*Final*

# 2002/2003 WORK PLAN
# NEW WORLD MINING DISTRICT
# RESPONSE AND RESTORATION PROJECT

*Prepared for:*

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# 1.0 INTRODUCTION

This document provides descriptions of work tasks to be completed in 2002/2003 in conjunction with response and restoration activities at the New World Mining District project in Park County, Montana (Figure 1). The 2002/2003 Work Plan complements the Overall Project Work Plan (Maxim, 1999a) by providing a description of specific work elements that will be completed in 2002/2003. This work plan initiates the project cycle for the fourth year of the project. Project activities conducted by the U.S. Department of Agriculture Forest Service (USDA-FS) began in 1999. Those activities are described in the 1999, 2000, and 2001 Work Plans (Maxim, 1999b; 2000a, 2001a).

A general description of the site, project objectives, and project organization are provided in this introduction. More detailed descriptions of the project are described in the Overall Project Work Plan (Maxim, 1999a), which is available on the project Web site ***(http:/www.fs.fed.us/r1/gallatin)*** and at the three project information repositories located at the Gallatin National Forest Supervisor's Office in Bozeman, Montana, the Gardiner Ranger District Office in Gardiner, Montana, and at the Cooke City Chamber of Commerce office in Cooke City, Montana. The reader is encouraged to review this document to gain a better understanding of the overall project.

## 1.1 PROJECT BACKGROUND

On August 12, 1996, the United States signed a Settlement Agreement (Agreement) with Crown Butte Mining, Inc. (CBMI) to purchase CBMI's interest in their New World Mining District (District) holdings. This transfer of property to the U.S. government effectively ended CBMI's proposed mine development plans and provided $22.5 million to cleanup historic mining impacts in the district. In June 1998, all interested parties and CBMI signed a Consent Decree (Decree). The Decree, approved by the United States District Court, finalized the terms of the Agreement and made available the funds that are being used for mine cleanup. Monies available for cleanup will be first spent on District Property, which, as defined in the Decree, includes all property or interests in property that CBMI relinquished to the United States (Figure 1). As funds are available after District Property is cleaned up to the satisfaction of the United States, other mining disturbances in the District will be addressed.

The USDA-FS, as the lead agency responsible for implementing the cleanup, has assembled a management team and has published objectives to guide reclamation and restoration of the historic mining impacts in the New World Mining District. Under their Superfund authority, the USDA-FS will execute the response and restoration project by following guidance provided by the EPA for Non-time-critical removal actions. Non-time-critical removal actions are defined by CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) as actions that are implemented by the lead agency to respond to "the cleanup or 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 to the environment…" (EPA, 1993a). Non-time critical removal actions respond to releases that can start six months after the determination that a response is necessary.

In 1995, EPA began a site investigation after the initial announcement of the property transfer from CBMI. The EPA investigation involved installation of monitoring wells, surface water sampling, groundwater monitoring, and completion of a groundwater tracer study. In October 1998, the USDA-FS assisted CBMI in completing and submitting a Support Document and Implementation Plan to support the CBMI petition for temporary modification of water quality standards. Under the Consent Decree and

Settlement Agreement, CBMI is required to submit petitions regarding temporary standards if requested by the USDA-FS. The Support Document and Implementation Plan (Maxim, 1998) were submitted to the State of Montana Board of Environmental Review (Board) on January 22, 1999. The petition for the adoption of temporary standards for Fisher Creek, Daisy Creek, and a portion of the upper Stillwater River was accepted by the Board and noticed for public hearing. The proposed rule was modified to reflect public comment and the temporary water quality standards were approved and adopted by the Board on June 4, 1999. The goal of the temporary standards is to improve water quality in Fisher Creek, Daisy Creek, and Stillwater River to the point where these streams meet the uses for waters classified B-1 under the classification standards established by the State of Montana.

In March 1999, the USDA-FS initiated the planning process for the project. Planning documents were in place in June 1999, and work was begun on the project with the monitoring of surface water and groundwater quality at selected monitoring points. In March 2000 and June 2001, the USDA-FS finalized the 2000 and 2001 Work Plans, respectively, that detailed work to be conducted in the second and third years of the project. Activities that have been conducted to date include the following:

- Establishing a database management system for the project.
- Cataloging existing information available for the site.
- Completing a technical evaluation of existing information and data.
- Improving portions of the Daisy Pass and Lulu Pass roads to accommodate construction traffic.
- Improving a previously constructed surface water diversion around the Como Shaft.
- Developing a suitable map base of District Property to support engineering design.
- Evaluating areas of erosion contributing excessive sediment to area drainages.
- Completing a repository siting evaluation report and collecting hydrogeologic data on two prospective repository sites.
- Completion by the U.S. Geological Survey of a surface water tracer study on Daisy Creek and Miller Creek to determine surface water inputs of metal contaminants.
- Preparing a Selective Source Response Action Engineering Evaluation/Cost Analysis (EE/CA) for potential response alternatives.
- Cleaning up selective waste dumps and placing wastes in an engineered repository for the Selective Source Response Action.
- Obtaining data to fill identified data gaps for proposed response actions at the site.
- Identifying unrecorded mine waste dumps, adits, and boreholes, and developing a database of site characteristics.
- Geochemical sampling of mine wastes throughout the district
- Ranking mine waste sources according to a modified Hazard Ranking System to aid in the prioritization of sites slated for clean up.
- Identifying unrecorded cultural features.
- Reopening the Glengarry Adit and Como Raise to more fully characterize underground sources of water within the mine.
- Evaluating water quality treatment alternatives for acid mine discharges.
- Satisfying the requirements of the petition for temporary standards submitted by CBMI.

Figure 1

Figure 1 back page

## 1.2 SITE LOCATION AND DESCRIPTION

The New World Mining District falls within the boundaries of the Gallatin and the Custer National Forests, and abuts Yellowstone National Park's northeast corner. The Absaroka-Beartooth Wilderness Area bounds the District to the north and east. The Montana-Wyoming state line forms the southern boundary of the District. The District lies entirely within Park County, Montana (Figure 1).

The communities of Cooke City and Silver Gate, Montana are the only population centers near the District. The neighboring communities of Mammoth, Wyoming, and Gardiner, Montana are located about 50 miles to the west. Red Lodge, Montana is located about 65 miles to the northeast, via the Beartooth Highway, and Cody, Wyoming is located 60 miles to the southeast.

The District is located at an elevation that ranges from 7,900 feet to over 10,400 feet above sea level. The site is snow-covered for much of the year and only one route of travel is open on a year-round basis -- the highway between Mammoth and Cooke City. The Sunlight Basin road accesses the District from northwestern Wyoming during the spring, summer and fall but only allows access to within a few miles of the District in winter. The Beartooth Highway is closed during winter, as is Highway 212 from Cooke City eastward to Pilot Creek near the Montana/Wyoming state line.

The District covers an area of about 40 square miles (25,600 acres). Historic mining disturbances affect about 50 acres. The McLaren Tailings and McLaren Mill Site, which are not District Property, cover an additional 17 acres. The topography of the District is mountainous with dominant glacial features, and is situated at the headwaters of three river systems that all flow into the Yellowstone River. The three tributaries are the Clark's Fork of the Yellowstone, the Stillwater, and the Lamar. The Lamar River flows through Yellowstone Park. The major tributary streams in the District include Daisy, Miller, Fisher, Goose, Sheep, Lady of the Lake, Republic, Woody, and Soda Butte creeks.

## 1.3 WORK PLAN ORGANIZATION

This work plan is organized into several sections. Following this introductory section is a description of the project goals and objectives (Section 2.0). Section 3.0 describes work tasks that will be completed during 2002/2003. The project schedule for 2002/2003 and project deliverables are presented in Sections 4.0 and 5.0, respectively.

# 2.0 PURPOSE AND OBJECTIVES

The primary purpose of the 2002/2003 Work Plan is to guide project activities that are directed toward completing response and restoration actions to mitigate impacts, or the threat of impacts, that result from historic mining activities in the District. The objectives for the 2002/2003 Work Plan are consistent with those detailed in the Overall Project Work Plan (Maxim, 1999a) and those generally described in "Year 3 Activities" of the Support Document and Implementation Plan to the Petition for a Temporary Modification to Water Quality Standards (Maxim, 1998). The primary objectives for work done in 2002/2003 include: conducting response actions; collecting sufficient information to support engineering analyses and designs for response actions to be completed during 2002/2003; measuring water quality and erosion parameters to document the results of response and restoration actions; and, satisfying requirements of the rule allowing adoption of temporary water quality standards.

# 3.0 SCOPE OF WORK

To meet the objectives for 2002/2003, the following activities will be performed:

- Maintain community relations by implementing activities described in the Community Relations Plan (Maxim, 1999c).
- Maintain the project database and the project Web site.
- Prepare a report on the status of temporary water quality standards.
- Continue long-term monitoring of surface water areas as described in the respective long-term planning documents (Maxim, 1999d) and prepare a report for submittal to the Montana Board of Environmental Review.
- Monitor groundwater at selected locations in July 2002.
- Complete the McLaren Pit groundwater investigation that was initiated in 2001.
- Plug and abandon monitoring wells located in the McLaren Pit.
- Determine the approach for characterization of natural resources impacted by historic mining.
- Complete the investigation of the McLaren Adit (Winter tunnel).
- Complete the construction of the Selective Source Response Action.
- Monitor germination success at revegetated dumps reclaimed in 2001.
- Initiate Phase I of the McLaren Pit Response Action
- Prepare an Engineering Evaluation/Cost Analysis to evaluate alternatives for the cleanup of the Glengarry Adit/Como Basin/Fisher Creek.
- Determine a preferred alternative for the Glengarry Adit/Como Basin/Fisher Creek.
- Investigate depth to water and waste characteristics in the Como Basin.
- Investigate ferricrete deposits in Daisy and Fisher Creeks.
- Prepare a Response Action construction package for the preferred clean up alternative for the Glengarry Adit/Como Basin/Fisher Creek.
- Characterize mine waste sources in the vicinity of the Republic Smelter.
- Prepare an Engineering Evaluation/Cost Analysis to evaluate alternatives that would effect clean up actions for sources in the Miller Creek drainage.
- Coordinate with the Gallatin and Custer National Forest specialists on travel planning in the District.
- Native seed collection.
- Prepare the 2003 Work Plan.

A more complete description of each of these activities is presented below.

## 3.1 COMMUNITY RELATIONS

A Community Relations Plan (CRP) has been developed for the project and is included in the Overall Work Plan (Maxim, 1999a). The CRP describes community relation strategies that will be used to share information with the public and obtain timely input on proposed project activities. Community relation techniques include preparing news releases, preparing fact sheets, conducting technical workshops and public meetings, making project documents readily available to interested parties, and accepting and responding to public comment on project related documents.

Community relation activities described in the CRP will be used in 2002/2003 to keep the public informed of project activities. Events expected for 2002/2003 with the anticipated timing of the events are listed in Table 1. As other events arise during the year, the public will be informed in a timely manner in accordance with the CRP. If necessary, the CRP will be modified to insure all interested citizens are kept informed of project activities and are afforded ample opportunities to provide input to the response and restoration process.

**TABLE 1**
**Community Relation Activities**
**New World Mining District Response and Restoration Project**
**2002/2003 Work Plan**

| Event/Task | Timing |
|---|---|
| News release | June 2002 |
| Fact sheets | Summer and Winter, 2002 |
| Public Meeting | June/July 2002 - Cooke City |
| Public Meeting | August/September 2002 - Cooke City |
| Technical Workshop on Work Plan Activities | December 2002/January 2003 – Bozeman |

## 3.2 MAINTAIN PROJECT WEB SITE AND DATABASE

The USDA Forest Service has maintained a project web site since project inception. The web site address is:

- http://www.fs.fed.us/r1/gallatin.

The project website contains general information on the project as well as a library of archived information specific to the work that has been conducted over the past two years. The library contains downloadable versions of all documents that have been released to the public for review as well as important maps and graphics. A page on current activities lists the time and place of any project meetings. Project information stored at the Gallatin National Forest Supervisor's Office in Bozeman is also listed on the web site, and analytical data for surface water and mine waste samples collected since 1990 is available for downloading from the project database.

The project Web site will be maintained to disseminate information, reports, and data related to the project. The Web site currently includes information relative to project status, schedule, description, background, contacts, and other general information. The Web site includes a page where most project documents, including maps and graphics, can be accessed. Relevant reports prepared during 2002/2003 will be posted to the Web site after the hard copy documents are released to the public. Some reports are not released to the public in hard copy but are available on the project Web site (i.e. technical reports).

The considerable environmental data that have been collected at the New World site are cataloged in a Microsoft Access® database. This database will continue to be updated as new project information is collected during 2002/2003. The project database is available to the public through the project Web site, allowing interested persons to view and query project data.

## 3.3 TEMPORARY STANDARDS REVIEW

The USDA-Forest Service met with DEQ staff on September 21, 2001 to discuss, among other things, the 3-year temporary standards review by the Board of Environmental Review. Under the Montana Water Quality Act, 75-5-312 (10), the 3-year review of temporary standards involves a public hearing with notice and opportunity for comment. Depending on the Board's review, the temporary standards can be left unchanged, modified, or terminated.

As part of this review process, a summary report and presentation have been requested by the DEQ. The report is to summarize the results of actions taken to date and to review the progress of the project against that submitted with the support document and implementation plan when the temporary standards were requested.

A summary report has been prepared for this review and submitted to the DEQ. The summary report presents the actions taken to date, reviews the long-term water quality data collected since the standards became effective in June 1999, and compares project progress with that presented in the implementation plan. The summary report is available for review on the project Web site (Maxim, 2002).

The Board of Environmental Review scheduled a public hearing that will be held during the Board's regularly scheduled meeting on July 26, 2002. The hearing will be held in Conference Room 111 in the Metcalf Building, 1520 East Sixth Avenue, Helena, Montana. The meeting begins at 9:00 A.M. with the hearing to be held as the last agenda item. The DEQ staff has recommended that the temporary standards continue in effect as adopted in June 1999.

## 3.4 SURFACE WATER AND GROUNDWATER QUALITY MONITORING

### *3.4.1 Surface Water Quality Monitoring*

Surface water quality monitoring will be conducted in 2002 at the 12 sampling stations identified in the Long-Term Surface Water Quality Monitoring Plan (Maxim, 1999d). Long-term surface water sampling sites are shown on Figure 2. Surface water samples will be collected and analyzed in accordance with procedures and methods described in the Site-Wide Sampling and Analysis Plan (SAP) (Maxim, 1999f). Samples will be collected before the onset of snowmelt (late April/early May), before construction begins during higher flow conditions (June/July), and during low flow (September/October).

Surface water quality monitoring will also be performed during response action construction in 2002. Monitoring will be completed at the repository site for the Selective Source Response Action and during construction at the McLaren Pit. At the repository site, monitoring will be done at Stations SBT-3 and SBT-6 and at any seeps present at the repository. At the McLaren Pit, construction monitoring will also be done at Stations DC-2 and DC-5.

Figure 2 –Surface Water Quality Monitoring Locations

Figure 2 – Back page

Field personnel will visually monitor construction regularly for turbidity. Water quality samples will be collected at construction monitoring stations on a weekly basis during significant earthmoving construction activities and as needed during other times. The objective of construction water quality monitoring is to document water quality conditions and make appropriate adjustments to construction practices if water quality is significantly affected by construction activities. The following field parameters will be measured:

- Flow
- pH, specific conductivity, and turbidity

Construction surface water quality monitoring measurements will be obtained in accordance with procedures and methods described in the Site-Wide SAP (Maxim, 1999f). Depending on the results of field measurements, selected samples will be split and analyzed at an analytical laboratory for parameters listed in the Site-Wide SAP.

### *3.4.2 Groundwater Quality Monitoring*

Groundwater monitoring of selected wells will be conducted one time in July 2002 when water levels are typically at seasonal highs. Monitoring will include groundwater sampling, water level measurement, and laboratory analysis. Table 2 lists monitoring wells targeted for the 2002 sampling events. Figure 3 shows the location of wells listed in Table 2.

Water samples will also be collected from six monitoring wells at the SB-4B(B) repository site in July 2002 in conjunction with long-term groundwater monitoring activities (Table 2). Monitoring will be conducted using methods and procedures described in the Site-Wide Sampling and Analysis Plan (Maxim, 1999f). Groundwater samples will be submitted to an analytical laboratory for analysis of parameters listed in the SAP. Water levels will be measured in each monitoring well immediately before purging the wells. Results of water quality monitoring will be presented in the annual monitoring report.

## 3.5 MCLAREN PIT GROUNDWATER INVESTIGATION

The McLaren Pit groundwater investigation was initiated in the fall of 2001 with the installation of eight monitoring wells. The work associated with installing these wells was described in the 2001 Work Plan (Maxim, 2001a). Not all the work was completed, however, and the remaining work associated with this task in 2002 is drilling and completion of one background monitoring well, installation of numerous piezometers downgradient of the pit, sampling of wells and piezometers, and aquifer testing. Piezometers are being sampled one time to establish background conditions before the response action is completed and to augment water quality data collected from the clustered well pairs installed in 2001. More detailed descriptions of these activities are presented below. The results of this work will be presented in the 2002 Surface Water and Groundwater Monitoring Report.

### *3.5.1 Background Monitoring Well*

One monitoring well will be completed in the Meagher Limestone upgradient of the McLaren Pit to determine water quality in the Meagher Limestone unaffected by mining. The proposed general location for the well is shown on Figure 4. The location of the well takes into account the presumed

**TABLE 2**
**Monitoring Wells Scheduled for Sampling**
**New World Mining District Response and Restoration Project**
**2002/2003 Work Plan**

| Well No. | Year Installed | Completion Formation |
|---|---|---|
| **McLaren Pit/Daisy Creek** | | |
| DCGW-101S | 2001 | Glacial Till |
| DCGW-101D | 2001 | Lulu Pass Rhyodacite Porphyry |
| DCGW-102S | 2001 | Glacial Till |
| DCGW-102D | 2001 | Wolsey Shale |
| DCGW-103S | 2001 | Glacial Till |
| DCGW-103D | 2001 | Wolsey Shale |
| DCGW-104 | 2001 | Waste Rock |
| DCGW-105 | 2001 | Waste Rock |
| DCGW-106 | 2002 | Meagher Limestone |
| Piezometer | 2002 | Colluvium |
| Piezometer | 2002 | Colluvium |
| Piezometer | 2002 | Colluvium |
| Piezometer | 2002 | Colluvium |
| Piezometer | 2002 | Colluvium |
| Piezometer | 2002 | Colluvium |
| Piezometer | 2002 | Colluvium |
| Piezometer | 2002 | Colluvium |
| Piezometer | 2002 | Colluvium |
| Tracer-2 | 1997 | Fisher Mtn. Intrusive |
| MW-2 | 1989 | Wolsey Shale |
| MW-3 | 1989 | Wolsey Shale |
| **Como Basin Area** | | |
| EPA-11 | 1996 | Tertiary Intrusive Dike |
| EPA-12 | 1996 | Scotch Bonnet Diorite |
| MW-1 | 1989 | Wolsey Shale |
| MW-8 | 1989 | Lulu Pass Rhyodacite |
| Tracer-4 | 1997 | Fisher Mtn. Intrusive |
| Tracer-6 | 1997 | Scotch Bonnet Diorite |
| **Fisher Creek Area** | | |
| MW-9A | 1990 | Alluvium |
| MW-9B | 1990 | Precambrian |
| MW-10A | 1990 | Alluvium |
| MW-10B | 1991 | Precambrian |
| MW-11 | 1990 | Precambrian |
| SB-16 | 1991 | Precambrian |
| Tracer-5 | 1997 | Fisher Mtn. Intrusive |

**TABLE 2**
**Monitoring Wells Scheduled for Sampling**
**New World Mining District Response and Restoration Project**
**2002/2003 Work Plan**

| | | |
|---|---|---|
| **Miller Creek Area** | | |
| MW-5A | 1989 | Alluvium |
| MW-5P | 1989 | Wolsey Shale |
| **SB-4B(B) Repository** | | |
| SB-105T | 1999 | Till |
| SB-105 | 1999 | Granite |
| SB-107T | 1999 | Till |
| SB-107 | 1999 | Granite |
| SB-108T | 1999 | Till |
| SB-108 | 1999 | Granite |

direction of groundwater flow in the Meagher Limestone, and the fact that the Meagher Limestone is cut by the Crown Butte fault and the Fisher Mountain intrusive to the north and west of the proposed location. The well is located on the same side of the Crown Butte fault as the McLaren Pit.

Available geologic information indicates that this background monitoring well will be drilled to a depth of approximately 50-120 feet. The well will be completed using a nominal 4-inch diameter casing and screened through the upper water-bearing interval within the Meagher Limestone. Borehole diameter would be sufficient to allow a 4-inch diameter completion using rotary drilling methods.

The background well will be drilled, developed, and purged using methods and procedures described in the Site-Wide Sampling and Analysis Plan (Maxim, 1999f). Following purging, a sample will be collected and submitted for laboratory analysis in accordance with the site-wide SAP. Water quality parameters and analytical methods will be the same as those used for the long-term groundwater sampling event.

### *3.5.2 Piezometer Installation Downgradient of the McLaren Pit*

To determine depth to water in shallow colluvium immediately downgradient of the McLaren Pit, and to verify the location and characteristics of a suspected plume of contaminated groundwater originating in the McLaren Pit, about 10 piezometers will be installed (Figure 4). These piezometers will augment the three well pairs installed in 2001. The number and location of these additional piezometers will depend on review of the available geologic and hydrologic information and the results of drillhole logging and sampling. The field hydrogeologist, in consultation with the project hydrogeology group, will make final selection of the location for the additional piezometers.

Piezometers were initially considered for installation using a backhoe, but, after further consideration, piezometers will be installed by auger drilling methods. Piezometers will be completed with 2-inch PVC casing with a slotted screen consisting of 2-inch PVC with 0.020-inch factory slots. The length of screen will depend on groundwater conditions encountered at each well location. Colorado silica sand (No. 10/20) will be placed in the annular space across the screened interval. The bottom of the screened

interval will be capped with a 2-inch PVC threaded cap or secured to the bottom of the casing with three stainless steel screws. Blank tailpipe will not be used below the screen.

A bentonite plug consisting of Enviroplug® or equal bentonite chips will be placed on top of the sand pack. The bentonite plug will be a minimum of two feet thick. The remaining annular space to within two feet of the surface will be filled with cuttings. A six-inch diameter steel casing well protector will be placed in the boring at the surface to protect the PVC casing, and will extend a minimum of three-feet above the ground surface and three feet below the ground surface. The steel casing will be cemented in place with dry mix or equal cement.

The PVC casing will be capped with a 2-inch PVC cap and the steel casing capped with a locking lid and locked. The well designation will be inscribed on the inside of the lid with an indelible marker, along with the date of installation and the total depth of the piezometer. The measuring point location will be marked on the north side of the PVC and noted on the well log.

Piezometers will be purged following procedures specified in the Site-Wide SAP. Field parameters (depth to water, pH and specific conductance) will be measured in each piezometer immediately after completion to assist in the siting of the next piezometer location. In addition, depth to water, pH, and specific conductance will be measured in piezometers on a weekly basis until the end of the field season in October.

### *3.5.3 Water Sampling*

Water levels in all new wells, existing wells, and piezometers will be measured prior to sampling. New wells and piezometers will be developed using methods and procedures included in the site-wide SAP (Maxim, 1999). Following well development and purging, water quality samples will be collected from all wells and piezometers as described in Section 3.4.2 using methods and procedures described in the Site-Wide SAP. Groundwater samples will be submitted to Northern Analytical Laboratories in Billings, Montana for analysis of parameters listed in the SAP. Results of water quality monitoring will be presented in the annual monitoring report.

### *3.5.4 Aquifer Testing*

During the 2002 field season, one of the six wells to be located between the McLaren Pit and Daisy Creek will be tested to determine relevant aquifer characteristics using a pumping test. Test duration will depend on well drilling results and evaluation but will be a minimum of 8 hours. The remaining five wells of the paired well nests will be slug tested. Aquifer testing methods would follow those procedures presented in the site-wide SAP.

## 3.6 PLUG AND ABANDON MONITORING WELLS IN THE MCLAREN PIT

The McLaren Pit Response Action will commence in 2002 with the consolidation of mine waste from outlying sources placed into the pit, and the construction of runon and runoff controls. With these actions, it will be necessary to plug and abandon 11 wells that are located in areas of the pit that will be capped (Figure 4, Table 3). Wells installed in 2001 in the cap area (DCGW-104 and DCGW-105) will be preserved during construction, and will be used to monitor the performance of the cap along with other wells installed in 2001 and wells that will be installed in 2002.

Figure 3 – Groundwater Monitoring Wells

Figure 4 – McLaren Pit Wells

**TABLE 3**
**McLaren Pit Monitoring Wells to be Abandoned**
**New World Mining District Response and Restoration Project**
**2002/2003 Work Plan**

| Well ID | Well Protector Type | Casing Diameter/Type | Total Depth (meters) |
|---|---|---|---|
| EPA-01 | 152 mm x 1.52 m Steel | 102 mm/PVC | 27.6 |
| EPA-02 | 152 mm x 1.52 m Steel | 102 mm/PVC | 27.3 |
| EPA-03 | 152 mm x 1.52 m Steel | 102 mm/PVC | 6.1 |
| EPA-04 | 152 mm x 1.52 m Steel | 102 mm/PVC | 9.1 |
| EPA-05 | 152 mm x 1.52 m Steel | 102 mm/PVC | 12.3 |
| EPA-07 | 152 mm x 1.52 m Steel | 102 mm/PVC | 3.7 |
| EPA-08 | 152 mm x 1.52 m Steel | 102 mm/PVC | 12.2 |
| EPA-09 | 152 mm x 1.52 m Steel | 102 mm/PVC | 24.7 |
| EPA-10 | 152 mm x 1.52 m Steel | 102 mm/PVC | 11.7 |
| MW-2 | 152 mm x 1.52 m Steel | 102 mm/PVC | 18.2 |

Wells will be plugged and abandoned by a licensed Monitoring Well Constructor according to the current Montana Board of Water Well Contractor's regulations, Montana Codes Annotated, Administrative Rules of Montana, Title 37, Chapter 43 MCA, Title 36, Chapter 21 ARM. Wells will be abandoned such that they neither produce water nor serve as a channel for vertical movement of water. Any obstructions or debris that interfere with abandonment operations will be removed prior to sealing. Steel well casings will also be removed in accordance with abandonment regulations.

## 3.7 IDENTIFY NATURAL RESOURCES IMPACTED BY HISTORIC MINING

A Natural Resource working group has been formed with representatives from the various agencies involved in the project. This group will guide the identification, characterization, and restoration of natural resources in accordance with the Consent Decree and all other agreements. The agreements state that a goal is to restore natural resources impacted from mining activities at the site. In order to ensure cost-effective use of the limited resources available, the evaluation, planning, and implementation of response and restoration activities will be integrated to the greatest extent possible. The Natural Resource Damage Assessment process will not be used at this site.

The Natural Resources working group will help identify natural resources that have been impacted as a result of mining activities at the site. This group will then develop a plan to conduct any needed assessment of natural resources and discuss possible restoration strategies to be integrated into response actions. Natural resources may include wetlands, stream banks, stream sediments, sediment from roads and other disturbances, aquatics, wildlife, and surface water and groundwater.

## 3.8 REOPEN THE MCLAREN ADIT

The McLaren Adit (also known as the Winter Tunnel) is one of a series of nine adits driven to explore the McLaren deposit prior to open pit mining in the late 1930s. It produces a small quantity of severely degraded water throughout most of the year at a rate of about 8-10 gallons per minute. The other eight adits were presumably mined out during open-pit operations, although this has never been verified. However, no workings were exposed in the deranged topography of the pit post-mining, no workings

were encountered during exploration drilling, and no buried working were discovered by Crown Butte Mines while recontouring the historical pit using heavy equipment. This does not preclude however, that some portions of the old workings could remain buried, especially in the vicinity of the highwall.

The Winter Tunnel, used in exploring the McLaren deposit, was not disturbed by historic open-pit mining activities and still remains at the north end of the pit. It collars at about 9,640 feet in elevation, near the junction of the main county road with the Lake Abundance road. The actual layout of the workings is unknown. Based on the size of the waste rock dump and the dimensions of the adit (about 6 feet wide by 7 feet high), the estimated length of workings is about 1,770 feet. Because 1,770 feet would take the tunnel well past the main Fisher Mountain intrusive contact, it is presumed that there must be cross-cuts and drifts and/or stopes developed in the mine to account for additional waste material present on the dump.

Maxim Technologies reopened the Winter Tunnel in September of 2001 using a track-mounted excavator (Maxim, 2001c). The Winter Tunnel was entered on September 18, 2001 to explore the workings and look for sources of the water inflow. The tunnel has continuous timber sets for a distance of about 100 feet with lagging in the back and sidewalls. The mine is open for a distance of about 400 feet from the portal, where there is a cave about 3.5 feet high that dams water. An oxygen meter indicated that oxygen levels were depleted to 19.5%, a level that the Mine Safety and Health Administration (MSHA) deems unsafe for workers without supplied air. From the cave at 400 feet, the next approximately 100 feet of workings were visible, at which point there was another small cave. Both of these caves could be crossed allowing access to the remaining workings if safe oxygen levels were present. No water sources other than an occasional drip were observed in the first 400 feet of working, and water was flowing over the dam at 400 feet. Based on the fact that the mine flows year-round, it is assumed that a significant inflow must occur at some point further into the mine.

The area around the portal was cleaned up and regraded once the mine was reopened and drained. A construction safety fence and a plywood portal closure were constructed for the winter. It is likely that the air will improve by natural convection over the winter, and access to the deeper portions of the mine could be attempted in early summer of 2002.

A visual assessment of the extent of workings and sources of water will be completed in 2002. If the entire workings are accessible under conditions noted in September 2001, geologic mapping, surveying, water quality sampling, and water level elevation measurements will be performed. This information will be used to determine if conditions in the McLaren Adit impact closure of the McLaren Pit, and is needed to determine closure options that might be available for closing the adit.

If the mine proves to be inaccessible, either due to dangerous conditions or poor air quality, a contingency plan is included in this task to ensure access. The contingency scope of the work includes the following tasks and estimated number of days to complete the task:

- Mobilize men and equipment to the site
- Muck out and repair the existing settling ponds (1 day)
- Cut a ditch along rib and drain sill sludge for the first 400 feet (1 day)
- Install ventilation and compressed air lines (1 day)
- Pump down water or muck through debris at 400 feet (2 days)
- Pump down water or muck through debris at 500 feet (2 days)

- Pump down water or muck through debris at one more ground fall (2 days)
- Roof support or scaling as necessary (2 days)
- Muck out and repair the existing settling ponds (1 day)
- Demobilize

Reopening work will be most easily accomplished during the late summer or early autumn when water flow is low, but before snow and freezing temperatures become a problem. The estimated duration of this contingency plan is two weeks, including reopening and assessment. If conditions are worse than anticipated in the underground workings, an expanded scope of work would be required to meet the task objective of gaining access.

The following work is not included in the contingency plan for difficult conditions:

- Removing large quantities of ferricrete, sand, or silt in discharge water as work progresses
- Poor ground conditions beyond the 500-foot ground fall (may occur if workings follow a fault or similar structure)
- Removing large volumes of debris in the adit (may occur at bottom of raises or stopes; also a problem if the workings follow a fault or similar structure with poor ground conditions)

In addition, reopening work that would include vertical openings such as raises, winzes, or stopes, or would involve significantly worse ground conditions than those observed during the re-entry are beyond the scope of work for this task.

A technical memorandum will be prepared summarizing the results of the reopening work. The technical memorandum will include a compass and tape survey of the underground showing geologic features if access to the underground is gained.

## 3.9 SELECTIVE SOURCE RESPONSE ACTION CONSTRUCTION

Construction associated with the Selective Source Response Action was initiated in June 2001, with winter shutdown of construction activities occurring in October. Mine waste removals were completed during this time, as was reclamation of the removal sites. About 24,000 cubic meters of waste were placed in the repository, and a temporary cover installed over portions of the waste.

Due to the onset of winter weather in October 2001, several construction tasks at the repository could not be completed in accordance with design specifications. These tasks mainly involved construction of the permanent cover on the finished slopes of the repository, and installation of the temporary cover that is being used to protect the waste until the repository is reopened for placement of additional waste from District and non-District Property. The construction work that could not be completed included placing a geocomposite over the permanent geosynthetic liner on those portions of the repository that were to receive the final cover, geosynthetic liner weld testing on the permanent and temporary covers, welding of the top and bottom geosynthetic liners along the edges of the repository, construction of runon control ditches, placing the drainage layer and soil cover over the geocomposite, installing erosion control blankets on the final cover, and revegetation of the final cover.

One construction-related problem at the repository was experienced over the winter of 2001/2002. Monitoring of the water level in the repository sump showed that a considerable amount of water had

accumulated. The repository sump is a gravel layer that was placed on top of the bottom liner and beneath the waste to collect fluid percolating through the repository. Water had accumulated in the sump (approximately 11,000 gallons) from melting snow that fell on the waste in October 2001 before the cover liners were installed.

Water quality monitoring indicated that the sump water contained relatively high concentrations of iron, manganese, sulfate, bicarbonate, and total dissolved solids. While the pH was neutral to alkaline, the salinity of the water was relatively high. Trace concentrations of copper, zinc, and arsenic were also measured. As the water level in the sump stabilized over the winter, the USDA-FS determined that removal of the water was necessary prior to spring runoff. Removing the water would provide the entire capacity of the sump, which is approximately 28,000 gallons, in the event that melting snow entered the repository through the incompletely welded liner.

Following discussions with DEQ, it was determined that turning sump water into snow and spreading the snow on the slope adjacent to the repository would not cause any significant changes to water quality in receiving streams, primarily because the melting of man-made snow would mix with the much larger, surrounding snowpack, diluting constituent contributions from the man-made snow. Snow making was conducted during three days in late April and the repository sump was empty on April 23, 2002.

Surface water quality monitoring in the drainage immediately below the repository showed that melting of the man-made snow did not impact water quality. However, with the onset of spring runoff in early May, the repository sump filled to capacity by May 15, 2002, indicating that the incompletely sealed cover liner was allowing about 1.2 gallons per minute (gpm) of melt water to enter the sump. Water may be entering the sump at several places, but the most likely area is the east side of the repository at the interface between the cover liner and bottom liner. After reaching capacity on May 15, additional meltwater flowing into the sump may be exiting through the rock toe and eventually into the tributary flowing along the south edge of the repository site (surface water sampling stations SBT-3 and SBT-6, Figure 2).

Monitoring of the repository sump was done weekly following the snowmaking operation. Monitoring at stations SBT-3 and SBT-6 showed that no significant changes in water quality were measured above background conditions for the majority of the time, although a considerable increase in iron concentrations were measured during the period of May 15 through May 30 at both stations, along with increased concentrations of aluminum, copper, lead, and manganese. Some of these increases can be attributed to the larger sediment load carried by the stream as runoff progressed and not to the dissolved constituents in the repository sump. Monitoring of copper, lead, manganese, and cadmium at Station SBT-3, the station closest to the repository, never exceeded DEQ's water quality standards. Iron and manganese concentrations exceeded these standards at one or both stations during several events in May when runoff was at its peak.

There are several options available for disposal of water in the sump. A water disposal lagoon operated by Park County in Cody, Wyoming is an option, with Park County and the Wyoming DEQ giving verbal indications that the water can be disposed in the Cody lagoon. Another available option is the treatment and direct discharge of the sump water using a reverse-osmosis process. The Shaw Group, the company that is now in charge of finishing construction of the repository, is responsible for disposal of water in the sump.

## 3.10 SELECTIVE SOURCE RESPONSE ACTION RECLAMATION MONITORING

Mine waste removal areas reclaimed in 2001 will be monitored for potential erosion problems and revegetation success. As 2002 will be the first growing season, the main objective for reclamation monitoring is to document germination success. Reclamation monitoring will be conducted in accordance with Area-Wide Monitoring procedures that are described in the Long-Term Revegetation Monitoring Plan (Maxim, 1999g), which is published in Appendix E of the Overall Work Plan (Maxim, 1999a). Area-Wide procedures do not involve measuring cover; the primary purpose of using Area-Wide monitoring procedures is to identify erosion problems and areas in need of reseeding.

The purpose of area-wide observational monitoring of reclaimed areas is to identify areas that require maintenance. Area-wide observational monitoring will be conducted on the reclaimed areas to record the number, size, and location of revegetated areas bare of vegetation and, the presence, size and extent of erosional features such as rills and gullies. Area-wide surveys will also be done on reclaimed roads.

Criteria used to determine if an area is barren will be: 1) areas that are approximately 10 percent or more of the monitoring strata; and, 2) areas where reclamation treatment has clearly failed. For roads, criteria used will be: 1) areas that are 10 percent or more of the reclaimed segment; and, 2) areas where significant erosion or slope stability concerns are associated with lack of vegetation. For recording erosional features, a minimum size criterion will not apply; rather, the criterion for noting erosional features will be determined by field personnel. If erosional features dominate the character of the reclaimed areas, these features will be recorded.

Observations of barren reclaimed areas will include an assessment of the cause for the lack of vegetation and be recorded on field sheets. Factors to note may be the appearance of salts, steepness of slope, pooling of water, seeding failure, or other soil inhibiting factors. Reclamation practices (e.g., road re-contouring, erosion mats) that may be affecting performance will also be noted. Field assessment will include photo documentation and a generalized site map. Soil samples will be collected in areas without vegetation according to methods presented in the Site-Wide SAP.

Soil samples will be collected to a depth of approximately 15 cm and a minimum sample of 300 grams will be placed in 1-gallon polyethylene bags. Samples will be labeled by location and returned to a qualified laboratory for selected analyses in accordance with the parameters and methods in the Site-Wide SAP for native soil collection. Laboratory parameters may include USDA soil texture, coarse fragment content, pH, electrical conductivity, organic matter, nutrients, and total metals (aluminum, arsenic, cadmium, copper, lead, and zinc). Sample collection and parameter selection will be performed at the discretion of the field investigator to ensure site-specific conditions are being addressed and overall project objectives are being met.

After receipt of the laboratory analysis, recommendations will be made to amend soils or reseed the barren areas. Reclamation maintenance will either be performed in the same field season that the data become available during the dormant fall seeding window or will be done the following year.

The following reclaimed areas will be monitored using the Area-Wide procedures:

- Upper Tredennic Dumps 1 and 2
- Upper Tredennic access road and loading area

- Middle Tredennic Dump 1
- Lower Tredennic Dump 1
- Small Como Dump
- Lower Spaulding Dump and access road
- Upper and Middle Spaulding Dump
- Soda Butte Tailings
- Rommel Tailings area and borrow area

In addition to Area-Wide Monitoring, cover sampling will be conducted at the McLaren Triangle Area, which is located to the east of the main McLaren Pit area and adjacent to the highwall. The purpose of cover monitoring at the McLaren Triangle Area is to determine if revegetation cover has improved since the last time the area was monitored in 2000 (Maxim, 2000b). Soil samples will be collected from bare areas following the procedures described above and submitted for analysis. If there is no improvement in cover at the Triangle or if bare areas have expanded, soil amendments (e.g. fertilizer, organics, or lime) or reseeding may be required.

A technical memorandum will be prepared describing the results of revegetation monitoring. The memorandum will contain a summary of field data and recommendations for maintenance, treatment, or monitoring.

## 3.11 MCLAREN PIT RESPONSE ACTION

The proposed action for the McLaren Pit Response Action is consolidation of waste rock from dumps in the Daisy Creek headwaters into the McLaren Pit and capping of the consolidated wastes with an impermeable cap. The removal action will address the immediate threat to the environment posed by the mine waste piles. More detail on the selection process, removal action objectives, and alternative analysis can be found in the EE/CA.

The waste dumps slated for consolidation into the pit are the McLaren Pit spoils (wastes located below the county road and west of the pit) and the Multicolor Dump. The dumps are all located within the Custer National Forest. Approximately 18,400 cubic meters (24,000 cubic yards) of waste rock are contained in the dumps, which cover about 1.4 hectares (3.5 acres) of disturbance. A more detailed description of the proposed action is provided below.

- *Site Preparation*: Clearing and grubbing of outlying waste rock dump sites; separating combustible and non-combustible debris; and, debris disposal.

- *Consolidation of Wastes*: Outlying, waste rock dumps including the Multicolored Dump and McLaren Spoils would be excavated, moved, and placed onto the McLaren Pit.

- *US Forest Service Revegetation Demonstration Plots:* The USDA-FS established these experimental plots in 1977. The plots are located north of the Daisy Pass Road, just uphill of the McLaren Adit. Because this demonstration area is one of the only revegetation study areas with many years of data in subalpine environment, the USDA-FS will maintain this area as a revegetation study area. The area will remain in its existing condition and will not be affected by consolidation or cap construction.

- *Triangle Area:* The Triangle area is located to the east of the main McLaren Pit area and adjacent to the highwall. This area was reclaimed by CBMI, but the wastes recontoured and reseeded are more similar to background soils than to wastes in the McLaren Pit. Revegetation monitoring of the Triangle in 2000 (Maxim, 2000b) indicated that there was 390 square meters of bare areas, but that most of the barren areas were on steep slopes. Erosion is not a problem in the Triangle area. Based on these and other results, the Triangle will not be covered or consolidated. The Triangle area will be included in revegetation monitoring activities in 2002 to monitor any changes in percent cover that might indicate maintenance is needed.

- *Grade Consolidated Wastes in the McLaren Pit*: Consolidated wastes will be graded to a stable configuration, and the upper waste surface prepared for placement of the liner and cap system.

- *Borrow Area Development*: A soil borrow area will be developed to supply cover materials for cap construction from a glacial moraine located in the Daisy Creek drainage just below the pit area. Development of the soil borrow area will involve excavating borrow to a depth of about 3 to 6 meters (10 to 20 feet). The area of disturbance will vary based on depth of material present and the desired reconfigured topography for the borrow area. Construction elements will include developing sufficient access to the borrow site, clearing and grubbing vegetation, stockpiling topsoil, excavating borrow, regrading the borrow area, respreading stockpiled topsoil, revegetating the site with native grasses, and providing erosion controls.

- *Capping Wastes*: The capping system for the McLaren Pit uses a 60 mil HDPE synthetic liner in the cover system as a barrier layer. The synthetic liner would be placed on non-amended waste rock. A geocomposite drainage layer and one meter of borrowed soil will be placed on top of the liner. The capping system requires about 50,000 cubic meters of soil.

- *McLaren Mine Adit Discharge:* Response technologies will not be applied to the adit discharge present at the McLaren Mine as part of this Response Action. At a later timeframe in the overall cleanup process for the New World site, all adit discharges, including the McLaren Mine adit, will be evaluated, and further actions will be determined. So that the proposed response action does not interfere with any future response actions at the McLaren Mine adit, the adit drainage will be routed from the current point of discharge to a drainage channel placed outside the area capped. The historic point of discharge where the existing adit flows leave the waste site will be constructed in the same or near-by location as exists under current conditions. The existing character and condition of the adit discharge will be essentially unchanged.

- *Revegetate Waste Dump Removal Sites*: The removal areas (McLaren Spoils and Multicolor Dump) will be regraded to blend with the surrounding topography. Revegetation of the removal areas will follow prescriptions developed by the USDA-FS Rocky Mountain Research Station specifically for revegetating amended mine wastes in the District. Revegetation prescriptions specify amount and types of amendments recommended for organic matter, fertilizer, seeding, mulching, and use of erosion control blankets.

- *Monitoring and Maintenance:* Monitoring of vegetation, surface erosion, surface water, and groundwater will be conducted to assess and verify the performance of the capping system constructed on the consolidated wastes. Maintenance would be performed if monitoring indicated the capping system or reclaimed areas are not performing to the level expected.

Response Action work at the McLaren Pit is expected to take two seasons to complete. In 2002, the primary work that will be conducted is earthwork associated with regrading slopes to the design slope configuration and consolidating wastes from the McLaren Spoils and the Multicolor Dump in the pit. Other work that will likely occur in 2002 is installation of best management practices for erosion and sediment control, and construction of the upper portion of runoff diversion channels. In 2003, construction work should involve placing the geomembrane and geocomposite, developing the soil borrow area and hauling and placing the soil cap, constructing drainage channels on the cap, completion of runoff diversion channels, and revegetating the cap, temporary haul roads, and the soil borrow area.

## 3.12 PREPARE COMO BASIN/GLENGARRY ADIT/FISHER CREEK EE/CA

An EE/CA will be prepared to evaluate response action alternatives to address mining impacts from the Como Basin, Glengarry Adit, and in Fisher Creek. Included in the EE/CA will be the remaining waste sources present in Fisher Creek. The EE/CA will be structured around each of the three mine areas: the Glengarry Adit, the Como Basin, and Fisher Creek dumps. Based on the assessment work completed in the Glengarry Adit, Como Basin, and at the Gold Dust during the 2001 field season, several potential Response Action alternatives will be developed for each of the mine areas. Response Action alternatives will be developed to specifically address human health and environmental problems that occur in each of the mine areas.

Response Action options for the Glengarry will include seven different actions that specifically address each of the four major sources of water in the underground workings. For the Como Basin, the alternatives that will be developed will be similar to those described for the McLaren Pit Response Action EE/CA. These include total removal to an on-site repository, in-situ treatment, and capping. For the mine dumps in Fisher Creek, in-situ treatment, and total removal will be considered. A combination of the options and alternatives may be assembled depending on the results of the detailed analysis of alternatives for each of the three mine areas. A preferred alternative will be selected for each of the mine areas. Key sections of the EE/CA will include:

- Executive Summary
- Site Background
- Waste Characteristics
- Streamlined Risk Assessment
- Removal Action Goals and Objectives
- Screening and Development of Alternatives
- Detailed Analysis of Alternatives
- Comparative Analysis of Alternatives

The EE/CA will contain figures and tables summarizing supporting information and will have appendices of laboratory analytical data and cost estimates. The EE/CA will be prepared in accordance with EPA guidance for preparing non-time-critical removal actions (EPA 1993b). Responses to significant comments on the draft EE/CA will be provided in a separate submittal or will be incorporated into the final EE/CA.

## 3.13 INVESTIGATE DEPTH TO WATER AND WASTE CHARACTERISTICS IN THE COMO BASIN

The Como Basin consists of about six acres of reclaimed land located in the Fisher Creek watershed on the south side of Lulu Pass. Between late 1992 and 1994, CBMI completed intense surface reclamation activities at the Como Basin, McLaren Pit, and the Glengarry Mine. Reclamation in the Como Basin included the following activities: lining and armoring a surface water interceptor diversion ditch around the collar area of the two shafts; recontouring and regrading primarily exploration road and drill pad disturbances; construction of a side-hill surface water runoff diversion ditch along the high-wall of the Como Basin; surface drainage controls consisting of drainage channels on the west and east side of the basin; liming, fertilization, revegetating, and mulching the regraded areas.

To better define the thickness of disturbed material in the basin, and to define the depth to water in the shallow colluvium underling the basin, this task involves installing about 15 piezometers using auger drilling methods in the six acre area. The piezometers will be spaced approximately two per acre depending on access and will be drilled to the colluvium/bedrock contact. Lithology would be noted in split spoon samples collected every five feet according to the methods and procedures described in the Site-Wide SAP. Samples will be containerized in plastic bags, and labeled and archived according to procedures in the Site-Wide SAP.

Piezometers will be completed with 2-inch PVC casing with a one to five foot screen, depending on drilling results. Screen will consist of 2-inch PVC with 0.020-inch factory slots. Colorado silica sand (No. 10/20) will be placed in the annular space across the screened interval. The bottom of the screened interval will be capped with a 2-inch PVC threaded cap or secured to the bottom of the casing with three stainless steel screws. Blank tailpipe will not be used below the screen.

A bentonite plug consisting of Enviroplug® or equal bentonite chips will be placed on top of the sand pack. The bentonite plug will be a minimum of two feet thick. The remaining annular space to within two feet of the surface will be filled with cuttings. A six-inch diameter steel casing well protector will be placed in the boring at the surface to protect the PVC casing and will extend a minimum of three-feet above the ground surface and three feet below ground surface. Steel casing will be cemented in place with dry mix or equal cement.

The PVC casing will be capped with a 2-inch PVC cap and the steel casing capped with a locking lid and locked. The piezometer designation will be inscribed on the inside of the lid with an indelible marker, along with the date of installation and total depth of the piezometer. The measuring point location will be marked on the north side of the PVC and noted on the well log.

Piezometers will be purged following procedures specified in the Site-Wide SAP. Water levels, pH, and specific conductance will be measured in piezometers on a monthly basis following installation and until fall shut-down occurs in October. Selected soil samples will be analyzed for total metals, sieve analysis, and lime requirement according to methods and parameters listed in the Site-Wide SAP. Groundwater samples will not be collected for laboratory analysis. Data collected for this task will be used to develop a response action design, and several of the piezometers will be preserved for monitoring the selected response action. Data will be summarized in a technical memorandum.

## 3.14 PREPARE RESPONSE ACTION CONSTRUCTION PACKAGE FOR COMO BASIN/GLENGARRY ADIT/FISHER CREEK

Based on the technical evaluation of alternatives developed in the Como Basin/Glengarry Adit/Fisher Creek EE/CA as describe above, the USDA-FS will select a preferred alternative and solicit comments from the cooperating agencies and the public. Following a review of comments received and a response to those comments, the Forest Service will document the selection of the preferred alternative and prepare an engineering design. The engineering design will be developed into a construction package, and bids for construction of the Response Action will be solicited from qualified contractors. The USDA-FS expects that a contractor will be selected in spring 2003 and the Response Action would begin construction in 2003.

## 3.15 FISHER CREEK FERRICRETE STUDY

Natural acid rock drainage and ferricrete deposition have occurred for the last 8690 +/-80 years in the Fisher Creek Drainage (Furniss and Hinman, 1998; Furniss and others, 1999). The dating of wood fragments contained within the deposits of ferricrete provides evidence that acid rock drainage predates the earliest mining activity of the past century.

The purpose of this task is to use ferricrete as a surrogate for pre-mining water quality in Fisher Creek. Based on preliminary work by Furniss (1999), Furniss and Hinman (1998), and Furniss et al (1999) showing a correlation between the compositions of ancient ferricrete and modern iron oxyhydroxide precipitates, a correlation between the solids and water quality may also be possible. A detailed study plan to complete this work is presented in Appendix A.

## 3.16 CHARACTERIZE MINE WASTE SOURCES

Over the past three years, more than 150 individual mine waste dumps in the District have been characterized and evaluated in the project mine waste inventory. This task involves characterizing any remaining sites that are not listed in the inventory. Characterization activities may include plotting the location of the waste areas, estimating mine waste volumes, and collecting and analyzing samples.

Field personnel will locate sites using resource-grade GPS equipment and provide volume estimates using field estimation techniques described in the project Site-Wide SAP. Attribute information about each mine waste source will be recorded with the GPS unit and on standard field forms. Locations will also be recorded on a field map. In addition, a material sample may be obtained from source areas where analytical data do not exist.

One specific area will be included in this task. This area is National Forest System (NFS) land that lies adjacent to the Republic Mill Site. Sampling conducted by the Montana DEQ showed that metals concentrations on the adjacent NFS land contained arsenic and lead levels much greater than background levels. Preliminary data from the DEQ study indicates that surface soil enrichment on areas surrounding the site may be attributed to air emissions from the smelter. The DEQ study did not investigate the lateral extent of metals enrichment in surface soils.

To define the lateral extent of metals contamination on NFS land adjacent to the smelter, surface soil samples will be collected and analyzed in accordance with the procedures described in the project Site-

Wide SAP. The samples will be collected from the 0-2-inch depth interval of mineral soil with a stainless steel trowel. If duff is present at a sample location, the duff will be carefully removed from the mineral soil prior to sampling. Sample locations will be selected by establishing a 150 foot grid laid out in a north-south and east-west orientation and originating from the claim corner shown on Figure 5. The grid will extend approximately 150 feet to the west of this location, 900 feet east, 450 feet north, and 450 feet south of this point of origin. In the area immediately surrounding the Republic Smelter site, a 50-foot grid will be used (Figure 5). Only NFS land will be sampled, as Montana DEQ previously sampled the private land that overlays the former smelter site (Tetra Tech, 1999). A boundary survey will be conducted as part of this task.

The sample labeling scheme will follow the procedures described in the Site-Wide SAP (Maxim, 1999f). An example sample label follows:

RR-SBSI-99-93-0N100E

SBSI-99-93 is the site code for the Great Republic Smelter and the number 0N100E is the sample location number. The sample numbering system will be established in the field and noted in the field notebook. Approximately 90 samples will be collected from sample locations established on NFS lands.

Samples will be analyzed for metals using a portable X-ray fluorescence (XRF) instrument following standard procedures for National Priorities List (NPL) sites. The procedure used for XRF analysis is included in Appendix B. Samples with elevated metals concentrations will be submitted to an analytical laboratory for analysis of parameters identified in the Site-Wide SAP (Maxim, 1999f). Results of the data collected for this task will be summarized in a technical memorandum.

## 3.17 PREPARE EE/CA FOR MILLER CREEK SOURCES

An EE/CA for sources located on District Property in the Miller Creek drainage will be prepared during late 2002/early 2003. This EE/CA will evaluate response options and technologies to mitigate potential impacts from mine waste areas that contribute to surface water quality degradation. The primary sources of information to make this determination are existing water quality data, a USGS report on metal concentrations in Miller Creek (USGS, provisional draft, 2001) and the Abandoned and Inactive Mine Scoring System (AIMSS) ranking for waste sources located in Miller Creek.

Key sections of the EE/CA will include:

- Executive Summary
- Site Background
- Waste Characteristics
- Streamlined Risk Assessment
- Removal Action Goals and Objectives
- Screening and Development of Alternatives
- Detailed Analysis of Alternatives
- Comparative Analysis of Alternatives

The EE/CA will contain figures and tables summarizing supporting information and will have appendices of laboratory analytical data and cost estimates. The EE/CA will be prepared in accordance with EPA guidance for preparing non-time-critical removal actions (EPA 1993b). Responses to significant comments on the draft EE/CA will be provided in a separate submittal or will be incorporated into the final EE/CA.

### 3.18 TRAVEL MANAGEMENT

The Gallatin National Forest has started the process of reviewing travel management in systematic, Forest-wide approach. Upon completion of an Environmental Impact Statement (EIS), the Gallatin Forest Plan will be amended to include the travel management decision. All existing information concerning roads from the New World Mining District Response and Restoration Project will be provided to the team working on the travel planning effort. Recommendations will be made to the team for reclamation, additional drainage controls, or realignment of roads based on both chemical contamination and erosion data. The plan is expected to be completed in 2004.

### 3.19 NATIVE SEED COLLECTION

Native plants are an important component of reclamation for the waste site clean up activities that will be conducted in the District. An immediate need for native seeds has been identified for the reclamation work at the McLaren Pit. The borrow area and capped area of the pit will be planted with native grasses that are available from commercial sources, but native white bark pine will be planted at the borrow site to replace trees disturbed when salvaging soil needed for the project.

To fulfill the need for native white bark pine seedlings, native white bark pine seeds will be collected from mature trees located on NFS land in the District that grow at an elevation between 9,200 and 9,800 feet, which is the elevation range for the McLaren Pit borrow site. Mature trees with ripe cones (third-year cones) will be selected, and approximately five to 10 cones removed from each tree. Assuming about 10 seeds can be harvested from each cone, and with a target of 2,500 viable seeds, about 250 cones will be harvested. Seeds will be sent to a nursery, where the seeds will be grown for approximately two years to obtain 500 seedlings. Seedlings will be planted at the borrow site at a specified density during the following growing season.

A preliminary survey of mature cones was completed in July 2002, and it was noted that mature cones are sparse in the District. If cones are too few to collect in 2002, this task will be delayed until 2003.

### 3.20 PREPARE 2003/2004 WORK PLAN

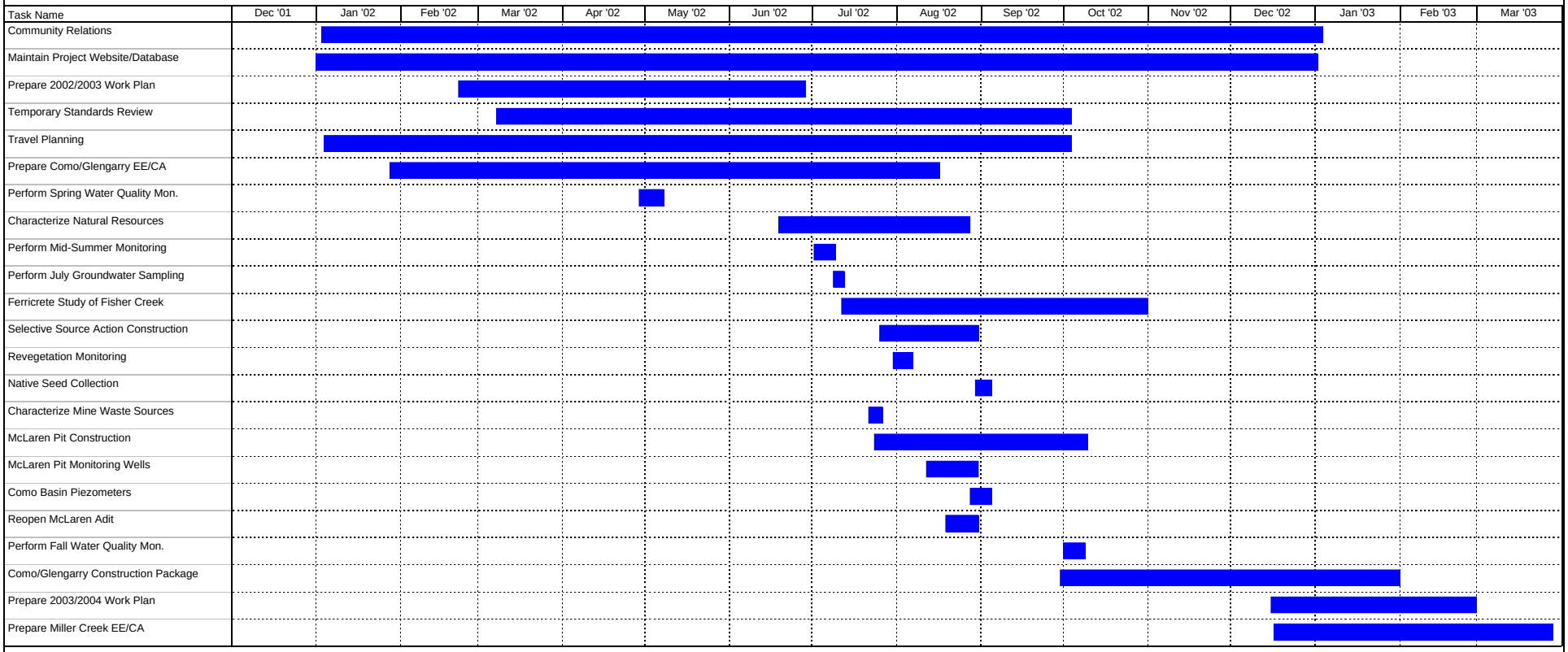
A work plan similar to this plan will be prepared to guide specific work activities to be completed during 2003/2004. These activities will complement those performed under the longer-term plans and will likely be oriented toward filling data gaps for the construction projects identified for the 2003 construction season. In addition, work tasks to complete many of the engineering tasks during the 2003/2004 will be described.

## 4.0 PROJECT SCHEDULE

Figure 6 illustrates the schedule for 2002/2003 activities discussed in Section 3.0.

Figure 5

***FIGURE 6***
***NEW WORLD MINING DISTRICT - RESPONSE & RESTORATION PROJECT***
***2002/2003 PROJECT SCHEDULE***




02_SCHED.MPP

Revised: July 22, 2002

# 5.0 REPORTS

Technical reports will be prepared during 2002/2003 as a result of completing the activities described in Section 3.0. These reports are summarized in Table 4 along with a description of the report contents and approximate delivery schedule.

**TABLE 4**
**List of Reports**
**New World Mining District Response and Restoration Project**
**2002/2003 Work Plan**

| Deliverable Title | Contents | Delivery Schedule |
|---|---|---|
| 2002/2003 Work Plan | This Document | Draft – May 2002<br>Final – July 2002 |
| Temporary Standards Progress Report | Summary of Water Quality and Cleanup Progress for 3-Year Review by DEQ of Temporary Standards Rule | April 2002 |
| Glengarry/Como Basin EE/CA | Evaluation of alternatives for the Glengarry Adit/Como Basin and remaining dumps in Fisher Creek | Draft – June 2002<br>Final – August 2002 |
| Glengarry/Como Basin Action Memorandum | Decision document for proposed Response Action | September 2002 |
| Glengarry/Como Basin Design Package | Engineering Design Drawings, Technical Specifications, and Bid Package | 2002/2003 |
| Revegetation Monitoring Technical Memorandum | Results of revegetation monitoring on Selective Source Response Action Reclaimed areas | November 2002 |
| Ferricrete Study Report | Report of results of ferricrete study | December 2002 |
| Como Basin Groundwater and Waste Characteristics Technical Memorandum | Results of Como Basin field investigations | December 2002 |
| Republic Smelter Area Soils Investigation Technical Memorandum | Soil results from field investigation | December 2002 |
| McLaren Adit Assessment Technical Memorandum | Results of assessment of McLaren Adit condition and water quality | December 2002 |
| 2002 Surface Water and Groundwater Monitoring Report | Results and analyses of ongoing surface water and groundwater monitoring | January 2003 |
| 2003/2004 Work Plan | Proposed activities for 2003/2004 | Draft – February 2003<br>Final – April 2003 |
| Miller Creek EE/CA | Engineering evaluation of alternatives developed for Miller Creek source areas | Draft – March 2003<br>Final – June 2003 |

# 6.0 PERTINENT REFERENCES

Amacher, M.C., 1998. Metal Loadings and Metals in Sediments and Wetland Soils in the Fisher and Daisy Creek Catchments in the New World Mining District, Montana. A Draft Assessment Report Prepared for USDA-FS Region 1 and the USEPA. Forestry Sciences Laboratory, USDA-FS-RMRS, Logan, Utah. January.

EPA, 1993a. Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA. EPA/540-R-93-057. Publication 9360.0-32. Office of Emergency and Remedial Response. Washington D.C. August.

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# APPENDIX A

## FERRICRETE STUDY PLAN

*2002/2003 Work Plan*
*New World Mining District Response and Restoration Project*

**United States Department of Agriculture** | **Forest Service** | **Beaverhead-Deerlodge National Forest** | **420 Barrett Street Dillon, MT 59725-3572 (406) 683-3900**

**File Code:**

Date: April 9, 2002

*FINAL*

# STUDY PLAN FOR NEW WORLD MINING DISTRICT RESPONSE AND RESTORATION PROJECT: Estimation of Pre-Mining Water Quality in Fisher Creek Using Ferricrete Zonation Patterns

**To:** Mary Beth Marks, Gallatin National Forest and Bob Kirkpatrick, Region 1

## Objectives

Maxim Technologies, Inc. is presently developing an Engineering Evaluation/Cost Analysis (EE/CA) for the Forest Service. The purpose of the report will be to present an engineering evaluation and cost analysis of alternatives for response and restoration work proposed for Fisher Creek. Based on the outcome of the Daisy Creek EE/CA and the opinion of most qualified researchers, it is likely that none of the alternatives developed, short of active water treatment, will meet Montana's B-1 standards for surface water quality in Fisher Creek.

The charge placed on the Response and Restoration Project by the Crown Butte Mines, Inc. Consent Decree, is to minimize the impacts from historical mining and exploration activities on District Properties "**to the extent practicable"**. Given the fact that natural sources may contribute a large percentage of the metals load to the creeks via groundwater and surface water pathways, eliminating metals impacts from mining related activities will not likely allow achievement of water quality standards. Original water quality is debatable as no one has convincingly determined or estimated pre-mining water quality. However, it is likely that Montana's B-1 standards were never met in the headwaters of Fisher and Daisy Creeks.

Standards are not met in Fisher Creek or Daisy Creek until a point downstream where significant dilution by tributary and groundwater sources occurs. This point on Fisher Creek is presently about 3 km below the Glengarry adit at the confluence with Lady of the Lake Creek. This point on Daisy Creek is presently at the confluence with the Stillwater River. Preliminary work on base metal zonations in ferricrete indicates that the point at which standards were met historically was significantly farther upstream. One of the objectives of this study will be to verify these locations.

We propose to use ferricrete as a surrogate for pre-mining water quality in Fisher and Daisy Creeks. Based on preliminary work by Furniss (1999), Furniss and Hinman (1998), and Furniss et al (1999) showing a correlation between the compositions of ancient ferricrete and modern iron oxyhydroxide precipitates, a correlation between the solids and water quality may also possible. We contend that a more thorough understanding of the ferricrete record and its relation to "natural" acid rock drainage in the Fisher and Daisy Creek valleys is essential for closure planning.

## Background

Natural acid rock drainage and ferricrete deposition have occurred for the last 8690 +/-80 years in the Fisher and Daisy Creek drainages (Furniss and Hinman, 1998; Furniss and others, 1999). The dating of wood fragments contained within the deposits of ferricrete provides evidence that acid rock drainage predates the earliest mining activity of the past century. Fifteen radiocarbon dates from wood collected in the tightly cemented ferricrete deposits along Fisher and Daisy Creeks include five ages identified in the last thousand years (30 +/-50, 60 +/-70, 100 +/-100, 550 +/-80, 890 +/-70 years before present).

Intervals of ferricrete deposition in the headwaters of Miller, Daisy, and Fisher Creeks correspond to periods of increased moisture in the Holocene (8840 to 8270 bp; 7170 to 5810 bp; at 4000 bp; and from 2050 bp to present) identified by other paleoclimatic records (Furniss and others, 1999). Conversely, periods of dry and arid climate recorded in paleoclimatic records correlate with periods of non-deposition of ferricrete. The accumulation of ferricrete during wetter non-glacial climatic periods is related to increased saturated thickness associated with increased moisture which leads to increased flow rates of oxygenated groundwater passing through shallow sulfide ore bodies resulting in higher rates of acid rock drainage. The Northern Rockies are presently in a wet non-glacial climatic period where ferricrete formation would be expected under natural conditions.

The ancient ferricrete in the headwaters of Fisher and Daisy Creeks is similar in morphology and mineralogy to the iron oxyhydroxide coatings currently forming on the streambeds (Furniss and Hinman, 1998). They both occur as laminated deposits within stream sediments and on colluvium. The ancient ferricrete and modern iron oxyhydroxide also have similar base metal compositions. This relationship can be used to predict the historic chemical composition of stream water.

Modern iron oxyhydroxide in Fisher and Daisy Creeks, as well as ferricrete show a longitudinal zonation of metals (Furniss, 1999). Iron decreases and aluminum, copper, and finally zinc increase as the pH changes from 3 in the headwaters to 6 downstream. This zonation extends farther downstream than similar element zonations detected in adjacent ferricrete deposits. This is because mining has lowered the pH in the upstream reaches causing these trace elements to travel farther in solution until neutral inflows increase the pH causing the precipitation of trace elements along with the iron oxyhydroxide. A reasonable remediation objective for Fisher and Daisy Creeks would be realized when the zonation patterns of trace metals in the iron oxyhydroxide precipitates correspond to patterns found in the adjacent pre-mining ferricrete geologic record.

The ferricrete deposits along Fisher and Daisy Creeks contain a fossil record of surface water quality for the past nine thousand years. Pre-mining water quality can be estimated by correlating base metal zonation patterns in ferricretes that formed prior to any mining activity with iron oxyhydroxide coatings currently forming in the streams and current stream water quality.

## Study Plan

Reconstruct the trace element zonation pattern that existed in Fisher Creek and Daisy Creek before any mining disturbance occurred and correlate that pattern to a longitudinal pH and trace element concentration continuum for each stream.

1. Water quality will be determined at measured distances along Fisher Creek at low flow at 10 collection sites. Water quality will be determined at measured distances along Daisy Creek at low flow at 10 collection sites. Two QA/QC samples will be analyzed.

2. Chemical composition of modern iron oxyhydroxide precipitates and coatings on the streambed will be determined at low flow at a total of 20 collection sites. These sites will correspond to water quality and ferricrete collection sites along Fisher and Daisy Creeks. Samples will be collected using glass beads/porcelain strip collectors suspended in the water column. Two QA/QC samples will be analyzed.

3. Chemical composition of ancient ferricretes will be determined at 20 sites along Fisher and Daisy Creeks. Grab samples will be collected from exposed ferricrete terraces along stream channels and will correspond to the locations of water quality and streambed iron oxyhydroxide precipitate collections. Sample preparation and analytical methods will follow those used by Furniss and Hinman (1998). Two QA/QC samples will be analyzed.

4. Carbon-14 dating will be performed on organic materials in ferricrete from locations not previously dated.

All chemical procedures and analyses will be conducted at Energy Laboratory located at Billings, Montana. A strong acid leaching procedure (EPA Method 3050A) will be used to dissolve the streambed iron oxyhydroxide precipitates as well as the ancient ferricretes. A sequential extraction involving refluxing with concentrated nitric acid, followed by dissolution in warm hydrogen peroxide (30%) solution and then filtration constitutes the digestion steps of the procedure. The resulting sample digests are analyzed using inductively coupled plasma emission spectrophotometry (ICP). Surface water samples will be collected and analyzed using standard water quality procedures. Electron microscopy examinations of solids on porcelain collectors will be done at the surface analysis facility at Montana State University, Bozeman. Approximately 10% of samples will be collected in duplicate to establish the variability between equivalent samples. To ensure the quality of the resulting data, EPA and USGS standards, laboratory duplicates, and spike recovery techniques will be used. Carbon-14 dating will be performed at Geochron Labs using conventional methods or, for small samples, accelerator mass spectrometry.

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# APPENDIX B

# PORTABLE XRF ANALYSIS OF METALS IN SOIL

*2002/2003 Work Plan*

*New World Mining District Response and Restoration Project*