Final

2001 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 during the 2001 calendar year in conjunction with response and restoration activities at the New World Mining District project in Park County, Montana (Figure 1). The 2001 work plan compliments the Overall Project Work Plan (Maxim, 1999a) by providing a description of specific work elements that will be completed in 2001. This work plan initiates the project cycle for the third 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 and 2000 Work Plans (Maxim, 1999b; 2000a).

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. 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 May 14, 1999.

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, the USDA-FS finalized the 2000 Work Plan that detailed work to be conducted in the second year 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 Draft Selective Source Response Action Engineering Evaluation/Cost Analysis (EE/CA) for potential response alternatives.
- 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 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.

Following the preparation of the draft Selective Source Response Action EE/CA, and considering public comments submitted on the preferred alternative, the USDA-FS modified the preferred alternative and prepared a decision document (Action Memorandum) for the Selective Source Response Action. The draft Action Memorandum was submitted to the agency cooperators for comment and comments received were incorporated into a revised draft. At the same time, the USDA-FS prepared a construction bid package for the modified preferred alternative and solicited bids from potential contractors. The Selective Source Response Action involves construction of a capped and lined repository that will be used to dispose of selected priority mine waste dumps. Negotiations with a qualified bidder are completed and a contract was awarded in April 2001. Construction is expected to begin on the response action in June 2001.

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 (0.19 %). The McLaren Tailings, which is not a District Property, covers an additional 11 acres (0.04 %). 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 calendar year 2001. The project schedule for 2001 and project deliverables are presented in Sections 4.0 and 5.0, respectively.

2.0 PURPOSE AND OBJECTIVES

The primary purpose of the 2001 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 2001 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 2001 include: conducting response actions; collecting sufficient information to support engineering analyses and designs for response actions to be completed during 2002; measuring water quality and erosion control parameters to document the results of response and restoration actions; and, satisfying the requirements of the rule allowing the adoption of temporary water quality standards.

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3.0 SCOPE OF WORK

To meet the objectives for 2001, 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.
- 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.
- Continue to evaluate water quality treatment alternatives for acid mine discharges.
- Continue the evaluation of the Glengarry Adit to assess the feasibility of potential response actions directed at reducing the inflow of water that results in acid mine drainage from the adit.
- In addition to the Glengarry Adit, collect water quality and flow data from discharging adits.
- Monitor groundwater at selected locations in July 2001.
- Evaluate the results of the USGS surface water tracer study performed on Miller Creek.
- Prepare the McLaren Pit EE/CA and a Response Action construction package for the preferred alternative.
- Construct the Selective Source Response Action in accordance with the preferred alternative identified in the Action Memorandum.
- Identify potential response actions for implementation in 2002.
- Prepare the 2002 Work Plan.
- Prepare the Glengarry Adit EE/CA.

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 2001 to keep the public informed of project activities. Events expected for 2001 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. The public will be periodically interviewed to assure that the CRP is functioning as intended and providing the necessary level of information to the interested public.

TABLE 1
Community Relation Activities
New World Mining District Response and Restoration Project
2001 Work Plan

Event/Task	Timing
News release	June 2001
Fact sheets	Summer and Winter, 2001
Public Meeting	June/July 2001 - Cooke City
Technical Workshop on Work Plan Activities	December 2001 – 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 1999 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 2000 will be posted to the Web site within a few days after the hard copy documents are released to the public.

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 2001. The project database is available to the public through the project Web site, allowing interested persons to view and query project data.

3.3 LONG-TERM SURFACE WATER AND GROUNDWATER QUALITY MONITORING

Surface water quality monitoring will be conducted in 2001 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 in the Long-Term Surface Water Quality Monitoring Plan (Maxim, 1999d).

Groundwater monitoring of selected wells will be conducted one time in July 2001 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 2001 sampling events. Figure 4 in the Site-Wide Sampling and Analysis Plan shows the location of wells listed in Table 2 (Maxim, 1999f).

Water samples will be collected from the monitoring wells using methods and procedures described in the Site-Wide Sampling and Analysis Plan (Maxim, 1999f). Groundwater samples will be submitted to Northern Analytical Testing in Billings, Montana 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.

3.4 GLENGARRY ADIT ASSESSMENT

The Glengarry adit and associated underground workings were partially rehabilitated in the fall of 2000 allowing access to all of the sub-horizontal workings (or drifts), but not to the raises. Water quality samples were collected from numerous stations within the mine. An assessment of the character of groundwater draining into the underground workings at various locations over the next year will allow an evaluation of potential mitigation measures directed at reducing or eliminating acid discharges from the Glengarry into Fisher Creek. Further assessment work in 2001 will include the following: collection of water quality samples from established stations within the underground workings; detailed geologic mapping of the surface in the area crossed by the underground workings; completion of a dye tracer study to evaluate possible hydrologic connections to the Spaulding Tunnels; completion of an engineering analysis of potential underground closure alternatives; and, geochemical modeling of Fisher Creek water quality. These assessment tasks are further described below.

3.4.1 Water Quality Monitoring

Water quality samples will be collected from selected underground sampling stations that were established in October 2000. These stations are shown on Figure 2. In October 2000, a piping system was established to bring water from the major sources of water in the underground workings (Stations 15, 14, 12, and 4) to the portal. Samples were collected from these main stations in December 2000, and these same stations will be sampled in conjunction with the April/Mail long-term surface water sampling event (Section 3.3). All underground stations will also be sampled in July and October 2001 in conjunction with long-term water quality monitoring. Additional stations may be identified for sampling based on the flow conditions encountered in the underground workings during the high flow sampling event (July).

Water quality parameters that will be analyzed for samples collected from the Glengarry are listed in Table 3 of the Long-Term Surface Water Quality Monitoring Plan Maxim, 1999d). In addition to these parameters, total recoverable arsenic, nickel, molybdenum, nitrate, and phosphorus will also be measured. Dissolved analysis of all parameters will also be done by collecting a filtered sample (using a 0.45 micron filter) to facilitate iron speciation as well as to evaluate dissolved vs. colloidal metal concentrations.

TABLE 2
Monitoring Wells Scheduled for Sampling
New World Mining District Response and Restoration Project
2001 Work Plan

Well No.	Year Installed	Completion Formation
McLaren Pit Area		
EPA-1	1996	Wolsey Shale
EPA-2	1996	Fisher Mtn. Intrusive/Wolsey Shale
EPA-3	1996	Waste Rock
EPA-4	1996	Waste Rock
EPA-5	1996	Fisher Mtn. Intrusive
EPA-6	1996	Fisher Mtn. Intrusive
EPA-7	1996	Waste Rock
EPA-8	1996	Meagher Limestone
EPA-9	1996	Wolsey Shale
EPA-10	1996	Meagher Limestone
MW-2	1989	Wolsey Shale
Tracer-2	1997	Fisher Mtn. Intrusive
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
Miller Creek Area		
MW-5A	1989	Alluvium
MW-5P	1989	Wolsey Shale
Daisy Creek Area		
MW-3	1989	Wolsey Shale

Note: Well locations shown on Figure 4 in the Site-Wide Sampling and Analysis Plan (Maxim, 1999f)

Figure 2 - Sketch Map of Glengarry Adit

Figure 2 back page

Field parameters measured will include pH, specific conductance, temperature, and flow as shown in Table 2 of the long-term plan. Flow measurements will be made at those stations where flow gauging is practical. Samples of floor sediments will be collected for extraction of pore water chemistry. Water quality monitoring will be completed according to standard operating procedures specified in the long-term plan.

3.4.2 Geologic Mapping

Detailed geologic mapping will be completed in the vicinity of the surface trace of the underground workings. Geologic mapping will consist of identifying on a map of sufficient scale, rock types, rock formations, geologic contacts, geologic structures, faults, and notable fractures. This mapping will complement and attempt to correlate water-bearing structures observed during underground geologic mapping with structures at the surface. This mapping will be used in conjunction with other aspects of the project to further the understanding of water flow and quality in the Glengarry mine workings.

3.4.3 Reopening Como Shaft

Underground assessment of the Glengarry Adit in October 2000, indicates that about one- half (18 gpm) of the water discharging from the Glengarry adit (38 gpm) has its source in the first set of raises off a southwest-trending crosscut that intersects the main Glengarry tunnel about 1,540 feet from the portal (Figure 2). Due to considerable caving, accumulation of muck in the crosscut, and debris at the bottom of the raise, assessment of the source of water within the raise could not be determined.

While the raise could be accessed from the bottom via the Glengarry portal by continuing mucking and rehabilitation operations in the crosscut, the large quantity of muck present in the crosscut, the caving condition of the drift, and the wet conditions present beneath the raise make this a difficult alternative to pursue. However, by entering the workings at the top of the second set of raises (Figure 2) that come to surface in the Como pit, which the assessment team was able to do to a limited extent in October, it may be possible to survey the raises from the underground workings that connect the two raises and avoid mucking and associated engineering difficulties present in the crosscut. Reopening the raises in the Como pit area would involve excavating earth and debris at the collar, and installing cribbing to a depth of about 20 feet below the surface. An underground room at this depth accesses a timbered heading and the top of the raise. Ladders present in the man way compartment of the two-compartment raise would be replaced to allow safe access to the underground workings.

Once entry of these underground workings is gained, the workings and raises will be surveyed, geology mapped, points of water inflow delineated and water samples collected. Some mucking may be required depending on the condition of the workings.

3.4.4 Reopen the portal of the Lower Spalding Adit and the McLaren Adit

There are two adits that need at least a preliminary assessment prior to constructing adit closures. One of these is the Lower Spalding Adit and the other is the McLaren Adit. The waste rock dump material at the Lower Spalding Adit is slated for removal in the summer of 2001 to the SB-4B repository. The McLaren mine site is slated for closure in the summer of 2002, pending the recommendations of an EE/CA currently under review.

The Lower Spalding adit currently weeps water in the spring and early summer through a waste rock plug placed at the portal to prevent unauthorized entry. The lower adit is connected to the upper adit through a raise and interconnected working on three levels that are shown on historical maps.

The McLaren Adit is one of a series of five (5) 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. This portal is also blocked with a plug of waste rock. The other four adits were presumably mined out during open-pit operations, although this has never been verified.

If possible, based on the condition of the underground workings, these two adits will be reopened to complete a visual assessment of the extent of workings and sources of either pooled or flowing water. The portals of each of these adits will be opened with a tracked excavator to attempt to gain access to the workings. If the workings are easily accessible, geologic mapping and water quality sampling will be performed to determine if geology, structure, or water inflows might be significant with respect to overall closure plans in the Como Basin and the McLaren Pit areas. No other activity is proposed to clear these adits if the workings are inaccessible, although further consideration of the underground conditions may warrant review after initial evaluation.

Opening of the adits will be executed concurrently with the opening of the Glengarry raises from the Como Basin while the tracked-excavator is on-site. 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.

3.4.5 Engineering Analysis of Potential Closure Alternatives

An engineering evaluation of potential closure alternatives in the Glengarry mine workings will be completed to assess the costs and potential benefits of reducing or eliminating flows from the Glengarry Adit. Potential closure alternatives that may have a positive impact on the quality and quantity of water emanating from the Glengarry adit include grouting of specific water-bearing fractures within the mine, plugging portions of the underground drift, and backfilling the mine workings and raises. The engineering analysis will include a discussion of feasibility, implementability, logistics, and cost. The impact on reduction of water inflows into the mine for each alternative considered will also be discussed. The results of the engineering evaluation will be presented in a technical memorandum.

One additional task will be performed to support engineering analysis of potential closure alternatives. This task is to complete batch testing of proposed back-fill and cemented back-fill material. Batch testing will be conducted on composited samples of select waste rock proposed for use as mine back-fill. Various cement/waste rock ratios will be prepared to evaluate overall structural strength of cemented back-fill and to evaluate final ABA (Acid-base accounting) characteristics of the various mixes. Size distribution of materials comprising the backfill will also be obtained to determine if screening or crushing, or screening and crushing may be desirable in preparing the backfill material and aggregate for the cemented back-fill. Waste rock at the portal of the Glengarry adit is a likely first candidate for back-fill material; however, other sources may be evaluated if this material is unsuitable.

3.4.6 Geochemical Evaluation of Fisher Creek Water Quality

In selecting a potential response action that would reduce or eliminate the Glengarry discharge or that would reduce or eliminate some or all metals in the Glengarry discharge, geochemical changes in Fisher Creek downstream of the adit may play as important a role in the ultimate water quality in Fisher Creek as any response action implemented at the Glengarry. This is due to the complex relationship between minerals deposited in the Fisher Creek floodplain, streambanks, and streambed and minerals within the water column, as well as contributions from undisturbed sulfide mineralization lower in the drainage. To better understand these relationships, and to better understand the impact of a response action that affects the Glengarry discharge, a geochemical model that describes changes in chemical concentrations in Fisher Creek below the adit will be developed. The geochemical study will primarily involve modeling of existing surface water and sediment chemistry, with a goal of developing a model that can represent possible changes in equilibrium water chemistry in Fisher Creek downstream of the Glengarry adit following the implementation of a response action. This work will rely heavily on the USGS tracer study results (Kimball, et at, in progress), which will be used as input for mixing and geochemical equilibrium calculations. Modeling will be done using the USGS code PHREEQ-C (Parkhurst, 1995). The results of the geochemical modeling will be presented in a technical memorandum.

3.4.7 Collect Engineering Data in the Como Basin

In conjunction with the Glengarry Adit assessment, severe erosion conditions present in the Como Basin and in the upper reaches of Fisher Creek above the Glengarry will be surveyed. These data will be used to develop a response alternative that could be completed in conjunction with the Glengarry Response Action. Data needed for engineering drawings include physical measurements of erosion features and hydrologic calculations that estimate erosive forces and surface water runoff flows and velocities. Realignment and consolidation of existing roads and tracks will likely be desirable in any overall erosion control plan.

3.4.8 Hydrogeologic Assessment

The Glengarry adit is a point discharge of mine drainage that collects water from fractures and other geologic structures along its entire length. The source of the water entering the fractures is currently unknown, and the connections between the Glengarry and other mined areas in the Como Basin are unknown as well. While much is known about the geology of the basin, specific flow direction pathways and quantity of groundwater flow along those pathways is not well understood. The purpose of this task is to combine existing information from previous investigations (Kimball et al, 1997; URS, 1998; Maxim, 2000b) and, in conjunction with the data collected under the previously described tasks, develop a conceptual model of groundwater flow in the basin. This conceptual model would in turn be used to identify data gaps and make recommendations on any further investigation work that would be needed to identify specific pathways of groundwater metals loading to Fisher Creek.

Groundwater occurs in two general hydro-stratigraphic units in the Como Basin area: relatively thin unconsolidated material along drainage basins and consolidated bedrock. Aquifer tests conducted on bedrock wells completed in intrusive rocks in the Como Basin area indicate hydraulic conductivities range from 3 x 10-4 to 5 x 10-5 cm/sec. Groundwater flow in Como Basin is primarily attributable to fracture flow. Cambrian-age sedimentary rocks in Como Basin were primarily fine-grained, shale, limestone, and dolomite, which were altered, lithified and compacted resulting in rock masses of low porosity and hydraulic conductivity.

Six monitoring wells were previously installed in the Como Basin. These wells are completed in various geologic units at depths ranging from 105 feet to 200 feet. Water levels measured in these wells fluctuate

seasonally by as much as 65 feet. Groundwater typically rises from its seasonal low to its peak in about 45 days. The direction of groundwater movement in the Como Basin is to the southeast, down Fisher Creek Valley. Based on a study completed by the USGS (1999), as much as 35% of baseflow in upper Fisher Creek is attributable to groundwater inflow.

The result of this task will be a technical memorandum that presents a conceptual model of groundwater flow. A potentiometric map of the area will be developed using existing well information, considering the permeability of the different rock units and the dominant fractures that are thought to influence flow directions. Water quality data will be compiled to develop an understanding of groundwater chemistry and how changes in chemistry may impact Fisher Creek.

3.5 MCLAREN PIT GROUNDWATER INVESTIGATION

Evaluation of hydrologic conditions in the McLaren Pit area indicates that water level fluctuations in the backfilled material may be the result of infiltration, and that water chemistry in the pit is impacted by the wastes in the pit. However, little is know about potential water movement pathways from the pit to the receiving waters of Daisy Creek, and no wells are currently installed in the area that could document natural water quality conditions unimpacted by mining. Further investigation of groundwater conditions in the McLaren Pit area are proposed to better define groundwater flow pathways, and to document natural groundwater conditions outside the influence of impacts that may be attributable to historic mining in the vicinity of the pit.

3.5.1 Background Groundwater Quality

Results of previous investigations suggest that the chemical nature of water exiting the pit may be similar to regional groundwater in the vicinity of near surface ore deposits (Maxim, 2001). However, natural background conditions in the mineralized Meagher Limestone have not been documented by direct measurement by these investigations. To provide this background groundwater information, one monitoring well will be completed in the Meagher Limestone upgradient of the pit. The proposed general location for the well is shown on Figure 3. The location of the well takes into account the presumed 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.

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 a mineralized interval within the Meagher Limestone. Borehole diameter would be sufficient to allow a 4-inch diameter completion using rotary drilling methods.

The well will be drilled, developed, and purged using methods and procedures described in the Site-Wide Sampling and Analysis Plan (Maxim, 1999f). Following purging, water quality samples 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 (Section 3.3)

3.5.2 Hydrogeologic Conditions Within and Downgradient of the McLaren Pit

To determine groundwater conditions downgradient of the McLaren Pit, monitoring wells will be installed in both the shallow alluvium water-bearing unit and the shallow bedrock water-bearing unit. To

provide sufficient information to meet the objectives of this task, a pair of wells will be drilled at three locations (Figure 3). These locations were selected to intercept the major groundwater flow path between the pit and Daisy Creek (well cluster #1, Figure 3), cross-gradient to the pit (well cluster #3), and further downgradient on Daisy Creek (well cluster #2, Figure 3). Each well cluster would consist of one well completed in alluvial/colluvial material near the bedrock contact and one well completed in the underlying bedrock material. Bedrock wells would be drilled approximately ten feet into the bedrock material and completed using a five-foot screen.

In addition to the proposed well nests, several piezometers will be installed in this general area. 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. Final selection of the location for the additional piezometers will be made by the field hydrogeologist in consultation with groundwater team members. Piezometers will be installed using a backhoe and will be completed with 2-inch pipe.

Finally, two wells will be installed and completed in the waste rock within the McLaren Pit. The three existing wells that were installed in 1996 by the EPA have some completion irregularities that may be affecting groundwater quality and water level measurements. The waste rock wells will be installed and completed in the same manner as the alluvial/colluvial wells.

Water levels will be measured following completion and wells 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. Water samples will be collected from monitoring wells using methods and procedures described in the site-wide SAP. Groundwater samples will be submitted to Northern Analytical Testing in Billings, Montana for analysis of parameters listed in the SAP. Results of water quality monitoring will be presented in the annual monitoring report.

During the 2001 field season, one of the six wells to be located between the McLaren pit and Daisy Creek would be tested to determine relevant aquifer characteristics using a pumping test. Test duration would depend on well drilling results and evaluation but would be a minimum of 8 hours. The remaining five wells installed during Phase 2 would be slug tested. Aquifer testing methods would follow those procedures presented in the site-wide SAP.

3.6 CHARACTERIZATION OF ADIT DISCHARGES

Numerous adit discharges are present in the District in each of the three drainages. Several of these discharges, such as the Glengarry Adit, Gold Dust, McLaren Mine, and Spalding have been previously sampled for complete chemical analysis. Many others have been sampled and analyzed for field parameters only. The purpose of this task is to chemically characterize all the known discharges in the District so that a more complete database of information is available to evaluate potential response actions for adit discharges.

Water quality samples will be collected from the adit discharges inventoried in the district. Samples will be collected one time during the month of July when higher flows from the adits are expected. Sample collection will follow methods and procedures for surface water as described in the Site-Wide SAP (Maxim, 1999f). The same water quality parameters analyzed for the Glengarry Assessment (Section 3.4) will be analyzed for this task. Field parameters measured will include flow, pH, specific conductance, temperature, and field analysis of total copper and iron.

3.7 SELECTIVE SOURCE RESPONSE ACTION CONSTRUCTION

The USDA-FS solicited bids from prospective contractors in September 2000 to construct the Selective Source Response Action. Following the evaluation of bids and the selection of a contractor, the Selective Source Response Action will be constructed as specified in the construction bid package.

The Selective Source Response Action involves removal of mine wastes from several selected sites located on District Property and disposing of those wastes in an on-site constructed repository. The repository site is located about two miles north of U.S. Highway 212 on the Lulu Pass road. Approximately 24,600 cubic meters (32,000 cubic yards) of waste will be placed in the repository on a geocomposite liner and covered with a soil and geocomposite cap. Leachate generated from moisture in the waste will be collected in a sump and disposed.

The work that will be conducted to complete the response action includes the following activities:

- Road Improvements - Considerable road improvements were made in 1999 on the Daisy Pass and Lulu Pass roads. Remaining improvements will be made to improve access to selected dump sites. Road improvement work includes regrading existing roads, improving drainage, increasing the width of the road, and constructing new access roads. All new access roads will be fully reclaimed after the removal is completed.

- Bridges - Two permanent, pre-cast concrete bridges were installed on the Lulu Pass Road, one crossing Fisher Creek and one crossing Polar Star Creek. Bridge installation was preferred by Park County over other alternatives considered. Park County is the agency responsible for long-term maintenance of the Lulu Pass and Daisy Pass roads.

- Connect Road Construction – A new connect road from the Lulu Pass to Daisy Pass roads will be constructed about 0.5 km north of the existing County Connect Road. This new road is in a better location than the old road, has fewer stream crossings, is on flatter slopes, and is entirely within the 1988 burn area. The location traverses a bench outside the view shed of US 212, with no side slopes exceeding 30%. The old road will remain for ATV use until the Gallatin National Forest determines which road will remain for long-term use.

- Clearing and grubbing, separating combustible and non-combustible debris, and debris disposal.

Figure 3

Figure 3 – back page

- Repository construction - The area of disturbance is about 1.5 hectares (3.7 acres). Construction activities include:

  - Salvaging soil from the disturbed area;
  - Excavating the area to a design depth of 1 m (3 feet) and stockpiling excavated materials;
  - Preparing the subgrade of the repository by compacting to a specified density;
  - Constructing runon and runoff control ditches around the perimeter of the repository;
  - Constructing a perimeter drainage trench to intercept subsurface flow;
  - Blasting rock from a nearby source to provide material for the rock toe;
  - Crushing rock from a nearby source to provide drainage gravel and sand;
  - Revegetating the repository cap with an appropriate seed mix and mulch; and,
  - Covering the cap with an erosion control blanket.

- Excavate, load, and haul waste to the repository.

- To facilitate regrading, seasonal drainages emanating from adits at several of the removal sites will be routed from the current point of discharge to a percolation basin constructed in front of the existing adit.

- Regrade and revegetate mine waste dump sites; truck and place 15 cm (0.5 feet) of coversoil from repository site; amend coversoil with lime and fertilizer, and seed, mulch, and cover with an erosion control blanket.

- Monitor and maintain vegetation on removal areas and at the repository; monitor surface water and groundwater quality at the repository.

Project engineers will provide oversight of the construction by monitoring the contractor's work to insure the project is completed in accordance with the design specifications. This will involve on-site inspection, coordination among agency and contractor personnel, documentation of construction activities, and generation of daily and weekly construction summaries. Lines of communication will be established to insure decision-makers are apprised of project progress and any issues that may develop. A construction report will be prepared following completion of construction. The report will include a project narrative, as-built drawings, important construction documents, and a summary of any problems encountered or recommended solutions for future construction related problems. Video and/or photographs of important construction activities will be obtained and presented in the report.

In conjunction with the construction oversight effort, field personnel will monitor surface water quality and quantity at locations immediately downgradient of construction activities. Specific monitoring locations will be field-determined and will be located to provide for early-detection of impacts created by the construction activities. Field measurements to be obtained at these locations will include:

- Flow
- pH
- Specific Conductivity
- Turbidity
- Field analyses of iron and copper and other site specific contaminants

These measurements will be obtained in accordance with procedures and methods described in the Site-Wide SAP (Maxim, 1999f). As a means to verify the field measurements, one out of every 20 surface

water samples collected will be split and analyzed at Northern Analytical Laboratories in Billings for metals parameters listed in the Site-Wide SAP. Where significant changes in water quality are noted either through review of field or laboratory analyses, prompt and appropriate actions will be taken to mitigate the problems identified up to and including halting the construction project.

3.8 MCLAREN PIT ENGINEERING EVALUATION/COST ANALYSIS

An Engineering Evaluation/Cost Analysis (EE/CA) for 2001 will be prepared to evaluate response action alternatives to address mining impacts in Daisy Creek. Included in the EE/CA will be potential contaminant sources present in the McLaren Pit, below the road south and west of the pit, and along the road toward Lulu Pass. Based on preliminary results from the assessment work completed in the pit area during the 2000 field season, several alternatives will be developed. These alternatives include total removal to an on-site repository, in-situ treatment, capping, and reactive barrier walls to treat the lateral flow of groundwater downgradient of the pit. Some combination of alternatives may be implemented depending on the results of the detailed analysis of each alternative.

This EE/CA will not develop alternatives to directly address water treatment of metals contamination in adit discharges present at the site. A separate EE/CA will be developed for all acid discharges in the District following the EE/CA that will be developed for 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 the final EE/CA.

3.9 MCLAREN PIT RESPONSE ACTION

Based on the technical evaluation of alternatives developed in the EE/CA for the McLaren Pit 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 McLaren Pit Response Action will be solicited from qualified contractors. The USDA-FS expects that a contractor will be selected in 2001 and the Response Action would begin construction in 2002.

3.10 PREPARE 2002 WORK PLAN

A work plan similar to this plan will be prepared to guide specific work activities to be completed during the 2002 calendar year. 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 2002 calendar year will be described.

3.11 PREPARE GLENGARRY ADIT EE/CA

An EE/CA for 2002 will be prepared to evaluate alternatives for the annual response action. Potential source areas included in the response action will be determined from the AIMSS ranking. Work at the Glengarry Adit is expected to be the major source area included in the 2002 EE/CA.

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.

4.0 PROJECT SCHEDULE

Figure 4 illustrates the schedule for 2001 activities identified in Section 3.0.

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Figure 4 - Project Schedule

Figure 4 – back Page

5.0 REPORTS

Numerous reports will be prepared during 2001 as a result of completing the activities described in Section 3.0. These reports are summarized in Table 3 along with a description of the report contents and approximate delivery schedule.

TABLE 3
List of Reports
New World Mining District Response and Restoration Project
2001 Work Plan

Deliverable Title	Contents	Delivery Schedule
2001 Work Plan	This Document	Draft – April 2001 Final – June 2001
McLaren Pit EE/CA	Evaluation of alternatives for the McLaren Pit Response Action	Draft – July 2001 Final – August 2001
McLaren Pit Action Memorandum	Decision document for McLaren Pit Response Action	September 2001
McLaren Pit Design Package	Engineering Design Drawings, Technical Specifications, and Bid Package	October 2001
Glengarry Adit Assessment (Phase II) Technical Memorandum	Phase II Assessment Results	December 2001
Annual Surface Water and Groundwater Monitoring Report	Results and analyses of ongoing surface water and groundwater monitoring	January 2002
2001 Construction Report	Summary of construction field notes; as-built drawings for completed construction projects	January 2002
2002 Work Plan	Proposed activities for calendar year 2002	Draft – December 2001 Final – January 2002
Glengarry Adit EE/CA	Findings from 2001 field investigations; Engineering evaluation of alternatives developed for Glengarry Adit response action	Draft – February 2002 Final – March 2002

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