GLENGARRY MILL-SITE ADIT CLOSURE
CONSTRUCTION REPORT JULY 21ST – AUGUST 22ND, 2008

CONTRACT AND TASK ORDER NO. AG-0398-C-07
MODIFICATION 0002

NEW WORLD MINING DISTRICT
RESPONSE AND RESTORATION PROJECT

Prepared for:

USDA Forest Service
Gallatin National Forest
Bozeman, Montana

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EXECUTIVE SUMMARY

The Glengarry Mill-site Adit was reclaimed in summer of 2008 under contract number AG-0398-C-04-0018 between the USDA Forest Service and Tetra Tech. Reclamation of the Glengarry Mill-site Adit consisted of reopening the adit and removing mud, rock-fall, and ferricrete deposits from the adit sill. The source(s) of water entering the tunnel were located and grout rings were installed from within the tunnel to stem flow. Muck removed from the adit was mixed with a grout amendment and placed back into the adit. The portal was plugged with coarse rock to insure any remaining drainage would be directed to the constructed infiltration basin. The portal and construction disturbance was regraded and revegetated. The project was completed significantly under budget and within the anticipated schedule.

A cost estimate was submitted to the Forest Service in response to a Task Order to stem the flow and thereby improve surface and ground water quality to Fisher Creek. The cost estimate to pressure grout several drill-hole rings within the adit was $217,640. After constructing the first grout ring a reevaluation of the adit flow reduction was conducted. The observations of the flow reduction allowed increasing the pressure grouted ring spacing. The increased spacing reduced significant labor and materials that were initially estimated to stem the flow. The contractor completed the tasks 30% under budget as a result of lower fracture density within the adit. The project was completed for $165,000 (24% less than estimated). Additions to the contract were completed under this task order which included; construction of an infiltration basin for any remaining adit discharge and project site clean-up including portal and ancillary disturbance. The additional charges were included in the final project cost of $165,000.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

This Construction Report was prepared for the USDA Forest Service (USDA-FS) Region 1 to summarize work completed to close and reclaim the Glengarry Mill-site Adit (Adit) by Tetra Tech and its subcontractors for the New World Mining District Response and Restoration Project. The New World Mining District Response and Restoration Project is a non-time critical CERCLA removal action with the goal of achieving the highest and best water quality practicably attainable within the District. The evaluation of the closure options for the Glengarry Mill-site Adit were included as part of the Draft Adit Discharge EE/CA (Tetra Tech 2006) and the selection of a closure method is discussed in the Glengarry Mill-site, Lower Tredennic and Black Warrior Adits Response Action Memorandum (USDA-FS, 2008). Several major response actions previously conducted on the New World project were the Selective Source Response Action, the McLaren Pit Response Action, the Como Basin, Glengarry Adit, and Fisher Creek Response Action.

1.1 REPORT ORGANIZATION

This Construction Report begins with a discussion of the project background, which provides information on the construction contract, subcontracts and construction activities. The remainder of the report includes information pertaining to the general setting and site characteristics of the Glengarry Mill-site Adit, a sequential summary and discussion of overall project activities, a summary of project costs, as well as a discussion of major problems encountered, contract changes, and recommendations. **Table 3** in Section 5.0 compares the initial and final contract quantities and costs. Select digital photographs of project activities are included within the text of this document; additional construction photographs are available in **Appendix A** in the back of this document.

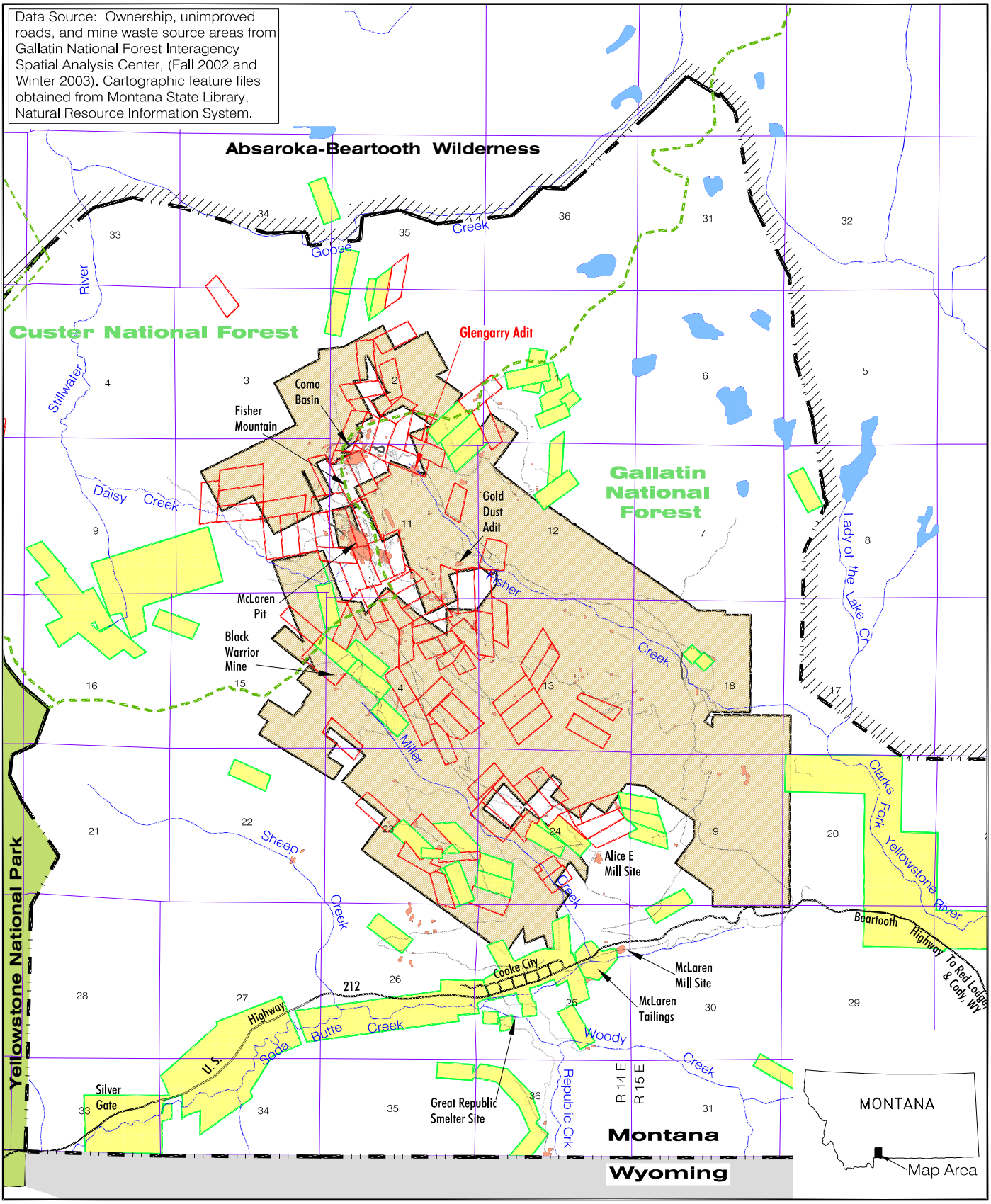
1.2 BACKGROUND

The New World Mining District (District) is located in Park County, Montana, in an area north of the small town of Cooke City (**Figure 1**). The principal environmental issues within the District are associated with impacts from historic mining and more recent mineral exploration activities that occurred since prospecting in the area was initiated in about 1869.

A draft Adit Discharge Engineering Evaluation/Cost Analysis (EE/CA) was previously completed (Tetra Tech, 2006) in order to evaluate response alternatives for the mitigation of mining-related water quality impacts associated with the Glengarry Mill-site Adit and other adits in the District. The EE/CA identified the Glengarry Mill-site Adit as a modest contributor of metals loading to Fisher Creek and the preferred alternative selected for the Glengarry Mill-site adit was continued monitoring with no additional action. However, 2008 monitoring data suggested that hydrologic and geochemical conditions at the Glengarry Mill-site adit were not improving appreciably as a result of the previously completed main Glengarry Adit closure and calculations indicated that the Glengarry Mill-site Adit was contributing 11.4 percent of the iron, 3 percent of the copper, 2.9 percent of the manganese and 1.4 percent of the lead loading at Fisher Creek monitoring station SW-3. Based on these data, it was deemed appropriate to complete a specific response action (USDA-FS Action memorandum, 2008) on the Glengarry Mill-site Adit source in order to control the contaminant migration into Fisher Creek. The preferred response action for the Glengarry Mill-site Adit involved an effort to reduce or stem the flow of

contaminated water from the portal using fracture grouting techniques. Because of the shallow (near surface) location of the Adit, fracture grouting of the host rock surrounding the Glengarry Mill-site Adit was chosen as the most cost-effective means likely to successfully reduce or stem the flow of contaminant-bearing water from the Adit.

The specific goal of the action was to significantly reduce flow from the adit and thereby improve surface and ground water quality, particularly with respect to metals loading in the upper reaches of Fisher Creek.



Project Vicinity Map
New World Mining District
Response and Restoration Project
Cooke City Area, Montana
FIGURE 1

1.3 CONTRACT OVERVIEW

Closure of the Glengarry Mill-site adit was proposed under the Action Memorandum (USDA-FS, July 2008) and approval was further described with Task Order No. 7 modification 0002. The work conducted under this Task Order and Modification was completed according to the terms and conditions of contract number AG-0398-C-04-0018 between the USDA Forest Service and Tetra Tech. The work was proposed to take place during mid-July and August of 2008, and included the following tasks:

1) Removing the building at the adit portal,
2) Mobilization of mine crew and equipment,
3) Portal clean-up and rehabilitation of the portal for safe access,
4) Construction of a sedimentation basin to be used during adit clean-up,
5) Reopening of the adit for safe working conditions, scaling, slusher set-up,
6) Mucking out mud, precipitate and rock fall from the sill (floor of the adit),
7) Identifying the source of water inflow,
8) Drilling the first "Ring" of grout holes near the face and grouting them,
9) Stepping back eight feet, ring-drill second set of holes and grout them,
10) Stepping back another eight feet, ring-drill a third set of holes and grout them,
11) Construction of an infiltration Basin to accommodate remaining adit discharge (contract addition)
12) Site clean-up (contract addition),
13) Demobilization,
14) Close portal,
15) Reclaim access road and remaining mine closure surface disturbances (contract addition).

Tasks 1 through 14 were to be carried out under the supervision of Tetra Tech, which awarded two subcontracts in order to accomplish these tasks. Mr. Allan Kirk with Tetra Tech was the on-site Project Manager and Mr. Mike Meredith was on-site in Mr. Kirks' absence. On July 23, 2008, Tetra Tech awarded a subcontract with a not to exceed amount of $8,600 to Asplund Enterprises of Cooke City, Montana, to provide materials, equipment and labor to carry out Task 1 and to reclaim any impacts to the site caused by the mining work. Additionally, on July 22, 2008, Tetra Tech awarded a subcontract with a not to exceed amount of $178,083.00 to Kockler Contract Mining, LLC of Kellogg, Idaho to furnish all materials, equipment and labor required to carry out Tasks 2 through 13. Contract Additions were used to accomplish Tasks 11, 12 and 14.

2.0 GLENGARRY MILL-SITE ADIT SETTING AND CHARACTERISTICS

This section contains a description of the historical mining activities, Mill-site Adit, and a summary of previous investigation and site characterization work that provided the basis for the Glengarry Mill-site Adit closure.

The Glengarry Mining Company drove the Glengarry adit beginning in 1925 (Lovering, 1929). The adit was collared at an elevation of about 2,841 meters (9,320 feet) near the base of Lulu Pass in the headwaters of Fisher Creek, a tributary of the Yellowstone River (**Figure 2**). The adit was driven about 700 meters (2,300 feet) west-northwest towards Lulu Pass and attempted to intercept mineralization mined at higher elevation in the Spaulding Tunnels near Lulu Pass.

No mineralization was found along the adit level heading of the mine (Lovering, 1929). A small adit (Mill-site Adit) was cut 42 feet into the west wall behind a small wooden building that stood at the portal. The Adit was presumed to be used for storage (possibly blasting agents) for continued support of the Glengarry Mine and Mill-site. Although the Mill-site Adit was significantly shorter than the main Glengarry Adit and Mine, it intercepted several near-surface fractures, mostly in the sill (floor) that were water-bearing. The Mill-site Adit has had a history of low-volume discharge that is likely forced to the surface at the portal by a prominent ferricrete bench.

2.1 HISTORICAL USES AND PREVIOUS REMEDIATION AND RECLAMATION WORK

The significant mine workings in the upper Fisher Creek drainage/Lulu Pass area, to which the Glengarry Mill-site Adit is ancillary, are comprised of the now closed Glengarry adit and Como raise (**Figure 2**). Together, these features make up a large portion of the now-closed Glengarry Mine's workings, which were driven between 1925 and the mid-1930's in part to access the Como stratabound massive sulfide replacement deposit, which is hosted in the Meagher Limestone Formation at the surface in the Como Basin. From 1974 through 2003, water flowing from these workings was identified as a major source of acidic metal laden adit discharge to Fisher Creek. Consequently, between 2003 and 2005, a major remediation and reclamation plan that included grouting, backfilling and placement of hydraulic cement plugs at strategic locations in the Glengarry Mine and Como Raise was designed and implemented. Ultimately, this work led to a very large reduction of flow from the Glengarry Mine and a major reduction in the contaminant metal load in Fisher Creek (Tetra Tech, 2007).

2.2 GLENGARRY MILL-SITE ADIT SETTING AND CHARACTERISTICS

The Glengarry Mill-site Adit (site F8-B; **Figure 2 and Figure 3**) is located immediately south of the reclaimed main Glengarry Adit, above the upper reach of Fisher Creek and south of Lulu Pass. This adit consists of a single horizontal drift extending approximately 13 meters (42 feet) into the east flank of Fisher Mountain. The Glengarry Mill-site Adit was likely driven to provide extended storage space behind a small wooden building that stood at its portal. No remediation or reclamation work has previously been completed on the Glengarry Mill-site Adit.

Prior to the 2008 construction activities at the Glengarry Mill-site Adit, a ferricrete dam at the portal backed up a 7.5 meter (25 foot) long pool of water approximately 1 meter (3 feet) deep that contained rock fall debris and chemically precipitated ferricrete mud. An approximate 1 meter (3 feet) wide rock fall occurred at the back of the pool, which formed a dam holding an additional 4.6 lineal meters (15 lineal feet) of ferricrete precipitated mud (Tetra Tech, 2006).

Water discharging from the adit flowed over an extensive ferricrete bench outside of the portal (**Figure 3**), around the old Mill-site, and infiltrated into colluvial materials directly below the Mill building foundations approximately 46 meters (150 feet) from Fisher Creek. This shallow groundwater likely reports to Fisher Creek. The presence of a sizable lithified ferricrete bench outside of the portal and ferrihydroxide mud within the workings suggests that groundwater, rich in reduced iron, is seeping from fractures in the country rock and precipitating iron-hydroxides upon contact with the atmosphere at the surface. Indirect age-dating of Ferricrete in the area has shown that these deposits areas much as 8,800 years old (Furness and Hinman, 1998), and indicate that these processes were occurring long before underground mining in the area.

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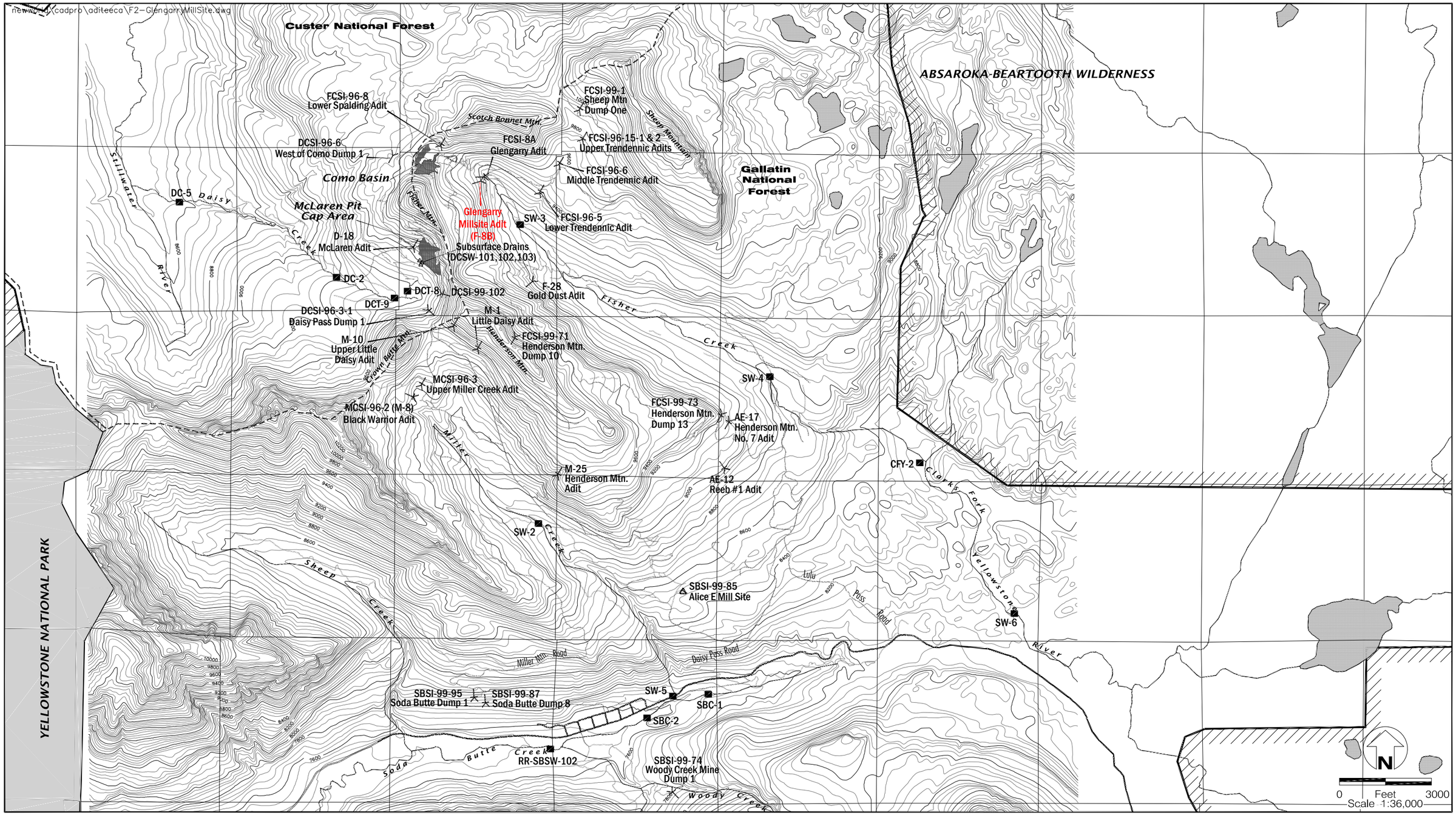

Source: Topographic data from USGS 7.5 Cooke City Quad
Contour Interval = 40'

District Boundary
Forest Boundary
Roads

SW-2 Surface Water Station
Collapsed Adit Discharge Site
Open Adit Discharge Site
Other Discharge Site

Map of Upper Fisher Creek Showing Glengarry Mill-Site Adit
New World Mining District
Response and Restoration Project
Cooke City Area, Montana
FIGURE 2

2.3 GLENGARRY MILL-SITE ADIT CHARACTERISTICS

The Glengarry Mill-site Adit (site F8-B; **Figure 2 and Figure 3**) is located immediately south of the now closed and reclaimed main Glengarry Adit, above the upper reach of Fisher Creek and south of Lulu Pass. This adit consists of a single horizontal drift extending approximately 13 meters (42 feet) into the northeast flank of Fisher Mountain from its portal. The Glengarry Mill-site Adit was likely driven to provide extended storage space behind a small wooden building that stood at its portal. No remediation or reclamation work has previously been completed on the Glengarry Mill-site Adit.

Figure 3. Glengarry Mill-site Adit site, view to west-northwest.

2.4 GLENGARRY MILL-SITE ADIT DISCHARGE CHARACTERISTICS

Surface and groundwater quality, and hydrologic data have been collected regularly from the upper Fisher Creek drainage/and adits in the Lulu Pass area since 1989 (**Table 1**). Water discharging from the Glengarry Mill-site Adit (station F-8B) has been sampled eight times between 1989 and 2007 and once in 2008 (Tetra Tech, 2008). The range of flow data values from the Glengarry Mill-site Adit have historically varied from 3 to 100 lpm (0.8 to 26.9 gpm) prior to closure activities, with a mean outflow from the Glengarry Mill-site Adit of 29.5 lpm (7.8 gpm; USDA-FS, 2008; Tetra Tech, 2008). These data include an anomalously high flow value from 1989 of 100 liters per minute (lpm) or 26.9 gallons per minute (gpm). A measurement taken directly before the start of the reconstruction project (July 29, 2008) indicated a discharge of 30 lpm or 8.1 gpm.

Analysis of adit discharge samples indicates poor water quality. The water regularly contains concentrations of cadmium, copper, iron, lead, manganese and zinc in excess of aquatic life standards, and is acidic (pH ranges from 3.1 to 3.9 s.u.) (Tetra Tech, 2008). Recent average concentrations of metals in the water (in milligrams per liter) were cadmium, 0.0008; copper, 0.13; iron, 15.3; lead, 0.002; manganese, 0.98; and zinc, 0.1 (Tetra Tech, 2008).

Table 1. Water Chemistry and Flow of the Glengarry Mill-site Adit Before the Project.

Station Name	Sample Date	Flow (gpm)	Field pH (su)	Hardness (mg/L CaCO3)	Sulfate (mg/l)	Concentration (Total Recoverable in Milligrams Per Liter)						
						Aluminum	Cadmium	Copper	Iron	Lead	Manganese	Zinc
F-8B	Average 1989 to 2007	5.6	3.4	37.5	85.2	0.2733	0.000794	0.1276	15.31	0.001613	0.982	0.107
F-8B	July 29, 2008 (Just before Project)	8.1										

The data indicate that water flowing from the Glengarry Mill-site Adit was a notable contributor to the contaminant load of Fisher Creek. Therefore, a response action to mitigate contaminant migration from the Adit into Fisher Creek was deemed necessary to provide improved surface and groundwater quality in the upper Fisher Creek catchment (USDA-FS, 2008).

3.0 GLENGARRY MILL-SITE ADIT CLOSURE PROJECT SUMMARY

Work to close the Glengarry Mill-site Adit was started on July 21, 2008 and final site work was completed on August 22, 2008. A summary of tasks completed to accomplish the closure are outlined below. Section 1.3 above (Contract Overview) includes a listing of tasks conducted for the this project. Those tasks are described in greater detail below and are arranged in approximate chronological order of completion.

Figure 4. View of muck/settling basin and drainage channel from portal.

3.1 INITIAL SITE WORK AND MINING CREW MOBILIZATION

The wooden building (**Figure 3**) at the Adit portal was dismantled and hauled away for disposal. A small settling basin was constructed approximately 75 feet south of the Adit on a partially reclaimed historic roadbed (**Figure 4**). The settling basin was constructed to contain muck and debris removed from the Adit during rehabilitation and to allow suspended sediment to settle from water discharging from the adit during construction (**Figure 5**).

After the initial site work was completed, a two-man mining crew was mobilized to the site, along with all necessary equipment to complete the Adit rehabilitation and grouting tasks. Twenty pallets of Portland Type II cement were delivered and stockpiled near the New World Waste Repository for use as grout. Equipment, such as pick-up trucks, air compressors, portable toilet and a tele-handler were staged on a road below the Adit to minimize the impact of construction activities on the site. Smaller equipment required for mining, such as jackleg drills, slusher and the grout pump were staged near the adit portal (**Figure 5**). Water and air would be needed for drilling and fracture grouting.

A gravity-fed water system was placed above the adit. The system collected water from behind a hand made dam in an adjacent stream using a flexible one-inch, PVC pipe that delivered the water to a tank located to the east and above the Adit portal. The water was used to clean equipment and the adit and to mix cement for grouting. Air for the pneumatic mining equipment and grout plant was supplied by a trailer mounted air compressor sited directly below the adit.

3.2 MINING AND GROUTING ACTIVITIES

3.2.1 Portal and Adit Rehabilitation

The Glengarry Mill-site portal and adit were found to be in good condition upon inspection by the mining crew. Aside from the previously described rock fall, ground conditions inside the adit were good and required minimal rehabilitation to establish a safe underground work area.

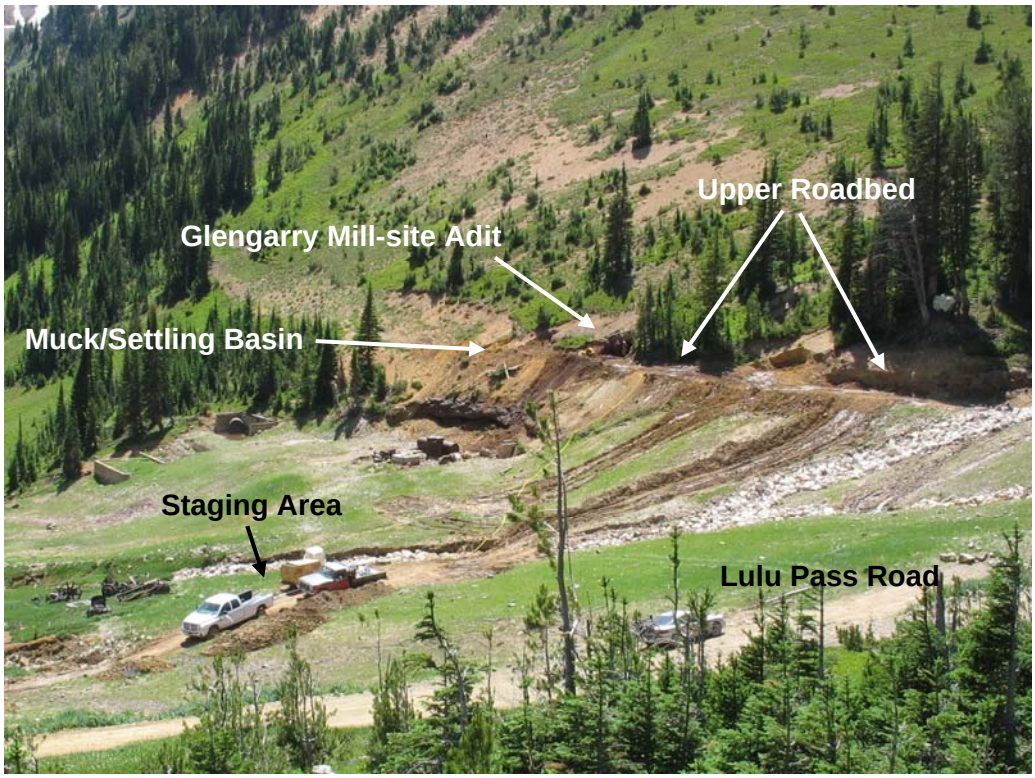

Figure 5. Overview of Glengarry Mill-site from Lulu Pass road, view to southwest.

The back and ribs of the Adit were scaled to remove any loose rock, and a slusher was set up to remove the rock-fall and ferricrete mud precipitates from the sill of the Adit. After all sill debris (muck) was removed to the front of the portal, a skid-steer loader was used to transport the muck to the settling pond.

3.2.2 Investigation of Water Inflow

Inspection of the Adit by Tetra Tech and mining personnel did not reveal a point source of water inflow other that a small volume (<0.5 gpm) from a fracture in the face. Rather, the source of most of the inflow appeared to be diffuse and predominantly coming into the adit from along the sill, with the face and ribs as minor secondary sources. A series of high-angle, intersecting joint sets (fractures/fissures) were pervasive in the host rock throughout the adit, however, these structural features did not appear to play a significant role in controlling water inflow from the ribs or back. Part of the reason for this is the adit itself had formed a cone of depression around itself that effectively lowered the water table to the sill elevation.

Figure 6. Packers set in holes comprising the first grout ring.

3.2.3 Cement Fracture Grouting

The contract proposed that cement grout curtains be installed by drilling about five groups of eight holes in a radial ("ring") pattern around the adit (**Figure 6**). Rings were to be initially spaced approximately eight feet apart, beginning at the face and continuing toward the portal. Grouting was conducted based on this general plan and took place between August 5, 2008 and August 15, 2008. Secondary rings of holes could have been drilled halfway between the primary rings (4-feet) if water flows between rings determined that this was necessary. No circumstances were encountered that suggested that secondary rings or holes needed to be drilled. A typical ring was installed and grouted as follows:

- Five to eight approximately 3.25 centimeter (1.25 inch) holes were drilled into the rock in a radial pattern to a depth of approximately 3 meters (10 feet) using either a pneumatic jackleg drill or a sinker rock drill for down-holes in the sill (**Figure 6**),
- Pump-through packers were inserted into the holes and sealed in place,
- Portland cement grout was pumped under pressure (generally between 40 and 100 pounds per square inch) into each hole until the fractures in the rock adjacent to the holes would no longer take grout or until grout flowed out of an adjacent hole, demonstrating connectivity, and
- After all holes in a ring had been grouted, valves were removed from the packers and the packers were permanently sealed.

3.2.4 Adit Water Inflow Reassessment:

After the drilling and grouting of the first ring (nearest the face), Tetra Tech and the mining crew reassessed the flow and grout ring spacing. The first ring used much less grout than was anticipated which led to the conclusion that the interconnectivity between holes along fractures was less than anticipated or that the fractures were in fact tight or coated with precipitated minerals. The discharge was in fact reduced by drilling this ring and the source of water at the face (described above) became negligible. The discharge source was reassessed and determined to be coming predominantly from the sill and along the lower portions of the ribs. As the connectivity between grout ring holes was minimal and the source was at the sill, the ring spacing was revised from eight feet to 12 feet.

To complete the grouting operations, three rings consisting of eight holes each were drilled, plus two additional fill-in holes in the sill for a total of 26 holes. Approximately eight tons (15,120 pounds, dry) of Portland cement was mixed and pumped into the holes under pressure. Following the final inflow/discharge assessment, mining equipment and supplies were removed and the mining crew was demobilized.

The final water flow of approximately 9 lpm or 2.3 gpm was measured which relates to a 72 percent reduction compared to the flow at the initiation of the project (8.1 gpm).

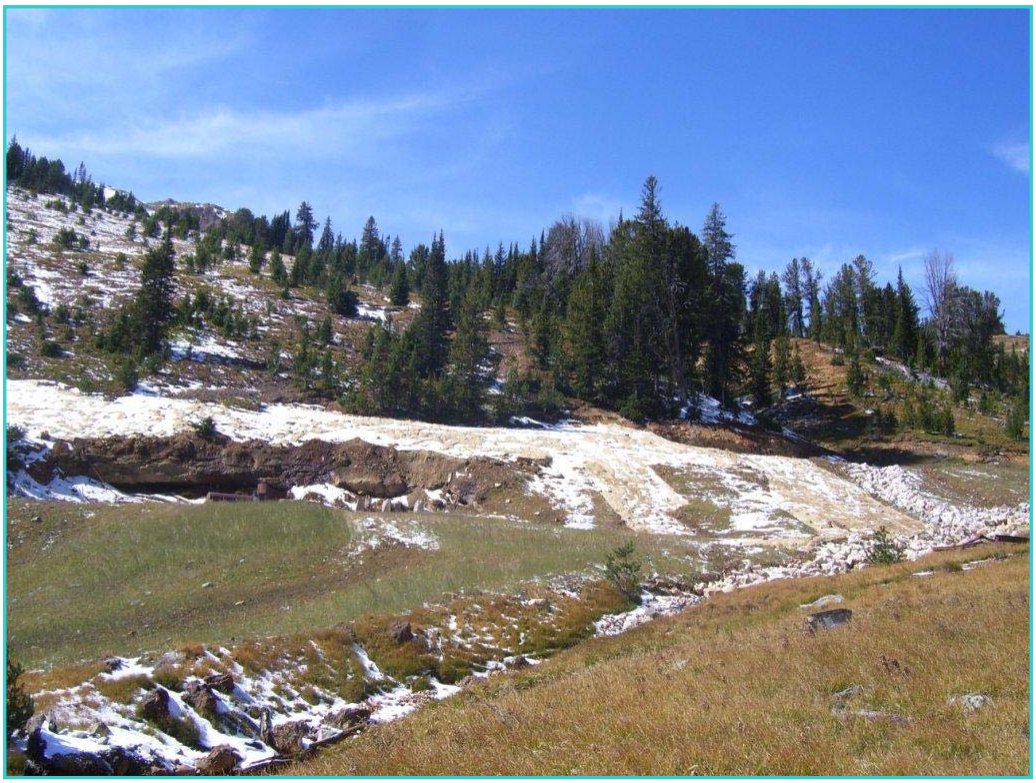

Figure 7. Reclaimed Glengarry Mill-site Adit site, view to west-northwest.

3.3 SITE RECLAMATION

After the mining crew and equipment had been demobilized, the portal was closed under a contract addition. Initially, the reclamation and portal closure was to be completed by the US Forest Service. The project site was recontoured and revegetated in order to restore the area to a more natural appearance (**Figure 7**). To provide a post mine contour and allow adit drainage the portal opening was filled with large rocks (about 0.5 to one meter (18 inches to three feet) in diameter) from the sill to the back using excavation equipment. The gaps in the face of the portal plug were then hand-filled with smaller rocks. To provide for any remaining adit discharge, an infiltration basin was sized and constructed at the front of the portal by excavating an area approximately six meters (20 feet) in diameter down to the ferricrete bench (about 0.5 meters [18 inches] deep). The basin was filled with gravel (1" to 3") and covered with a non-woven geotextile. Muck and ferricrete mud that were removed from the Adit and placed in the settling basin during the project were allowed to dry and were then re-contoured in place.

The entire upper roadbed (**Figure 5**), from south of the settling basin to the Glengarry Adit, was reclaimed by backfilling using the spoils from the cut slope. In addition, the access trails to the adit from the lower staging area created a disturbance that also required reclamation. The access disturbance was re-graded and new rock was added to a stream channel that had been bridged. All re-contoured and graded areas were scarified, top-soiled as needed and seeded. Erosion mat was placed to prevent rills from forming during germination in the first growing season.

4.0 POST-CLOSURE DATA

A water sample was collected from the Glengarry Mill-site Adit discharge on August 15, 2008; after grouting had been completed but before site reclamation occurred. The chemistry of this water is provided in (**Table 2)**. Cadmium and copper concentration reductions were significant although iron, lead zinc and aluminum increased. It should be noted that this closure project did not deliberately undertake actions to modify water quality, but rather was designed to reduce water flow.

The rate of discharge was measured at 8.7 lpm (2.3 gpm) on August 21, 2008, also after grouting, but before site reclamation. This reduction represents a 72 percent reduction as compared to the flow rate previously recorded just prior (July 29, 2008) to project initiation. The post closure flow rate also represents about a 70 percent reduction in flow from the adit compared to the historical average of 29.5 lpm or 7.8 gpm. Together, these data demonstrate the effectiveness of the Glengarry Mill-site Adit closure plan in attaining its goal of further reducing contaminant loading in the upper Fisher Creek catchment, principally through a reduction in flow.

Table 2. Water Chemistry and Flow of the Glengarry Mill-site Adit

Station Name	Sample Date	Flow (gpm)	Field pH (su)	Hardness (mg/L CaCO3)	Sulfate (mg/l)	Concentration (Total Recoverable in Milligrams Per Liter)						
						Aluminum	Cadmium	Copper	Iron	Lead	Manganese	Zinc
F-8B	Average 1989 to 2007	5.6	3.4	37.5	85.2	0.2733	0.000794	0.1276	15.31	0.001613	0.982	0.107
F-8B	July 29, 2008 (Just before Project)	8.1										
F-8B	Aug. 15, 2008 (After Stemming)	2.3		84.0	118.0	0.34	0.0002	0.045	19	0.002	1.07	0.13
(% Reduction) **% Increase**		(71.6)				**24.4**	(74.8)	(64.7)	**24.1**	**24.0**	**9.0**	**21.0**

5.0 PROJECT COSTS

The project was completed within the anticipated timeframe of thirty days and no issues that could have delayed the project occurred. The actual cost associated with this project was $165,000 as compared to the March 2008 cost estimate of $217,640. The difference in cost was principally due to the main adit discharge stemming being completed earlier than anticipated. The early completion was a result of increasing the “ring spacing” from five to eight feet. The reduction of rings saved both drilling and grouting time.

In addition to the original task order, the Forest Service requested contract additions that were completed within the original budget and time frame of the project. The additions included an infiltration basin for remaining discharge and site reclamation of the adit and ancillary disturbance. A breakdown of the original contract with the additions is described in **Table 3**.

Table 3. Change in Project Cost and Hours.

	Original Task Order	Additions	Final Costs ($)	Percent Change
Kockler	$192,246	$0	$134,877	-30%
Asplund	$0	$17,417	$17,417	-
Tetra Tech	$25,394	$0	$12,706	-50%
Cost	$217,640		$165,000	-24%
Project Hours	200		118	-41%

6.0 CONCLUSION/RECOMMENDATIONS

The Glengarry Mill-site Adit discharge contributed to overall metals loading to Fisher Creek which was the underlying decision for mitigation. The goal of the project was to reduce the adit discharge as much as possible in order to reduce the metals loading to groundwater and ultimately to the surface waters of Fisher Creek. The project was completed within the anticipated time frame and no safety incidents occurred. As identified in the previous section, the water chemistry was improved in regards to the most chronic and acute contaminants and the flow reduced by over 70 percent. The overall contaminant loading has been reduced to Fisher Creek and the surrounding groundwater.

No major problems were encountered and no significant changes to the closure plans were made during the Glengarry Mill-site Adit Closure project. Subcontractor Kockler Contract Mining, LLC (KMC) provided a competent, disciplined and efficient mining crew, who approached the project with ingenuity and intelligence. Additionally, subcontractor Asplund Enterprises carried out the site-work and reclamation tasks in a highly competent and professional manner.

Despite the success of this project, a similar project in the future may benefit from the following lessons learned:

- A more reasonably-sloped and durable temporary access pathway could have been constructed, which would have mitigated the access difficulties and minimized the subsequent required reclamation.

- Keeping as many extra parts as feasible on site for highly-specialized equipment has the potential to save a significant amount of time, especially in a remote location such as Cooke City, Montana. No extra “Reamer” bits were on site causing a lost day.

7.0 REFERENCES

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Appendix A