criteria, OSWER Publication 9234.2-09/FS (June 1990) (AWhere the ground water flows naturally into the surface water, the ground-water remediation should be designed so that the receiving surface-water body will be able to meet any ambient water-quality standards [such as State WQSs or FWQC] that may be ARARs for the surface water.@)

3.2.2 Montana Water Quality Act

State of Montana Surface Water Quality Requirements, Montana Water Quality Act, Section 75-5-101, *et seq.*, MCA, and implementing regulations (applicable). The Clean Water Act, 33 U.S.C. ' 1251, *et seq.*, provides the authority for each state to adopt water quality standards (40 CFR Part 131) designed to protect beneficial uses of each water body and requires each state to designate uses for each water body. The Montana Water Quality Act, 75-5-101, *et seq*., MCA, establishes requirements to protect, maintain and improve the quality of surface and groundwater. Montana's regulations classify State waters according to quality, place restrictions on the discharge of pollutants to State waters, and prohibit degradation of State waters. Pursuant to this authority and the criteria established by Montana surface water quality regulations, ARM ' 17.30.601, *et seq*., Montana has established the Water-Use Classification system. The classification for specific surface water bodies within the State are set for in ARM 17.30.607, *et seq.* The applicable standards for each classification are set forth in ARM 17.30.621 through ARM 17.30.629, inclusive.

General Prohibitions, ARM 17.30.637 (applicable). Provides that surface waters must be free of substances attributable to industrial practices or other discharges that will: (a) settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines; (b) create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials; (c) produce odors, colors or other conditions which create a nuisance or render undesirable tastes to fish flesh or make fish inedible; (d) create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life; (e) create conditions which produce undesirable aquatic life.

No waste may be discharged and no activities conducted which, either alone or in combination with other waste activities, will cause violation of surface water quality standards.

Leaching pads, tailings ponds, or water or waste or product holding facilities must be located, constructed, operated and maintained in such a manner and of such materials to prevent any discharge, seepage, drainage, infiltration, or flow which may result in pollution of state waters, and a monitoring system may be required to ensure such compliance.

Prohibited Activities, Section 75-5-605, MCA (applicable). Provides that it is unlawful to cause pollution of any state waters or to place or cause to be placed, any wastes where they will cause pollution of any state waters.

Nondegredation Policy, Section 75-5-303, MCA (applicable). Provides that existing uses of state waters and the level of quality of state waters necessary to protect those uses must be maintained and protected.

Nondegredation Policy – Applicability and Level of Protection, ARM 17.30.705 (applicable). For all state waters, existing and anticipated uses and water quality necessary to support those uses must be maintained and protected.

3.2.3 Montana Ambient Air Quality Regulations

Montana Ambient Air Quality Regulations, ARM 17.8.206, -.220, -.221, -.222 and -.223 (applicable). The following provisions establish air quality standards:

Methods and Data, ARM 17.8.206 (applicable). Establishes sampling, data collection, and analytical requirements to ensure compliance with ambient air quality standards.

Settled Particulate Matter, ARM 17.8.220 (applicable). Settled particulate matter shall not exceed a thirty (30) day average of 10 grams per square meter.

Visibility, ARM 17.8.221 (applicable). Concentrations of particulate matter in ambient air shall not exceed annual scattering coefficient particulate matter of 3×10^{-5} per meter.

Lead, ARM 17.8.222 (applicable). Lead emissions to ambient air shall not exceed a ninety (90) day average of 1.5 micrograms per cubic meter of air.

PM-10, ARM 17.8.223 (applicable). PM-10 concentrations in ambient air shall not exceed a 24 hour average of 150 micrograms per cubic meter of air and an annual average of 50 micrograms per cubic meter of air.

4.0 LOCATION-SPECIFIC ARARS

The statutes and regulations set forth below relate to solid waste, floodplains, floodways, streambeds, and the preservation of certain cultural, historic, natural or other national resources located in certain areas that may be adversely affected by Reclamation activities.

4.1 Federal

4.1.1 National Historic Preservation Act

National Historic Preservation Act, 16 USC ' 470, 40 CFR ' 6.301(b), 36 CFR Part 63, Part 65, and Part 800 (NHPA) (applicable). This statute and implementing regulations require Federal agencies to take into account the effect of Reclamation activities upon any district, site, building, structure, or object that is included in or eligible for the Register of Historic Places. If the effect of Reclamation activities cannot be reasonably avoided, measures should be implemented to minimize or mitigate the potential effects of the activity. In addition, Indian cultural and historical resources must be evaluated and effects avoided, minimized or mitigated.

4.1.2 Archaeological and Historic Preservation Act

Archaeological and Historic Preservation Act, 16 USC ' 469, 40 CFR 6.301(c) (applicable). This statute and implementing regulations establish requirements for the evaluation and preservation of historical and archaeological data, including Indian cultural and historic data, which may be destroyed through alteration of terrain as a result of a Federal program (such as AMLR). This requires the AMLR Program to survey the site for covered scientific, prehistoric or archaeological artifacts. If eligible scientific, prehistoric, or archeological data are encountered during Reclamation activities, they shall be preserved in accordance with these requirements.

4.1.3 Historic Sites Act of 1935

Historic Sites Act of 1935, 16 USC ' 461, *et seq.*, 40 CFR 6.310(a) (applicable). This statute and implementing regulations require Reclamation activities to consider the existence and location of landmarks on the National Registry of National Landmarks and to avoid undesirable impacts on such landmarks.

4.1.4 Protection and Enhancement of the Cultural Environment

Executive Order 11593 Protection and Enhancement of the Cultural Environment, 16 USC ' 470 (applicable). Directs federal agencies to institute procedures to ensure programs contribute to the preservation and enhancement of non-federally owned historic resources. Consultation with the Advisory Council on Historic Preservation is required if Reclamation activities should threaten cultural resources.

4.1.5 The Archaeological Resources Protection Act of 1979

The Archaeological Resources Protection Act of 1979, 16 USC ' ' 470aa-47011 (relevant and appropriate). Requires a permit for any excavation or removal of archeological resources from public lands or Indian lands. Substantive portions of this act may be relevant and appropriate if archeological resources are encountered during Reclamation activities.

4.1.6 American Indian Religious Freedom Act

American Indian Religious Freedom Act, 42 U.S.C. ' 1996, *et seq.* (applicable). This Act establishes a federal responsibility to protect and preserve the inherent right of American Indians to believe, express and exercise the traditional religions of American Indians. This right includes, but is not limited to, access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites. The Act requires Reclamation activities to consider and protect Indian religious freedom by refraining from interfering with access, possession and use of religious objects, and by consulting with Indian organizations regarding proposed Reclamation activities affecting their religious freedom.

4.1.7 Native American Graves Protection and Repatriation Act

Native American Graves Protection and Repatriation Act, 25 U.S.C. ' 3001, *et seq.* (applicable). The Act prioritizes ownership or control over Native American cultural items, including human remains, funerary objects and sacred objects, excavated or discovered on Federal or tribal lands. Federal agencies and museums that have possession or control over Native American human remains and associated funerary objects are required under the Act to compile an inventory of such items and, to the extent possible, identify their geographical and cultural affiliation. Once the cultural affiliation of such objects is established, the Federal agency or museum must expeditiously return such items, upon request by a lineal descendent of the individual Native American or tribe identified**.**

4.1.8 Fish and Wildlife Coordination Act

Fish and Wildlife Coordination Act, 16 USC ' 661, 40 CFR 6.302 (applicable). This statute and implementing regulations require that Federal agencies or federally funded projects ensure that any modification of any stream or other water body affected by any action authorized or funded by the Federal agency provide for adequate protection of fish and wildlife resources. This ARAR requires consultation with the U.S. Fish and Wildlife Service and the Montana Department of Fish, Wildlife, and Parks. Further consultation will occur during Reclamation design and construction.

4.1.9 Endangered Species Act

Endangered Species Act, 16 USC ' 1531, 50 CFR Parts 17 and 402 (applicable). This statute and implementing regulations provide that Reclamation activities not jeopardize the continued existence of any threatened or endangered species. This ARAR will be achieved

through consultation with the U.S. Fish and Wildlife Service and the Montana Department of Fish, Wildlife and Parks during Reclamation design and construction activities. Specific avoidance or other mitigation measures identified shall be incorporated into the Reclamation design and implemented as part of construction.

4.1.10 Floodplain Management Regulations

Floodplain Management Regulations, Executive Order No. 11988 and 40 CFR ' 6.302(b) (applicable). These require that actions be taken to avoid, to the extent possible, adverse effects associated with direct or indirect development of a floodplain, or to minimize adverse impacts if no practicable alternative exists.

4.1.11 Protection of Wetlands Regulations

Protection of Wetlands Regulations, 40 CFR Part 6, Appendix A, and Executive Order No. 11990 (applicable). Steps will be taken to avoid or mitigate the adverse impacts associated with the destruction or loss of wetlands to the extent possible and avoidance of new construction in wetlands if a practicable alternative exists. Wetlands are defined as those areas that are inundated or saturated by groundwater or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Compliance with this ARAR will be achieved through consultation with the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers, to determine the existence and category of wetlands present at the site, and any avoidance or mitigation and replacement which may be necessary.

4.1.12 Clean Water Act

Section 404, Clean Water Act, 33 USC ' ' 1251 *et seq.*, 33 CFR Part 330 (applicable). Regulates discharge of dredged or fill materials into waters of the United States. Substantive requirements of portions of Nationwide Permit No. 38 (General and Specific Conditions) are applicable to Reclamation activities conducted within waters of the United States within the Reclamation Project area.

4.1.13 Migratory Bird Treaty Act

Migratory Bird Treaty Act, 16 USC ' 703, *et seq.* (applicable). This requirement establishes a federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the USFWS during Reclamation design and construction to ensure that Reclamation activities at the site does not unnecessarily impact migratory birds.

4.1.14 Bald Eagle Protection Act

Bald Eagle Protection Act, 16 USC ' 668, *et seq.* (applicable). This requirement establishes a federal responsibility for protection of bald and golden eagles, and requires continued consultation with the U.S. Fish and Wildlife Service during Reclamation design and construction to ensure that Reclamation activities at the site do not unnecessarily adversely affect bald and golden eagles.

4.1.15 Resource Conservation and Recovery Act

Resource Conservation and Recovery Act and regulations, 40 CFR ' 264.18 (a) and (b) (relevant and appropriate). These regulations provide seismic and floodplain restrictions on the location of a waste management unit.

4.2 State

4.2.1 Montana Antiquities Act

Montana Antiquities Act, Section 22-3-421, *et seq.*, MCA (relevant and appropriate). The Montana Antiquities Act addresses the responsibilities of State agencies regarding historic and prehistoric sites including buildings, structures, paleontological sites, archaeological sites on state owned lands. The Montana Antiquities Act requires avoidance or mitigation of impacts to heritage property or paleontological remains. Each State agency is responsible for establishing rules regarding historic resources under their jurisdiction which address National Register eligibility, appropriate permitting procedures and other historic preservation goals. The State Historic Preservation Office maintains information related to the responsibilities of State Agencies under the Antiquities Act.

4.2.2 Montana Human Skeletal Remains and Burial Site Protection Act

Montana Human Skeletal Remains and Burial Site Protection Act (1991), Section 22-3-801, *et seq.* MCA (applicable). The Human Skeletal Remains and Burial Site Protection Act is the result of years of work by Montana Tribes, State agencies and organizations interested in ensuring that all graves within the State of Montana are adequately protected. The Human Skeletal Remains and Burial Site Protection Act prohibits purposefully or knowingly disturbing or destroying human skeletal remains or burial sites. If human skeletal remains or burial sites are encountered during Reclamation activities, then requirements will be applicable.

4.2.3 Montana Floodplain and Floodway Management Act

Montana Floodplain and Floodway Management Act and Regulations, Section 76-5-101, *et seq.*, MCA, ARM 36.15.601, *et seq.* (applicable). The Floodplain and Floodway Management Act and regulations specify types of uses and structures that are allowed or prohibited in the designated 100-year floodway[4] and floodplain.[5] If a Reclamation Project

[4] The "floodway" is the channel of a watercourse or drainway and those portions of the floodplain adjoining the channel that are reasonably required to carry and discharge the floodwater of the watercourse or drainway. ARM 36.15.101(13).

[5] The "floodplain" is the area adjoining the watercourse or drainway which would be covered by the floodwater of a base (100-year) flood except for sheetflood areas that receive less than one foot of water per occurrence. The floodplain consists of the floodway and flood fringe. ARM 36.15.101(11).

contains streams or creeks capable of flooding or may impact such areas, these standards are applicable to all Reclamation activities within these floodplains.

A. Prohibited uses. Uses prohibited anywhere in either the floodway or the floodplain are:

- P solid and hazardous waste disposal; and
- P storage of toxic, flammable, hazardous, or explosive materials.

ARM 36.15.605(2) and 36.15.703 (Applicable); *see also* ARM 36.15.602(5)(b) (Applicable). These provisions effectively prohibit the placement of mine waste repositories within the 100-year floodplain and require mine wastes addressed by Reclamation activities to be removed from the floodplain.

In the floodway, additional prohibitions apply, including prohibition of:

- P a building for living purposes or place of assembly or permanent use by human beings;
- P any structure or excavation that will cause water to be diverted from the established floodway, cause erosion, obstruct the natural flow of water, or reduce the carrying capacity of the floodway; and
- P the construction or permanent storage of an object subject to flotation or movement during flood level periods.

Section 76-5-403, MCA (applicable).

B. Applicable considerations in use of floodplain or floodway. Applicable regulations also specify factors that must be considered in allowing diversions of the stream, changes in place of diversion of the stream, flood control works, new construction or alteration of artificial obstructions, or any other nonconforming use within the floodplain or floodway. Many of these requirements are set forth as factors that must be considered in determining whether a permit can be issued for certain obstructions or uses. While permit requirements are not directly applicable to Reclamation activities conducted entirely on site, the substantive criteria used to determine whether a proposed obstruction or use is permissible within the floodway or floodplain are applicable standards. Factors which must be considered in addressing any obstruction or use within the floodway or floodplain include:

- P the danger to life and property from backwater or diverted flow caused by the obstruction or use;
- P the danger that the obstruction or use will be swept downstream to the injury of others;

P the availability of alternate locations;

P the construction or alteration of the obstruction or use in such a manner as to lessen the danger;

P the permanence of the obstruction or use; and

P the anticipated development in the foreseeable future of the area which may be affected by the obstruction or use.

See Section 76-5-406, MCA; ARM 36.15.216 (applicable, substantive provisions only). Conditions or restrictions that generally apply to specific activities within the floodway or floodplain are:

P the proposed activity, construction, or use cannot increase the upstream elevation of the 100-year flood a significant amount (2 foot or as otherwise determined by the permit issuing authority) or significantly increase flood velocities, ARM 36.15.604 (applicable, substantive provisions only); and

P the proposed activity, construction, or use must be designed and constructed to minimize potential erosion and may not reduce the carrying capacity of the floodway. *See* ARM 36.15.605.

For the substantive conditions and restrictions applicable to specific obstructions or uses, see the following applicable regulations:

- Excavation of material from pits or pools - ARM 36.15.602(1).
- Water diversions or changes in place of diversion - ARM 36.15.603.
- Flood control works (levees, floodwalls, and riprap must comply with specified safety standards) - ARM 36.15.606.
- Roads, streets, highways and rail lines (must be designed to minimize increases in flood heights) - ARM 36.15.701(3)(c).
- Structures and facilities for liquid or solid waste treatment and disposal (must be floodproofed to ensure that no pollutants enter flood waters and may be allowed and approved only in accordance with Montana Department of Environmental Quality (DEQ) regulations, which include certain additional prohibitions on such disposal) - ARM 36.15.701(3)(d).
- Residential structures – ARM 36.15.702(1)

- Commercial or industrial structures – ARM 36.15.702(1).

4.2.4 Montana Stream Protection Requirements

Montana Natural Streambed and Land Preservation Act of 1975 and Regulations, Section 75-7-101, *et seq.*, MCA, and ARM 36.2.401, *et seq.*, (applicable). Applicable if Reclamation activities alter or affect a streambed or its banks. The adverse effects of any such action must be minimized.

Standards and Guidelines, ARM 36.2.410 (applicable). Establishes minimum standards which would be applicable if Reclamation activities alter or affect a streambed, including any channel change, new diversion, riprap or other streambank protection project, jetty, new dam or reservoir or other commercial, industrial or residential development. Reclamation Projects must be designed and constructed using methods that minimize adverse impacts to the stream (both upstream and downstream) and future disturbances to the stream. All disturbed areas must be managed during construction and reclaimed after construction to minimize erosion. Temporary structures used during construction must be designed to handle high flows reasonably anticipated during the construction period. Temporary structures must be completely removed from the stream channel at the conclusion of construction, and the area must be restored to a natural or stable condition. Channel alterations must be designed to retain original stream length or otherwise provide hydrologic stability. Streambank vegetation must be protected except where removal of such vegetation is necessary for the completion of the Reclamation activities. When removal of vegetation is necessary, it must be kept to a minimum. Riprap, rock, and other material used in a project must be of adequate size, shape, and density and must be properly placed to protect the streambank from erosion. The placement of road fill material in a stream, the placement of debris or other materials in a stream where it can erode or float into the stream, reclamation activities that permanently prevent fish migration, operation of construction equipment in a stream, and excavation of streambed gravels are prohibited unless specifically authorized by the district. Reclamation activities must also protect the use of water for any useful or beneficial purpose. *See* Section 75-7-102, MCA.

Sections 87-5-502 and 504, MCA (applicable -- substantive provisions only). Provide that a state agency or subdivision shall not construct, modify, operate, maintain or fail to maintain any construction project or hydraulic project which may or will obstruct, damage, diminish, destroy, change, modify, or vary the natural existing shape and form of any stream or its banks or tributaries in a manner that will adversely affect any fish or game habitat.

While the administrative/ procedural requirements, including the consent and approval requirements set forth in these statutes and regulations are not ARARs, consultation with the Montana Department of Fish, Wildlife and Parks, and any conservation district or board of county commissioners (or consolidated city/county government) is

encouraged during the design and implementation of Reclamation activities to assist in the evaluation of the factors discussed above.

4.2.5 Montana Solid Waste Management Act

Montana Solid Waste Management Act and regulations, Section 75-10-201, *et seq.*, MCA, ARM 17.50.101, *et seq.* (applicable) . Provides that solid waste management systems must protect the public health and safety and conserve natural resources wherever possible.

These standards apply to any solid waste facility for the treatment, storage, or disposal of mine wastes, including, for example, any mine waste repository, tailing deposit, or waste rock pile that is actively managed as part of a response action.

Floodplains, ARM 17.50.1004 (applicable). A solid waste facility located within the 100-year floodplain may not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste that poses a hazard to human health or the environment. *See also* **ARM 17.50.1009(1)(h) (applicable).**

Wetlands, ARM 17.50.1005 (applicable). A solid waste facility may not be located in a wetland, unless there is no demonstrable practicable alternative.

Fault Areas, ARM 17.50.1006 (applicable). A solid waste facility cannot be located within 200 feet (60 meters) of a fault that has had displacement in Holocene time without demonstration that an alternative setback will prevent damage to the structural integrity of the solid waste facility and will be protective of human health and the environment.

Seismic Areas, ARM 17.50.1007 (applicable). A solid waste facility may not be located in a seismic impact zone without demonstration, by a Montana licensed engineer, that the solid waste structure is designed to resist the maximum horizontal acceleration in lithified earth material for the site.

Unstable Areas, ARM 17.50.1008 (applicable). A solid waste facility may not be located in an unstable area (determined by consideration of local soil conditions, local geographic or geomorphologic features, and local artificial features or events, both surface and subsurface) without demonstration, by a Montana licensed engineer, that the solid waste facility is designed to ensure that the integrity of the structural components will not be disrupted.

Location Restrictions, ARM 17.50.1009 (applicable). Sets forth general requirements applying to the location of any solid waste facility. Among other things, the location must have sufficient acreage, including adequate separation of wastes from underlying groundwater or adjacent surface water, must be located so as to prevent pollution of

ground, surface, and private and public water supply systems, and must allow for reclamation of the land.

Under ARM 17.50.1009, a facility for the treatment, storage or disposal of solid wastes:

1. must be located where a sufficient acreage of land is suitable for solid waste management, including adequate separation of wastes from underlying ground water or adjacent surface water;[6]

2. must be located where local roads are capable of providing access in all weather conditions and local bridges are capable of supporting vehicles with maximum rated loads;

3. must be located in a manner that does not allow the discharge of pollutants in excess of state standards for the protection of state waters, public water supply systems, or private water supply systems;

4. drainage structures must be installed where necessary to prevent surface runoff from entering waste management areas; and

5. must be located to allow for closure, post-closure, and planned uses of the land.

Section 75-10-212, MCA (applicable). For solid wastes, prohibits dumping or leaving any debris or refuse upon or within 200 yards of any highway, road, street, or alley of the State or other public property, or on privately owned property where hunting, fishing, or other recreation is permitted.

4.2.6 Endangered Species and Wildlife

Sections 87-5-106, 107 and 111, MCA (applicable). Endangered species should also be protected in order to maintain and to the extent possible, enhance their numbers. These Sections list endangered species, prohibited acts, and penalties. Section 87-5-201, MCA (applicable) concerns protection of wild birds, nests and eggs and under ARM 12.5.201 certain activities are prohibited with respect to specified endangered species.

[6] The extent of separation shall be established on a case-by-case basis, considering terrain and the type of underlying soil formations, and facility design.

5.0 ACTION-SPECIFIC ARARS

5.1 Federal and State Water Protection Requirements

5.1.1 Clean Water Act

Clean Water Act, Point Source Discharges Requirements, 33 USC ' 1342 (applicable, substantive provisions only). Section 402 of the Clean Water Act, 33 USC ' 1342, *et seq.*, authorizes the issuance of permits for the Adischarge@ of any Apollutant.@ This includes storm water discharges associated with Aindustrial activity.@ *See*, 40 CFR ' 122.1(b)(2)(iv). AIndustrial activity includes inactive mining operations that discharge storm water contaminated by contact with or that has come into contact with any overburden, raw material, intermediate products, finished products, byproducts or waste products located on the site of such operations, *see*, 40 CFR ' 122.26(b)(14)(iii); landfills, land application sites, and open dumps that receive or have received any industrial wastes including those subject to regulation under RCRA subtitle D, *see*, 40 CFR ' 122.26(b)(14)(v); and construction activity including clearing, grading, and excavation activities, *see*, 40 CFR ' 122.26(b)(14)(x). Because the State of Montana has been delegated the authority to implement the Clean Water Act, these requirements are enforced in Montana through the Montana Pollutant Discharge Elimination System (MPDES). The MPDES requirements are set forth below.

5.1.2 Montana Pollutant Discharge Elimination System Requirements

Substantive MPDES Permit Requirements, ARM 17.30.1342-1344 (applicable). These regulations set forth the substantive requirements applicable to all MPDES and National Pollutant Discharge Elimination System (NPDES) permits. The substantive requirements, including the requirement to properly operate and maintain all facilities and systems of treatment and control, are applicable requirements for a repository containing mine waste.

Technology-Based Treatment, ARM 17.30.1203 and 1344 (applicable). Provisions of 40 CFR Part 125 for criteria and standards for the imposition of technology-based treatment requirements are adopted and incorporated in MPDES permits. Although the permit requirement would not apply to on-site discharges, the substantive requirements of Part 125 are applicable, i.e., for toxic and nonconventional pollutants treatment must apply the best available technology economically achievable (BAT); for conventional pollutants, application of the best conventional pollutant control technology (BCT) is required. Where effluent limitations are not specified for the particular industry or industrial category at issue, BCT/BAT technology-based treatment requirements are determined on a case by case basis using best professional judgment (BPJ). *See* CERCLA Compliance with Other Laws Manual, Vol. I, August 1988, p. 3-4 and 3-7.

5.1.3 Montana Water Quality Act and Regulations

Causing of Pollution, Section 75-5-605, MCA (applicable). This section of the Montana Water Quality Act prohibits causing pollution of any state waters. Pollution is defined as contamination or other alteration of physical, chemical, or biological properties of state waters which exceeds that permitted by the water quality standards or the discharge, seepage, or drainage of any substances into state water that will likely create a nuisance or render the water harmful, detrimental or injurious to public health, recreation, safety, or welfare, or to livestock or wild animals. Also, it is unlawful to place or caused to be placed any wastes where they will cause pollution of any state waters.

Nondegradation, Section 75-5-303, MCA (applicable). This provision states that existing uses of state waters and the level of water quality necessary to protect the uses must be maintained and protected. Section 75-5-317, MCA, provides an exemption from nondegradation requirements which allows changes of existing water quality resulting from an emergency or Reclamation that is designed to protect the public health or the environment and that is approved, authorized, or required by the department. Degradation meeting these requirements may be considered nonsignificant.

Surface Water, ARM 17.30.637 (applicable). Prohibits discharges containing substances that will: (a) settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines; (b) create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials; (c) produce odors, colors or other conditions which create a nuisance or render undesirable tastes to fish flesh or make fish inedible; (d) create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life; or (e) create conditions which produce undesirable aquatic life.

Nondegradation Policy – Application and Level of Protection, ARM 17.30.705 (applicable). This provides that for all state waters, existing and anticipated uses and the water quality necessary to protect these uses must be maintained and protected unless degradation is allowed under the nondegradation rules at ARM 17.30.708.

Nondegradation, ARM 17.30.1011 (applicable). Provides that any groundwarer whose existing quality is higher than the standard for its classification mist be maintained at that high quality unless degradation may be allowed under the principles established in Section 75-5-303, MCA and the nondegradation rules at ARM 17.30.701, *et seq.*

5.1.4 Stormwater Runoff Control Requirements

Water Quality Performance Standards, ARM 17.24.633 (applicable). All surface drainage from a disturbed area must be treated by the best technology currently available (BTCA). Sediment control through BTCA must be maintained until the

disturbed area has been reclaimed, the revegetation requirements have been met, and the area meets state and federal requirements for the receiving stream.

General Permits, ARM 17.30.1341 (applicable). DEQ issues general storm water permits for certain activities. The substantive requirements of the following permit is applicable for the following activity: for construction activities B General Permit for Storm Water Discharge Associated with Construction Activity, Permit No. MTR100000 (April 16, 2007).

Generally, the permits require the permittee to implement best management practices (BMPs) and to take all reasonable steps to minimize or prevent any discharge which has a reasonable likelihood of adversely affecting human health or the environment. However, if there is evidence indicating potential or realized impacts on water quality due to any storm water discharge associated with the activity, an individual MPDES permit or alternative general permit may be required.

5.2 Federal and State RCRA Subtitle C Requirements

Federal and State RCRA Subtitle C Requirements, 42 U.S.C. Section 6921, *et seq.* (relevant and appropriate for solid wastes, applicable for hazardous wastes). The presentation of RCRA Subtitle C requirements in this section assumes that there will be solid wastes left in place in Awaste management areas@ (i.e., a repository) as a result of Reclamation activities. Because of the similarity of this waste management area to the RCRA Awaste management unit,@ certain discrete portions of the RCRA Subtitle C implementing regulations will be relevant and appropriate for Reclamation activities. RCRA Subtitle C and implementing regulations are designated as applicable for any hazardous wastes that are actively Agenerated@ as part of this Remedial activity or that were Aplaced@ or Adisposed@ after 1980. Also, should hazardous wastes be discovered as part of any Reclamation activity, RCRA Subtitle C requirements will be provided in more detail at a later date. All federal RCRA Subtitle C requirements set forth below are incorporated by reference as State of Montana requirements as provided for under ARM 17.53.105(2) unless mentioned otherwise below.

40 CFR Part 264 Subpart F, (relevant and appropriate).

General Facility Standards. These are potentially relevant and appropriate for solid wastes at Reclamation sites. Any waste management unit or similar area would be required to comply with the following requirements.

40 CFR ' 264.92, .93. and .94(relevant and appropriate). Prescribes groundwater protection standards.

40 CFR ' 264.97 (relevant and appropriate). Prescribes general groundwater monitoring requirements.

40 CFR ' 264.98 (relevant and appropriate). Prescribes requirements for monitoring and detecting indicator parameters.

Closure requirements.

40 CFR ' 264.111 (relevant and appropriate). Provides that the owner or operator of a hazardous waste management facility must close the facility in a way that minimizes the need for further maintenance, and controls or eliminates the leaching or escape of hazardous waste or its constituents, leachate, or runoff to the extent necessary to protect human health and the environment.

40 CFR ' 264.117 (relevant and appropriate). Incorporates monitoring requirements in Part 264, including those mentioned at Part 264.97 and Part 264.303. It governs the length of the post-closure care period, permits a lengthened security period, and prohibits any use of the property which would disturb the integrity of the management facility.

40 CFR ' 264.310(relevant and appropriate). Specifies requirements for caps, maintenance, and monitoring after closure.

40 CFR ' 264.301 (relevant and appropriate). Prescribes design and operating requirements for landfills.

40 CFR ' 264.301(a) (relevant and appropriate). Provides for a single liner and leachate collection and removal system.

40 CFR ' 264.301(f) (relevant and appropriate). Requires a run-on control system.

40 CFR ' 264.301(g) (relevant and appropriate). Requires a run-off management system.

40 CFR ' 264.301(h) (relevant and appropriate). Requires prudent management of facilities for collection and holding of run-on and run-off.

40 CFR ' 264.301(i) (relevant and appropriate). Requires that wind dispersal of particulate matter be controlled.

5.3 Federal and State RCRA Subtitle D and Solid Waste Management Requirements

40 CFR Part 257 establishes criteria under Subtitle D of the Resource Conservation and Recovery Act for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health or the environment. *See* 40 CFR ' 257.1(a). This part comes into play whenever there is a Adisposal@ of any solid or hazardous waste from

a Afacility.@ ADisposal@ is defined as Athe discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground waters.@ *See* 40 CFR ' 257.2. AFacility@ means Aany land and appurtenances thereto used for the disposal of solid wastes.@ Solid waste requirements are either applicable to mine wastes as solid waste or are relevant and appropriate for the management, handling, storage, monitoring and disposal of the mine wastes to be addressed in a Reclamation Project.

5.3.1. Federal Requirements

40 CFR ' 257 (applicable). Establishes Criteria for Classification of Solid Waste Disposal Facilities and Practices. Reclamation activities must comply with the following requirements:

40 CFR ' 257.3-1 (applicable).. Washout of solid waste in solid waste facilities in a floodplain posing a hazard to human life, wildlife, or land or water resources shall not occur.

40 CFR ' 257.3-2 (applicable).. Solid waste facilities shall not contribute to the taking of endangered species or the endangering of critical habitat of endangered species.

40 CFR ' 257.3-3 (applicable). A solid waste facility shall not cause a discharge of pollutants, dredged or fill material, into waters of the United States in violation of Sections 402 and 404 of the Clean Water Act, as amended, and shall not cause non-point source pollution, in violation of applicable legal requirements implementing an area wide or statewide water quality management plan that has been approved by the Administrator under Section 208 of the Clean Water Act, as amended.

40 CFR ' 257.3-4 (applicable). A solid waste facility shall not contaminate an underground source of drinking water beyond the solid waste boundary or beyond an alternative boundary specified in accordance with this section.

40 CFR ' 257.3-8(d) (applicable). Access to a solid waste facility shall be controlled so as to prevent exposure of the public to potential health and safety hazards at the site.

5.3.2. State of Montana Solid Waste Requirements.

The Montana Solid Waste Management Act, Section 75-10-201 *et seq.*, MCA, and regulations (applicable). Control the management and disposal of all solid wastes, including mine wastes at sites that are not currently subject to operating permit requirements.

Transportation, ARM 17.50.523 (applicable). Specifies that solid waste must be transported in such a manner as to prevent its discharge, dumping, spilling or leaking from the transport vehicle.

Location Restrictions, ARM 17.50.1009(1)(c) (applicable). Requires that solid waste facilities not discharge pollutants in excess of state standards. A solid waste facility must contain a leachate collection system unless there is no potential for migration of a constituent in Appendix I or II to 40 CFR 258.

Design Requirements, ARM 17.50.1204 (applicable). Solid waste facilities must either be designed to ensure that MCLs are not exceeded or the solid waste facility must contain a composite liner and leachate collection system that complies with specified criteria.

Access Requirements, ARM 17.50.1108 (applicable). Requires that the owner or operator of a solid waste facility use barriers to control public access.

Run-On and Run-Off Control Systems, ARM 17.50.1109 (applicable). Requires that owners or operators of solid waste facilities design, construct and maintain a run-on control system to prevent flow onto the active portion of the solid waste facility during the peak discharge from a 25-year storm and a run-off control system from the active portion of the solid waste facility to collect and control at least the water volume result from a 24-hour, 25-year storm.

Surface Water Requirements, ARM 17.50.1110 (applicable). Prohibits any discharge of a pollutant from a solid waste facility to state waters, including wetlands, that violates any requirement of the Montana Water Quality Act. Prohibits any discharge from a solid waste facility of a nonpoint source of pollution to waters of the United States, including wetlands, that violates any requirement of an area-wide or statewide water quality management plan approved under the Federal Clean Water Act.

Liquid Restrictions, ARM 17.50.1111 (applicable). Prohibits placement of bulk or noncharacterized waste into a solid waste facility, unless the waste is household waste other than septic liquid waste or leachate derived from and placed back into a facility with a composite liner and leachate collection and removal system.

Operating Criteria, ARM 17.50.1116, (applicable). Sets forth requirements for operation of a solid waste facility, including: that solid waste facilities be created and maintained with supervision, fencing and signage; that owners or operators of solid waste facilities take effective measures to control litter and prevent the public from salvaging materials at the facility; and that the facility be designed to control litter, insects, rodents, odor, residues, waste water and air pollutants.

Closure Criteria, ARM 17.50.1403 (applicable). Sets forth closure requirements for solid waste facilities. Solid waste facilities must meet the following criteria: (1) install a

final cover that is designed to minimize infiltration and erosion; (2) design and construct the final cover system to minimize infiltration through the closed unit by the use of an infiltration layer that contains a minimum 18 inches of earthen material and has a permeability less than or equal to the permeability of any bottom liner, barrier layer, or natural subsoils or a permeability no greater than 1 X 10-5 cm/sec, whichever is less; and (3) minimize erosion of the final cover by the use of a seed bed layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.

Post-Closure Criteria, ARM 17.50.1404 (applicable). Sets forth post-closure care requirements for solid waste facilities. Post-closure care must be conducted for a period sufficient to protect human health and the environment. Post-closure care requires maintenance of the integrity and effectiveness of any final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the cover and comply with the groundwater monitoring requirements found at ARM Title 17, chapter 50, subchapter 7.

Section 75-10-206, MCA,(applicable). Allows variances to be granted from solid waste regulations if failure to comply with the rules does not result in a danger to public health or safety or compliance with specific rules would produce hardship without producing benefits to the health and safety of the public that outweigh the hardship.

5.4 Federal and State Mine Reclamation Requirements

5.4.1 Surface Mining Control and Reclamation Act

Surface Mining Control and Reclamation Act, 30 USC ' ' 1201-1326 (relevant and appropriate). This Act and implementing regulations found at 30 CFR Parts 784 and 816 establish provisions designed to protect the environment from the effects of surface coal mining operations, and to a lesser extent non-coal mining. These requirements are relevant and appropriate to the covering of discrete areas of contamination. The regulations require that revegetation be used to stabilize soil covers over reclaimed areas. They also require that revegetation be done according to a plan which specifies schedules, species which are diverse and effective, planting methods, mulching techniques, irrigation if appropriate, and appropriate soil testing. Reclamation performance standards are currently relevant and appropriate to mining waste sites.

5.4.2 Montana Statutory and Regulatory Requirements

Montana Strip and Underground Mine Reclamation Act, Section 82-4-201, *et seq.*, MCA (relevant and appropriate) and Montana Metal Mining Act, Section 82-4-301, *et seq.*, MCA (relevant and appropriate). The specified portions of the following statutory or regulatory provisions, as identified below, are relevant and appropriate requirements.

Section 82-4-231, MCA (relevant and appropriate). Requires operators to reclaim and revegetate affected lands using most modern technology available. Operators must grade, backfill, topsoil, reduce high walls, stabilize subsidence, control water, minimize erosion, subsidence, land slides, and water pollution.

Section 82-4-233, MCA (relevant and appropriate). Operators must plant vegetation that will yield a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area and capable of self-regeneration.

Section 82-4-336, MCA (relevant and appropriate). Disturbed areas must be reclaimed to utility and stability comparable to adjacent areas.

General Backfilling and Grading Requirements, ARM 17.24.501 (relevant and appropriate). Provides general backfilling and grading requirements. Backfill must be placed so as to minimize sedimentation, erosion, and leaching of acid or toxic materials into waters, unless otherwise approved. Final grading must be to the approximate original contour of the land.

Monitoring for Settlement, ARM 17.24.519 (relevant and appropriate). Requires monitoring of settling of regraded areas.

General Hydrology Requirements, ARM 17.24.631(1), (2), (3)(a) and (b) (relevant and appropriate). Requires minimization of disturbances to the prevailing hydrologic balance. Changes in water quality and quantity, in the depth to groundwater and in the location of surface water drainage channels should be minimized. Other pollution minimization devices must be used if appropriate, including stabilizing disturbed areas through land shaping, diverting runoff, planting quickly germinating and growing stands of temporary vegetation, regulating channel velocity of water, lining drainage channels with rock or vegetation, mulching, and control of acid-forming, and toxic-forming waste materials.

Water Quality Performance Standards, ARM 17.24.633 (relevant and appropriate). Surface drainage from a disturbed area must be treated by the best technology currently available (BTCA). Treatment must continue until the area is stabilized.

Reclamation of Drainage Basins, ARM 17.24.634 (relevant and appropriate). Requires disturbed drainages be restored to the approximate pre-disturbance configuration. Drainage design must emphasize channel and floodplain dimensions that approximate the pre-mining configuration and that will blend with the undisturbed drainage above and below the area to be reclaimed. The average stream gradient must be maintained with a concave longitudinal profile. This regulation provides specific requirements for designing the reclaimed drainage to: (1) approximate an appropriate geomorphic habit or characteristic pattern; (2) remain in dynamic equilibrium with the system without the use of artificial structural controls; (3) improve unstable premining

conditions; (4) provide for floods and for the long-term stability of the landscape; and (5) establish a premining diversity of aquatic habitats and riparian vegetation.

Diversions, ARM 17.24.635 through 17.24.637 (relevant and appropriate). Set forth requirements for temporary and permanent diversions.

Sediment Control Measures, ARM 17.24.638 (relevant and appropriate). Sediment control measures must be implemented during operations.

Sedimentation Ponds and other Treatment Facilities, ARM 17.24.639 (relevant and appropriate). Sets forth requirements for construction and maintenance of sedimentation ponds, including that sedimentation ponds be located as near as possible to the disturbed area and out of any major stream courses.

Discharge Structures, ARM 17.24.640 (relevant and appropriate). Requires discharges from sedimentation ponds, permanent and temporary impoundments, and diversions be controlled to reduce erosion, deepening, or enlargement of stream channels, and to minimize disturbance of the hydrologic balance.

Acid- and Toxic-Forming Spoils, ARM 17.24.641 (relevant and appropriate). Requires drainage from acid- and toxic-forming spoil into ground and surface water be avoided and establishes practices to avoid such drainage.

Groundwater, ARM 17.24.643 through 17.24.646 (relevant and appropriate). Sets forth provisions for groundwater protection, groundwater recharge protection, and groundwater and surface water monitoring.

Soil, ARM 17.24.701 and 17.24.702 (relevant and appropriate). Sets forth requirements for redistributing and stockpiling of soil for reclamation. Also, outlines practices to prevent compaction, slippage, erosion, and deterioration of biological properties of soil.

Substitute Materials, ARM 17.24.703 (relevant and appropriate). When using materials other than, or along with, soil for final surfacing in reclamation, the operator must demonstrate that the material (1) is at least as capable as the soil of supporting the approved vegetation and subsequent land use, and (2) the medium must be the best available in the area to support vegetation. Such substitutes must be used in a manner consistent with the requirements for redistribution of soil in ARM 17.24.701 and 17.24.702.

Establishment of Vegetation, ARM 17.24.711 (relevant and appropriate). Requires that a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area of land to be affected shall be established except on road surfaces and below the low-water line of permanent impoundments. *See also* Section 82-4-233,

MCA (relevant and appropriate). Vegetative cover is considered of the same seasonal variety if it consists of a mixture of species of equal or superior utility when compared with the natural vegetation during each season of the year. This requirement may not be appropriate where other cover is more suitable for the particular land use or another cover is requested by the landowner.

Timing of Seeding and Planting, ARM 17.24.713 (relevant and appropriate). Requires seeding and planting of disturbed areas must be conducted during the first appropriate period favorable for planting after final seedbed preparation.

Soil Stabilizing Practices, ARM 17.24.714 (relevant and appropriate). Requires mulch or cover crop or both must be used until adequate permanent cover can be established.

Method of Revegetation, ARM 17.24.716 (relevant and appropriate). Requires revegetation be carried out in a manner that encourages prompt vegetation establishment, such as by drill or broadcast seeding, by seedling transplants or by established sod plugs, and in a manner that avoids the establishment of noxious weeds. Seeding must be done on the contour, wherever possible. Seed mixes should be frtee of weedy or other undesirable species. Noxious weeds mist be controlled in accordance with the Noxious Weed Management Act, 7-22-2101, *et seq.*,MCA.

Planting of Trees and Shrubs, ARM 17.24.717 (relevant and appropriate). Relates to the planting of trees and other woody species if necessary, as provided in Section 82-4-233, MCA, to establish a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the affected area and capable of self-regeneration and plant succession at least equal to the natural vegetation of the area, except that introduced species may be used in the revegetation process where desirable and necessary to achieve the approved land use plan.

Soil Amendments, ARM 17.24.718 (relevant and appropriate). Requires soil amendments, irrigation, management, fencing, or other measures, if necessary to establish a diverse and permanent vegetative cover.

Eradication of Rills and Gullies, ARM 17.24.721 (relevant and appropriate). Specifies that rills or gullies in reclaimed areas must be filled, graded or otherwise stabilized and the area reseeded or replanted if the rills and gullies are disrupting the reestablishment of the vegetative cover or causing or contributing to a violation of water quality standards for a receiving stream.

Monitoring, ARM 17.24.723 (relevant and appropriate). Requires operators conduct approved periodic measurements of vegetation, soils, water, and wildlife, and if data indicate that corrective measures are necessary, propose and implement such measures.

Revegetation Success Criteria, ARM 17.24.724 (relevant and appropriate). Specifies that revegetation success must be measured against approved technical standards or unmined reference areas. Reference areas and standards must be representative of vegetation and related site characteristics occurring on lands exhibiting good ecological integrity. Sets forth required management for reference areas.

Vegetation Measurements, ARM 17.24.726 (relevant and appropriate). Requires standard and consistent field and laboratory methods to obtain and evaluate revegetated area data with reference area data and/or technical standards and sets forth the required methods for measuring productivity.

Analysis for Toxicity, ARM 17.24.731 (relevant and appropriate). If toxicity to plants or animals on the revegetated area or the reference area is suspected due to the effects of the disturbance, comparative chemical analyses may be required.

Protection and Enhancement of Fish and Wildlife, ARM 17.24.751 (relevant and appropriate). Sets forth requirements to protect and enhance fish and wildlife habitat.

5.5 Air Requirements

Reclamation activities will comply with the Montana Ambient Air Quality Regulations (above) and with the following requirements to ensure that existing air quality will not be adversely affected:

Airborne Particulate Matter, ARM 17.8.308(1), (2) and (3) (applicable). There shall be no production, handling, transportation, or storage of any material, use of any street, road, or parking lot, or operation of a construction site or demolition project unless reasonable precautions are taken to control emissions of airborne particles. Emissions shall not exhibit an opacity exceeding 20% or greater averaged over 6 consecutive minutes.

Visible Air Contaminants, ARM 17.8.304(2) (applicable). Emissions into the outdoor atmosphere shall not exhibit an opacity of 20% or greater averaged over 6 consecutive minutes.

Materials Prohibited from Open Burning, ARM 17.8.604 (applicable). Lists certain wastes that may not be disposed of by open burning, including oil or petroleum products, RCRA hazardous wastes, chemicals, and wood and wood byproducts that have been coated, painted, stained, treated or contaminated by a foreign material. Any waste which is moved from the site where it was generated and any trade waste (material resulting from construction or operation of any business, trade, industry, or demolition project) may be open burned only in accordance with the substantive requirements of ARM 17.8.611 or 17.8.612.

Fugitive Dust Emissions, ARM 17.24.761 (relevant and appropriate). Specifies a range of measures for controlling fugitive dust emissions during mining and reclamation activities. Some of these measures could be considered relevant and appropriate to control fugitive dust emissions in connection with excavation, earth moving and transportation activities conducted as part of Reclamation at the site. Such measures include, for example, paving, watering, chemically stabilizing, or frequently compacting and scraping roads, promptly removing rock, soil or other dust-forming debris from roads, restricting vehicle speeds, revegetating, mulching, or otherwise stabilizing the surface of areas adjoining roads, restricting unauthorized vehicle travel, minimizing the area of disturbed land, and promptly revegetating regraded lands.

5.6 Noxious Weeds

Noxious Weeds, Section 7-22-2101(8)(a), MCA. Defines "noxious weeds" as any exotic plant species established or that may be introduced in the state which may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses or that may harm native plant communities and that is designated: (I) as a statewide noxious weed by rule of the department; or (ii) as a district noxious weed by a board, following public notice of intent and a public hearing. Designated noxious weeds are listed in ARM 4.5.201 through 4.5.204 and must be managed consistent with weed management criteria developed under Section 7-22-2109(2)(b), MCA.

6.0 TO BE CONSIDERED (TBC) DOCUMENTS

A list of TBC documents is included in the Preamble to the NCP, 55 Fed. Reg. 8765 (March 8, 1990). Those documents, plus any additional similar or related documents issued since that time, should be considered during the conduct of the Reclamation design and construction.

7.0 OTHER LAWS (NON-EXCLUSIVE LIST)

CERCLA defines as ARARs only federal environmental and state environmental and siting laws. Reclamation activities, incldуing design, implementation, and operation and maintenance must comply with other applicable laws, except as may be provided in SMCRA.

The following Aother laws@ are included here to provide a reminder of other legal requirements for Reclamation activity. They are not an exhaustive list of such requirements, but are included because they set out matters that must be addressed and, in some cases, may require advance planning. They are not included as ARARs because they are not Aenvironmental or facility siting laws.@ Because they are not ARARs, they are not subject to ARAR waiver provisions.

7.1 Other Federal Laws

Occupational Safety and Health Regulations. The federal Occupational Safety and Health Act regulations found at 29 CFR Part 1910 and Part 1926 are applicable to worker protection during the conduct of Reclamation .

7.2 Other State Laws

A. Groundwater Act

The Groundwater Act, ' 85-2-501, *et seq.,* MCA, and implementing regulations, ARM 17.30.601, *et seq.* govern uses of groundwater and provide measures to protect groundwater from depletion or contamination. The regulations also set requirements for water wells.

Section 85-2-505, MCA, precludes the wasting of groundwater. Any well producing waters that contaminate other waters must be plugged or capped, and wells must be constructed and maintained so as to prevent waste, contamination, or pollution of groundwater.

Section 85-2-516, MCA, states that within 60 days after any well is completed a well log report must be filed by the driller with the DNRC and the appropriate county clerk and recorder.

B. Public Water Supply Regulations

If Reclamation activities at the site require any reconstruction or modification of any public water supply line or sewer line, the construction standards specified in ARM 17.38.101(4) (applicable) must be observed.

C. Water Rights

Section 85-2-101, MCA, declares that all waters within the state are the state's property, and may be appropriated for beneficial uses. The wise use of water resources is encouraged for the maximum benefit to the people and with minimum degradation of natural aquatic ecosystems.

Parts 3 and 4 of Title 85, Chapter 2, MCA, set out requirements for obtaining water rights and appropriating and utilizing water. All requirements of these parts are laws which must be complied with in any action using or affecting waters of the State. Some of the specific requirements are set forth below.

Section 85-2-301, MCA, provides that a person may only appropriate water for a beneficial use.

Section 85-2-302, MCA, specifies that a person may not appropriate water or commence construction of diversion, impoundment, withdrawal or distribution works therefore except by applying for and receiving a permit from the Montana Department of Natural Resources and Conservation (DNRC). While the permit itself may not be required under federal law, appropriate notification and submission of an application should be performed and a permit should be applied for in order to establish a priority date in the prior appropriation system.

Section 85-2-306, MCA, specifies the conditions on which groundwater may be appropriated, and, at a minimum, requires notice of completion and appropriation within 60 days of well completion.

Section 85-2-311, MCA, specifies the criteria that must be met in order to appropriate water and includes requirements that:

1. there are unappropriated waters in the source of supply;
2 the proposed use of water is a beneficial use; and
3. the proposed use will not interfere unreasonably with other planned uses or developments.

Section 85-2-402, MCA, specifies that an appropriator may not change an appropriated right except as provided in this section with the approval of the DNRC.

Section 85-2-412, MCA, provides that, where a person has diverted all of the water of a stream by virtue of prior appropriation and there is a surplus of water over and above what is actually and necessarily used, such surplus must be returned to the stream.

D. Controlled Groundwater Areas

Pursuant to Section 85-2-507, MCA, DNRC may grant either a permanent or a temporary controlled groundwater area. The maximum allowable time for a temporary area is two years, with a possible two-year extension.

Pursuant to Section 85-2-506, MCA, designation of a controlled groundwater area may be proposed if: (i) excessive groundwater withdrawals would cause contaminant migration; (ii) groundwater withdrawals adversely affecting groundwater quality within the groundwater area are occurring or are likely to occur; or (iii) groundwater quality within the groundwater area is not suited for a specific beneficial use.

E. Occupational Health Act, Section 50-70-101, *et seq.*, MCA.

ARM 17.74.101 addresses occupational noise. In accordance with this section, no worker shall be exposed to noise levels in excess of the levels specified in this regulation. This rule is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR § 1910.95 applies.

ARM 17.74.102 addresses occupational air contaminants. The purpose of this rule is to establish maximum threshold limit values for air contaminants under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects. In accordance with this rule, no worker shall be exposed to air contaminant levels in excess of the threshold limit values listed in the rule. This rule is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR § 1910.1000 applies.

F. Montana Safety Act

Sections 50-71-201, 202 and 203, MCA, state that every employer must provide and maintain a safe place of employment, provide and require use of safety devices and safeguards, and ensure that operations and processes are reasonably adequate to render the place of employment safe. The employer must also do every other thing reasonably necessary to protect the life and safety of its employees. Employees are prohibited from refusing to use or interfering with the use of safety devices.

G. Employee and Community Hazardous Chemical Information

Sections 50-78-201, 202, and 204, MCA, state that each employer must post notice of employee rights, maintain at the work place a list of chemical names of each chemical in the work place, and indicate the work area where the chemical is stored or used. Employees must be informed of the chemicals at the work place and trained in the proper handling of the chemicals.

APPENDIX B
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