2016/2017 (Initial) Activities Scope of Work
New World Mining District
Response and Restoration Project

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PRESENTED TO

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1.0 INTRODUCTION

Tasks completed in conjunction with response and restoration activities for the New World Mining District Response and Restoration Project in Park County, Montana (**Figure 1**) are described in annual work plans prepared between 1999 and 2010 (Maxim, 1999; 2000; 2001; 2002; 2003; 2004; 2005; 2006a; Tetra Tech 2007, 2008, 2009, 2010).

Following completion of the response and restoration phase of the project, a Site-Wide Long-Term Operations and Maintenance Plan (Tetra Tech, 2012) was prepared. This plan describes annual monitoring tasks that will be completed to evaluate water quality conditions and to determine whether additional maintenance of reclaimed sites and the repository is needed, and estimated costs of site-wide monitoring and maintenance. The long-term operations and maintenance plan for the project began in 2012 after reclamation actions were complete and covers activities that will occur for the following 20 years (through 2032). The Plan is intended to modify the Overall Work Plan (Maxim, 1999), and the Repository Monitoring Plan (Maxim, 2006b) during the years of its implementation.

1.1 SITE LOCATION AND DESCRIPTION

The New World Mining District falls within the Custer Gallatin National Forest and lies adjacent to Yellowstone National Park's northeast corner. The Absaroka-Beartooth Wilderness Area bounds the District to the north and east, with the Montana-Wyoming state line forming the southern boundary of the District. The District lies entirely within Park County, Montana.

The District covers an area of about 10,360 hectares (25,600 acres) and is located at an elevation that ranges from 2,400 meters (7,900 feet) to over 3,170 meters (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 allows access to the District from the east but is closed during winter.

The topography of the District is mountainous with prominent glacial erosional and depositional features, and is situated at the headwaters of three river systems that all flow into the Yellowstone River. The three tributaries are the Clarks 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.

1.2 PURPOSE AND OBJECTIVES

The primary purpose of this scope of work is to guide project activities that will be conducted in the District in accordance with the Long-Term Operations and Maintenance Plan (Tetra Tech, 2012) through August, 2016. A separate scope of work describes activities that will be completed between September, 2016 and April, 2018 (Tetra Tech, 2016).

Primary objectives for work covered in the Long-Term Operations and Maintenance Plan are to document and monitor the effectiveness of reclamation response and restoration actions; to provide for maintenance actions as required to ensure long-term stability of erosion controls and reclamation covers; to monitor surface and groundwater quality and to satisfy the requirements of the rule allowing adoption of temporary water quality standards.

2.0 SCOPE OF WORK

The work for beginning of the fifth year (through August 31, 2016) under the Site-Wide, Long-Term Operations and Maintenance Plan (Tetra Tech, 2012) will include the following activities:

- Continue monitoring surface water (June 2016) and groundwater (July 2016) quality in the District as required by the BER for verification that temporary water quality standards are being met.
- Continue monitoring surface water (June 2016) and groundwater (July 2016) quality in the District, including locations downstream of the Como Basin capped reclamation area, downstream of the closed Glengarry Adit, and downstream and within the capped McLaren Pit.
- Continue to monitor the New World Waste Repository at the Repository Sump and select groundwater monitoring well locations.
- Conduct vegetation monitoring at reclaimed areas to determine if areas of failed revegetation or weed infestation are present. This work is scheduled to occur once every five years.
- Prepare a bid-specification package to support subcontractor selection for construction of a passive sump fluid treatment system at the New World Waste Repository.
- Provide project management and technical assistance during DEQ's evaluation of the proposed construction of a passive sump fluid treatment system at the New World Waste Repository, Idaho State University's proposed vegetation study, and other technical items as requested by USFS.

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

2.1 SURFACE WATER QUALITY MONITORING

Surface water quality monitoring will be conducted in June, 2016 at the 12 sampling stations identified in the Long-Term Operations and Maintenance Plan (Tetra Tech, 2012). These stations include the seven stations required for monitoring for compliance with temporary water quality standards (Stanley and Maxim 1998; and Maxim 2003c). Surface water sampling sites are listed in **Table 1**.

Surface water samples will be collected and analyzed in accordance with procedures and methods described in the Site-Wide Sampling and Analysis Plan (SAP) (Appendix B in Maxim, 1999). In addition to the analytical methods described in the Site-Wide SAP, analysis of dissolved metals will be added to the parameter list for all sites. Total recoverable and dissolved arsenic analysis will also be completed in response to inquiries made by BER.

Table 2 lists surface water field parameters and standard operating procedures (SOPs) from the Site-Wide SAP. **Table 3** lists preservation and bottle requirements and **Table 4** lists surface water analytical requirements and practical quantification limits (PQLs).

TABLE 1
SURFACE WATER SAMPLE SITES
Long-term Operations and Maintenance Plan

Site Name	Location	Monitoring Objective
Daisy Creek Drainage		
DCT-8	Daisy Cr. tributary south of McLaren Pit	Measures contribution of impacts from McLaren capped area to Daisy Creek.
DC-2*	Daisy Creek below confluence of McLaren tributaries	Temporary water quality standard required monitoring station.
DC-5*	Daisy Creek above confluence with Stillwater River	Temporary water quality standard required monitoring station
SW-7*	Stillwater River at Stillwater Trail Crossing	Temporary water quality standard required monitoring station
Fisher Creek Drainage		
FCT-11	Tributary below Como Basin	Measures contribution of impacts from Como Basin capped area to Fisher Creek
SW-3*	Fisher Creek below former Glengarry Adit	Temporary water quality standard required monitoring station
SW-4*	Fisher Creek at Lulu Pass Road Crossing	Temporary water quality standard required monitoring station
CFY-2*	Fisher Creek above Clarks Fork confluence	Temporary water quality standard required monitoring station
Clarks Fork River Drainage		
SW-6*	Clarks Fork Yellowstone River at Saw Mill Road	Temporary water quality standard required monitoring station
Soda Butte Creek Drainage		
SBMS-US	Soda Butte Creek above confluence with Miller Creek	Measures water quality in Soda Butte Creek above McLaren tailings and mill-site, and above junction with Miller Creek.
SBC-2	Soda Butte Creek below McLaren Tailings	Measures water quality in Soda Butte Creek below McLaren tailings and mill-site, and below junction with Miller Creek.
SBC-4	Soda Butte Creek at Park Boundary	Measures water quality at the Park Boundary

* Indicates stations required for temporary water quality sampling by BER.

TABLE 2
SURFACE WATER FIELD PARAMETERS
Long-Term Operations and Maintenance Plan

Parameter	SOP Number [1]	SOP Title	Event
Specific Conductance	SOP-05	Field Measurement of Specific Conductance	All
pH	SOP-06	Field Measurement of pH	All
Water Temperature	SOP-07	Field Measurement of Water Temperature	All
Flow	SOP-01	Stream Flow Measurement; Wading Technique	All

[1] Standard Operating Procedures (Appendix B of Maxim 1999)

TABLE 3
SURFACE WATER SAMPLING REQUIREMENTS
Long-Term Operations and Maintenance Plan

Parameter	Preparation / Preservation [1]	Bottle Size / Type
Total Recoverable Metals	HNO3 to pH < 2; Iced to 4°C	250 milliliter polyethylene
Dissolved Metals	Filtered through 0.45 micron filter; HNO3 to pH < 2; Iced to 4°C	250 milliliter polyethylene
Common Ions/Physicochemical	Iced to 4°C	500 milliliter polyethylene

[1] HNO_3 = nitric acid

TABLE 4
SURFACE WATER ANALYTICAL REQUIREMENTS
Long-Term Operations and Maintenance Plan

Parameter	PQL (mg/L) [1]	EPA Method No.	Max. Holding Time
Physicochemical			
Specific Conductivity (mS/cm)	1	2310B	28 days
pH (standard units)	0.1	150.1	Upon arrival at lab
Total Dissolved Solids	1	2340C	7 days
Total Suspended Solids	1	160.2	7 days
Hardness	1	2340B	6 months
Acidity	1	305.1	14 days
Total Recoverable and Dissolved Metals [2]			
Aluminum	0.05	200.8/200.7	6 months
Arsenic	0.003	200.8/200.7	6 months
Cadmium	0.0001	200.8/200.7	6 months
Copper	0.001	200.8/200.7	6 months
Iron	0.01	200.8/200.7	6 months
Lead	0.001	200.8/200.7	6 months
Manganese	0.003	200.8/200.7	6 months
Zinc	0.01	200.8/200.7	6 months
Common Cations [3]			
Calcium	1.0	200.8/200.7	6 months
Magnesium	1.0	200.8/200.7	6 months
Potassium	1.0	200.8/200.7	6 months
Sodium	1.0	200.8/200.7	6 months
Common Anions [3]			
Sulfate	1.0	375.2	28 Days
Bicarbonate	1.0	2320B	14 Days
Carbonate	1.0	2320B	14 Days
Chloride	1.0	325.3	28 Days
Other			
Cation / Anion Balance	None	Calculation	None

[1] PQL = Practical Quantitation Limit in milligrams per liter (mg/L) unless noted otherwise. If specified PQL is not technologically achievable due to matrix interference etc. then the Method Detection Limit should meet the specified PQL value.

[2] Surface water will be analyzed for total recoverable (unfiltered) and for dissolved metals for all stations.

[3] Common cations and anions are to be analyzed as total recoverable for use in determining cation/anion balance.

2.2 GROUNDWATER QUALITY MONITORING

Groundwater monitoring will be conducted in July, 2016 at the wells listed in **Table 5**. The groundwater monitoring event would involve measuring water levels, measuring field parameters, and collecting samples for laboratory analysis (**Tables 6**, **7**, and **8**).

2.2.1 New World Repository Monitoring

Groundwater monitoring would be conducted at one well pair location (SBGW-107, and -107T) at the New World waste repository in accordance with the methods and procedures described in the New World Waste Repository Long-Term Monitoring Plan (Maxim, 2006b). These wells will be monitored in June during the high flow surface water monitoring event in order to ensure that the SBGW-107T well contains sufficient groundwater to provide a sample for submittal to the analytical laboratory.

Groundwater monitoring will include maintaining and downloading water level data from the continuous water level measuring instrument installed in well SBGW-107T and collecting water quality samples. Repository wells will be sampled once in July. Prior to 2012, these monitoring wells were monitored in May when repository groundwater levels are typically highest. Groundwater samples will be submitted to an analytical laboratory for analysis of parameters listed in **Table 8**.

Monitoring would also include maintaining and downloading water level data from the continuous water level instrument installed in the repository sump. At the end of the field season in late September or early October, water in the sump will be pumped into water trucks and disposed of at the Cody, Wyoming, sewage treatment ponds.

Prior to pumping, a sample will be collected from the sump for analysis. This sample will be analyzed for the same suite of parameters as the other groundwater samples and also for an expanded list of parameters per the request of the Cody, Wyoming sewage treatment plant operators. These additional parameters for the sump sample are listed in **Table 8**.

TABLE 5
GROUNDWATER MONITORING WELLS
Long-Term Operations and Maintenance Plan

Well Identification	Year Installed	Completion Formation	Monitoring Event	
			June	July
Daisy Creek / McLaren Area				
DCGW-101S	2001	Colluvium	—	**X**
DCGW-101D	2001	Lulu Pass Rhyodacite Porphyry	—	**X**
DCGW-104	2001	Waste Rock	—	**X, W**
DCGW-105	2001	Waste Rock	—	**X, W**
DCGW-132	2002	Colluvium	—	**X**
Fisher Creek Area				
EPA-11	1996	Tertiary Intrusive Dike	—	**X**
EPA-12	1996	Scotch Bonnet Diorite	—	**X**
FCGW-100	2004	Glengarry Adit Workings	—	**X**
MW-1	1989	Wolsey Shale	—	**X**
MW-9A	1990	Alluvium	—	**X**
MW-9B	1990	Precambrian	—	**X**
Tracer-5	1997	Fisher Mtn. Intrusive	—	**X**
Repository Sump	2002	Not Applicable	—	**S, W**
SBGW-107T	1999	Till	**X**	**W**
SBGW-107	1999	Granite	**X**	—

X Samples collected and analyzed for full suite of laboratory parameters.

F Samples collected and monitored for field parameters only.

S Repository Sump sample submitted for analysis of a different analytical suite compared to other groundwater samples. Refer to **Table 8**.

W Continuous water level monitoring.

-- Indicates no monitoring.

TABLE 6
GROUNDWATER FIELD PARAMETERS
Long-Term Operations and Maintenance Plan

Parameter	SOP Number (1)	SOP Title	Event
Specific Conductance	SOP-05	Field Measurement of Specific Conductance	All
pH	SOP-06	Field Measurement of pH	All
Water Temperature	SOP-07	Field Measurement of Water Temperature	All
Oxidation-Reduction	SOP-28	Field Measurement of Redox Potential (Eh)	All
Dissolved Oxygen	SOP-08	Field Measurement of Dissolved Oxygen	All
Depth to Water	SOP-20	Field Measurement of Groundwater Level	All

1 Standard Operating Procedures (Appendix B of Maxim 1999)

TABLE 7
GROUNDWATER SAMPLING REQUIREMENTS
Long-Term Operations and Maintenance Plan

Parameter	Preparation / Preservation (1)	Bottle Size / Type
Dissolved Metals	Filtered through 0.45 micron filter; HNO3 to pH < 2; Iced to 4°C	250 milliliter polyethylene
Common Ions/Physicochemical	Iced to 4°C	500 milliliter polyethylene

1 HNO_3 = nitric acid

TABLE 8
GROUNDWATER ANALYTICAL REQUIREMENTS
Long-Term Operations and Maintenance Plan

Parameter	PQL (mg/l) [1]	EPA Method No.	Max. Holding Time
Physicochemical			
Specific Conductivity (mS/cm)	1.0	2310B	28 days
pH (standard units)	0.1	150.1	Upon arrival at lab
Total Dissolved Solids	1.0	2340C	7 days
Total Suspended Solids [2]	1.0	160.2	7 days
Hardness	1.0	2340B	6 months
Acidity	1.0	305.1	14 days
Metals [3]			
Aluminum	0.05	200.8/200.7	6 months
Arsenic [2]	0.003	200.8/200.7	6 months
Barium [2]	0.005	200.8/200.7	6 months
Cadmium	0.0001	200.8/200.7	6 months
Chromium [2]	0.004	200.8/200.7	6 months
Copper	0.001	200.8/200.7	6 months
Iron	0.01	200.8/200.7	6 months
Lead	0.001	200.8/200.7	6 months
Manganese	0.003	200.8/200.7	6 months
Mercury	0.001	245.1	6 Months
Selenium [2]	0.0005	200.8/200.7	6 months
Silver [2]	0.0005	200.8/200.7	6 months
Zinc	0.01	200.8/200.7	6 months
Common Cations [4]			
Calcium	1.0	200.8/200.7	6 months
Magnesium	1.0	200.8/200.7	6 months
Potassium	1.0	200.8/200.7	6 months
Sodium	1.0	200.8/200.7	6 months
Common Anions [4]			
Sulfate	1.0	300.0	28 Days
Bicarbonate	1.0	300.0	14 Days
Carbonate	1.0	300.0	14 Days
Chloride	1.0	300.0	28 Days
Other			
Cation / Anion Balance	None	Calculation	None

[1] PQL = Practical Quantitation Limit in milligrams per liter (mg/L) unless noted otherwise. If specified PQL is not technologically achievable due to matrix interference etc. then the Method Detection Limit should meet the specified PQL value.

[2] Shaded parameters only analyzed from Repository Sump sample.

[3] Groundwater parameters will be analyzed as dissolved constituents as filtered through a 0.45 micron filter. Repository Sump sample analyzed for total recoverable metals in addition to dissolved.

[4] Common cations and anions are to be analyzed as total recoverable for use in determining cation/anion balance.

2.3 VEGETATION MONITORING

2016 will be the first year that vegetation monitoring will be conducted under the Long-term Operations and Maintenance Plan. Vegetation monitoring is scheduled to occur every five years with subsequent events planned for 2021, 2026, and 2031. Monitoring will be completed in accordance with the Overall Project Work Plan (Maxim, 1999) as modified by the New World Long-Term Revegetation Monitoring: Review and Recommendations Technical Memorandum (Tetra Tech, 2009b).

Vegetation monitoring will be completed during the second half of August. It will consist of observing the areas monitored during the last annual vegetation monitoring event in 2010 (Tetra Tech, 2011) (**Table 9**) to determine whether there are areas of erosion warranting attention or whether there are germination failures or vegetation survival failures of 250 square feet or greater. The presence or absence of invasive plants will be verified as will the success of whitebark pine tree plantings.

If areas of vegetation failure are observed in areas of 250 square feet or greater soils samples will be collected for analysis of soil fertility and phytoxicity parameters in accordance with the Overall Project Work Plan (Maxim, 1999) and Long-Term Operations and Maintenance Plan (Tetra Tech, 2012). Following receipt of the laboratory analysis, recommendations will be made to amend soils or reseed barren areas.

TABLE 9
RECLAMATION VEGETATION MONITORING LOCATIONS
Long-Term Operations and Maintenance Plan

Reclamation Sites	Monitoring Locations	
McLaren Pit Cap Area	McLaren Upper	McLaren Triangle
	McLaren Lower	Borrow Area
Como Basin	Como Basin	
Fisher Creek	Glengarry Waste Dump	Gold Dust
		New World Repository
Miller Creek	Miller Creek Area	Black Warrior
		Little Daisy

2.4 REPOSITORY SUMP FLUID PASSIVE TREATMENT DESIGN

As outlined in the Sump Drainage Management Alternatives Memo (Tetra Tech, 2014), Tetra Tech shall prepare a construction bid package including installation of a drainage pipe to an infiltration basin to discharge repository sump fluids. The construction bid package design will include excavation of the repository cover and waste materials to expose the repository sump, placement and bedding of an 8-inch HDPE pipe, and an infiltration basin to infiltrate the repository fluid into the subsurface.

Tetra Tech shall prepare a draft construction bid package including construction drawings, specifications, and an engineer's estimate for Forest Service review and comments. Following agency review, Contractor shall prepare a final construction bid package, incorporating agency comments.

2.5 PROJECT MANAGEMENT AND AGENCY LIAISON

This work shall include project management activities such as budget tracking and progress reporting along with various discussions of technical data and issues at the site, construction issues related to reclamation, and potential implementation of maintenance activities. Technical memos may be requested by the Forest Service to document this work. Technical support related to DEQ's evaluation of repository sump passive treatment system construction, Idaho State University's vegetation study, or other items may also be required.

3.0 REFERENCES

Maxim Technologies. 1999. Overall Project Work Plan. New World Mining District Response and Restoration Project. Final. Prepared for the USDA Forest Service, November 10.

Maxim Technologies. 2000. 2000 Work Plan. New World Mining District Response and Restoration Project. Final. Prepared for the USDA Forest Service, March 10.

Maxim Technologies. 2001. 2001 Work Plan. New World Mining District Response and Restoration Project. Final. Prepared for the USDA Forest Service. June 25.

Maxim Technologies. 2002. 2002/2003 Work Plan. New World Mining District Response and Restoration Project. Final. Prepared for the USDA Forest Service. July 22.

Maxim Technologies. 2003. 2003/2004 Work Plan. New World Mining District Response and Restoration Project. Final. Prepared for the USDA Forest Service. May.

Maxim Technologies. 2004. 2004/2005 Work Plan. New World Mining District Response and Restoration Project. Final. Prepared for the USDA Forest Service. June.

Maxim Technologies. 2005. 2005/2006 Work Plan. New World Mining District Response and Restoration Project. Final. Prepared for the USDA Forest Service. July.

Maxim Technologies. 2006a. 2006/2007 Work Plan. New World Mining District Response and Restoration Project. Final. New World Mining District Response and Restoration Project. Prepared for the USDA Forest Service. October.

Maxim Technologies. 2006b. New World Waste Repository Long-Term Monitoring Plan. New World Mining District Response and Restoration Project. Final. Prepared for the USDA Forest Service. July.

Tetra Tech. 2007. 2007/2008 Work Plan. New World Mining District Response and Restoration Project. Final. New World Mining District Response and Restoration Project. Prepared for the USDA Forest Service. October.

Tetra Tech. 2008. 2008/2009 Work Plan. New World Mining District Response and Restoration Project. Final. New World Mining District Response and Restoration Project. Prepared for the USDA Forest Service. October.

Tetra Tech. 2009. 2009/2010 Work Plan. New World Mining District Response and Restoration Project. Final. New World Mining District Response and Restoration Project. Prepared for the USDA Forest Service. October.

Tetra Tech. 2011. Final 2010 Revegetation Monitoring Report. New World Mining District Response and Restoration Project. November.

Tetra Tech. 2014. Memo: Sump Drainage Management Alternatives Preliminary Cost Estimate. New World Repository. September.

Tetra Tech. 2016. 2016/2017 (Final) and 2017/2018 Activities Scope of Work. New World Mining District Response and Restoration Project. April.