United States Department of Agriculture
Forest Service
Northern Region

2002 Surface Water and Groundwater Monitoring Report

New World Mining District Response and Restoration Project

MAXIM TECHNOLOGIES INC®

2002 SURFACE WATER AND GROUNDWATER MONITORING REPORT NEW WORLD MINING DISTRICT RESPONSE AND RESTORATION PROJECT

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1.0 INTRODUCTION

Maxim Technologies, Inc. (Maxim) prepared this Surface Water and Groundwater Monitoring Report for the United States Department of Agriculture Forest Service (USDA-FS), Northern Region. This document presents surface water and groundwater data collected during the 2002 calendar year. Monitoring activities are being conducted in conjunction with on-going response and restoration work being completed in the New World Mining District (District).

Long-term monitoring of surface water and groundwater falls within the purpose and objectives of the overall project, which are described in detail in the *Overall Project Work Plan* (Maxim, 1999a). To avoid redundancy, only generalized descriptions of the site, study objectives, and organization of the project are provided herein. The reader is encouraged to review the *Overall Project Work Plan* and the *2002/2003 Work Plan* (Maxim, 2002a) to gain a better understanding of these aspects of the project.

Database summaries and laboratory analytical reports are included in the appendices to this report. Separate technical memorandums referenced in this report, the project database, and other project documents are available on the project website at the following address:

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

1.1 PROJECT BACKGROUND

The District, which includes a mixture of National Forest System and private lands, is a historic metals mining district located in the vicinity of Cooke City, Montana. This historic mining district is centered about four miles northeast of the northeast gate to Yellowstone National Park, and contains hard rock mining wastes and acid discharges that impact the environment. Human health and environmental issues are related to elevated levels of heavy metals present in mine waste piles, open pits, acidic water discharging from mine openings, surface water, stream sediments, and groundwater.

On August 12, 1996, the United States signed a Settlement Agreement with Crown Butte Mining, Inc. (CBMI), to purchase CBMI's interest in their District holdings. The resulting transfer of property to the United States effectively ended CBMI's proposed mine development plans and provided $22.5 million to cleanup historic mining impacts to specific properties in the District. In June 1998, a Consent Decree was signed by all interested parties and CBMI, and approved by the United States District Court, that finalized the terms of the Agreement and made available the funds that will be used for mine cleanup.

The USDA-FS, as the lead agency responsible for implementing the cleanup of the District, has assembled an organization and guiding objectives to proceed with response actions and restoration of historic mining impacts in the District. Under their Superfund authority, the USDA-FS is conducting response and restoration activities by following guidance provided by the United States Environmental Protection Agency (U.S. EPA) for Non-Time-Critical Removal Actions (U.S. EPA, 1993).

1.2 PURPOSE

The primary purpose of long-term surface water and groundwater monitoring conducted during 2002 was to continue to collect data to document changes in water quality that result from response and restoration actions. Surface water quality monitoring also is being conducted in the District to comply with the requirements of the rule adopting temporary water quality standards for segments of Daisy

Creek, the Stillwater River, and Fisher Creek (Stanley and Maxim Technologies, 1998) in accordance with the Montana Water Quality Act (§ 75-5-201 et seq.).

In addition to year 2002 long-term monitoring, which is conducted at specific stations in the Daisy Creek, Fisher Creek, Clarks Fork River, Miller Creek, and Soda Butte Creek drainages, surface water monitoring also was performed at other select sites in support of other, more detailed studies of water quality. These select sites include the McLaren Pit area, the McLaren Adit, other discharging mine adits, and water quality monitoring of construction activities associated with the Selective Source Response Action and the McLaren Pit Response Action.

For groundwater monitoring, sampling at select wells in the area of the Selective Source repository was performed in addition to long-term groundwater monitoring at established wells in the District. An extensive monitoring well installation program also was completed for further investigations of groundwater quality and groundwater characteristics in the McLaren Pit and Como Basin areas. Water level, water quality, and flow data collected for these two investigations are referred to in this report, but more detailed accounts of these specific monitoring activities are reported in a separate technical memorandum (Maxim, 2003a).

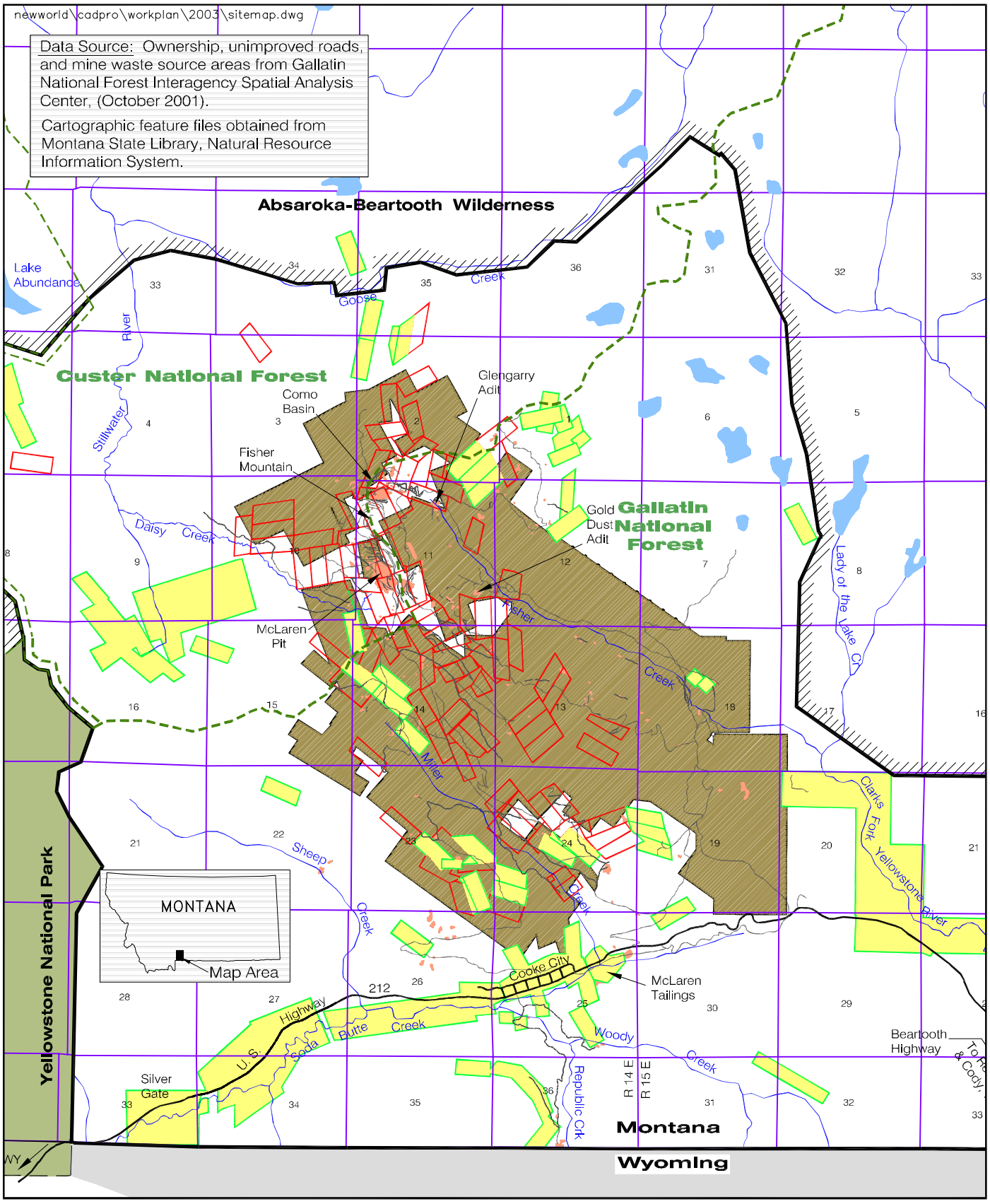
1.3 SITE LOCATION AND DESCRIPTION

The New World Mining District is located in southernmost Park County in south-central Montana. The District is bounded on the south by the Montana-Wyoming state line, on the west by Yellowstone National Park and on the north and east by the Absaroka-Beartooth Wilderness area boundary (Figure 1). The District is characteristic of subalpine regions of the northern Rocky Mountains with elevations that range from approximately 2,400 meters (7,900 feet) to over 3,100 meters (10,200 feet). Accumulated snow pack in the higher elevations range from 3 meters (10 feet) to over 6 meters (20 feet) deep where drifting occurs. The ground is generally snow covered from late October through mid-May at the lower elevations and from early October through late June at the higher elevations. Perennial and semi-perennial snowfields occupy the north facing slopes of the highest mountain peaks.

Area streams are high energy, first and second order tributaries of the Yellowstone River system. These streams occupy glacially carved valleys and are fed largely by melting snow pack. Peak streamflow is characteristically reached by mid June or early July and may be several orders of magnitude higher than baseflow conditions, which typically occur in late winter or early spring. Three drainage basins have been identified as being impacted by the proposed response and restoration actions: 1) Fisher Creek and the Clarks Fork of the Yellowstone River; 2) Daisy Creek and the Stillwater River drainage basin; and, 3) Miller Creek and Soda Butte Creek drainage basin.

The District covers an area of about 10,360 hectares (25,600 acres). Historic mining disturbances affect about 20 hectares (50 acres) located on District Property, which includes all lands or interest in lands transferred to the United States by CBMI. Mining disturbances on non-District Property include the McLaren Tailings and McLaren Mill Site, which cover an additional 6.9 hectares (17 acres), the Great Republic Smelter, and waste associated with numerous scattered mines and prospects. 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.

Topography of the District is mountainous with dominant glacial features. Stream valleys are U-shaped and broad while the ridges are steep, rock covered, and narrow. Much of the District is located at or near tree line, especially in the Fisher Mountain area where the major mining disturbances are located.



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

Figure 1. Back page

2.0 METHODS

Surface water and groundwater monitoring activities were conducted in accordance with the *2002/2003 Work Plan* (Maxim, 2002a), the *Site-Wide Sampling and Analysis Plan* (Site-Wide SAP) (Maxim, 1999b), and the *Long-Term Surface Water Quality Monitoring Plan* (Maxim, 1999c). More detailed descriptions of Maxim's methods can be found in these plans. A summary of methods used to complete 2002 monitoring activities is provided in this section.

2.1 SURFACE WATER MONITORING

Surface water monitoring was conducted at 12 long-term stations and 17 other stations (supplemental monitoring) during 2002 (Figure 2). The stations sampled during 2002 are listed in Tables 1 and 2. Methods used to collect the samples and analytical methods are described in the *Long-Term Surface Water Quality Monitoring Plan* (Maxim, 1999c).

2.1.1 Long-Term Monitoring

Long-term surface water monitoring was conducted in April, July, and October 2002. Monitoring occurred at or near low flow conditions (April), at or near high flow conditions (July), and at the end of the field season (October). All surface water samples were submitted to Northern Analytical Laboratories, Inc. (NAL) in Billings, Montana for analysis of parameters listed in the Site-Wide SAP (Maxim, 1999b). Discharge measurements, field parameter measurements, and site-specific sample notes were taken at all surface water monitoring stations before collecting samples.

2.1.2 Supplemental Monitoring

Supplemental monitoring was conducted at select stations on Daisy Creek, Fisher Creek, and tributaries to Soda Butte Creek during construction of the McLaren Pit Response Action and for completion of construction at the Selective Source repository site. Flow and field parameters were measured, and samples were collected and shipped to NAL for analysis of parameters listed in the Site-Wide SAP.

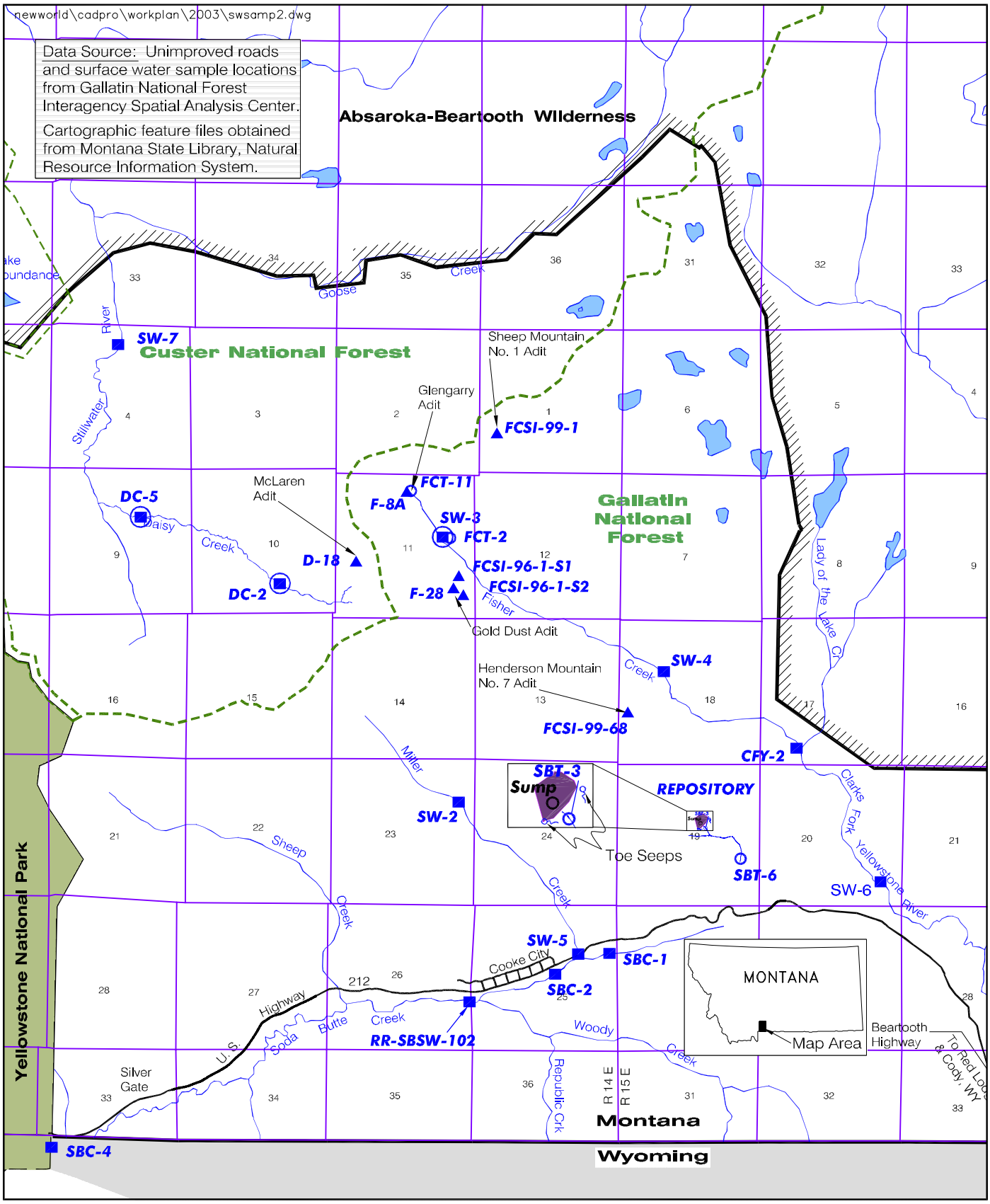
Monitoring was also conducted at five stations on streams draining the McLaren Pit area as part of the McLaren Pit Hydrogeologic Investigation. Field parameters were measured and samples were collected and shipped to NAL for analysis of parameters listed in the Site-Wide SAP (Maxim, 1999b).

Known adit discharges were also monitored in June, July, September, and October 2002 at five mine adits located in the Fisher Creek and Daisy Creek drainages. Flow was measured or estimated, field parameters were measured, and samples were submitted to NAL for analysis of parameters listed in the Site-Wide SAP and the *2002/2003 Work Plan*. Table 2 lists the mine adit locations sampled during 2002.

TABLE 1
2002 SURFACE WATER SAMPLE SITES
New World Mining District Response and Restoration Project

Site Name	Location	Month Sampled					Construction Monitoring
		April	May	July	September	October	
Daisy Creek Drainage							
D-18	McLaren Adit Discharge			X	X	X	
DCSW-0905	McLaren Tributaries (5 streams, sites A-E)				X		
DC-2	Daisy Creek Below Confluence of McLaren Tributaries	X		X	X	X	X
DC-5	Daisy Creek Above Confluence with Stillwater River (DNRC-127)	X		X	X	X	X
SW-7	Stillwater River at Stillwater Trail Crossing	X		X		X	
Fisher Creek Drainage[1]							
FCT-2	Fisher Creek Tributary Below Tredennick Removal Sites			X		X	X
FCT-11	Fisher Creek Tributary Below Spalding and Como Removal Sites			X			X
F-8A-0	Glengarry Adit Discharge			X		X	
F-28	Gold Dust Adit Discharge			X		X	
SW-3	Fisher Creek at DNRC Gauging Station (DNRC-207)	X		X		X	
SW-4	Fisher Creek at Lulu Road Crossing	X		X		X	
CFY-2	Fisher Creek Above Confluence with Clarks Fork.	X		X		X	
Clarks Fork River Drainage							
SW-6	Clarks Fork Yellowstone River at Saw Mill Road Crossing	X		X		X	
Miller Creek Drainage							
SW-2	Miller Creek below Miller Mountain Road crossing	X		X		X	
SW-5	Miller Creek at U.S. Highway 212 crossing			X			
Soda Butte Creek Drainage							
	Repository Seep			X			X
	West Repository Toe Seep			X			X
SBT-3	South of Repository at Lulu Road	X	X	X			X
SBT-6	Soda Butte Tributary Below Waste Rock Repository Site	X[2]	X	X		X	X
SBC-1	Soda Butte Creek above confluence with Miller Creek	X		X		X	
SBC-2	Soda Butte Creek below McLaren Tailings	X		X		X	
SBC-4	Soda Butte Creek at Yellowstone Park Boundary	X		X		X	
RR-SBSW-102	Soda Butte Creek below confluence with Republic Creek	X		X		X	

Notes: Sample locations shown in Figure 2.
X : Sampled
Shading indicates supplemental sampling stations
1 : See Table 2 for additional mine adit sample sites
2 : Also monitored in March 2002



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2002 Surface Water Monitoring Stations
New World Mining District
Response and Restoration Project
Cooke City Area, Montana
FIGURE 2

Figure 2 - back page

TABLE 2
2002 MINE ADIT SAMPLE SITES
New World Mining District Response and Restoration Project

Site Name	Month Sampled			Location
	June/July	Sep	Oct	
D-18-0	X	X	X	McLaren Adit discharge
D-18-366		X		McLaren Adit at roof leak, 366 feet in from portal
D-18-423		X		McLaren Adit end of accessible workings, 423 feet in from portal
F-8A-0	X		X	Glengarry Adit discharge
F-28 (aka FCSI-96-1)	X		X	Gold Dust Adit discharge
FCSI-96-1-S1	X			Gold Dust waste rock toe seepage NE of corner dump
FCSI-96-1-S2	X			Gold Dust waste rock toe seepage SE of corner dump
FCSI-99-1	X			Sheep Mtn. #1 Adit discharge
FCSI-99-68	X			Henderson Mtn. #7 Adit discharge

Notes: **X - Sampled**
Sample locations shown on Figure 2

2.2 GROUNDWATER MONITORING

Groundwater sampling was conducted at 44 monitoring wells during 2002. Table 3 lists monitoring wells sampled during 2002 and Figure 3 shows locations of these wells. Monitoring was conducted in accordance with the *2002/2003 Work Plan* and the Site-Wide SAP. Water levels were measured in each well prior to purging the wells.

2.2.1 Long-Term Monitoring

Long-term groundwater monitoring was conducted at 25 monitoring wells during July 2002 when groundwater levels were at or near seasonal highs. Monitoring activities included water level measurement, field parameter measurement, well purging, sample collection, and laboratory analysis. Samples were submitted to NAL for analysis of parameters listed in the Site-Wide SAP.

2.2.2 Selective Source Repository Well Monitoring

Three well pairs installed in till and bedrock on the margins of the Selective Source repository site were monitored in July 2002 in accordance with the Site-Wide SAP. Monitoring activities included water level measurement, field parameter measurement, well purging, sample collection, and laboratory analysis. Samples were submitted to NAL for analysis of parameters listed in the Site-Wide SAP.

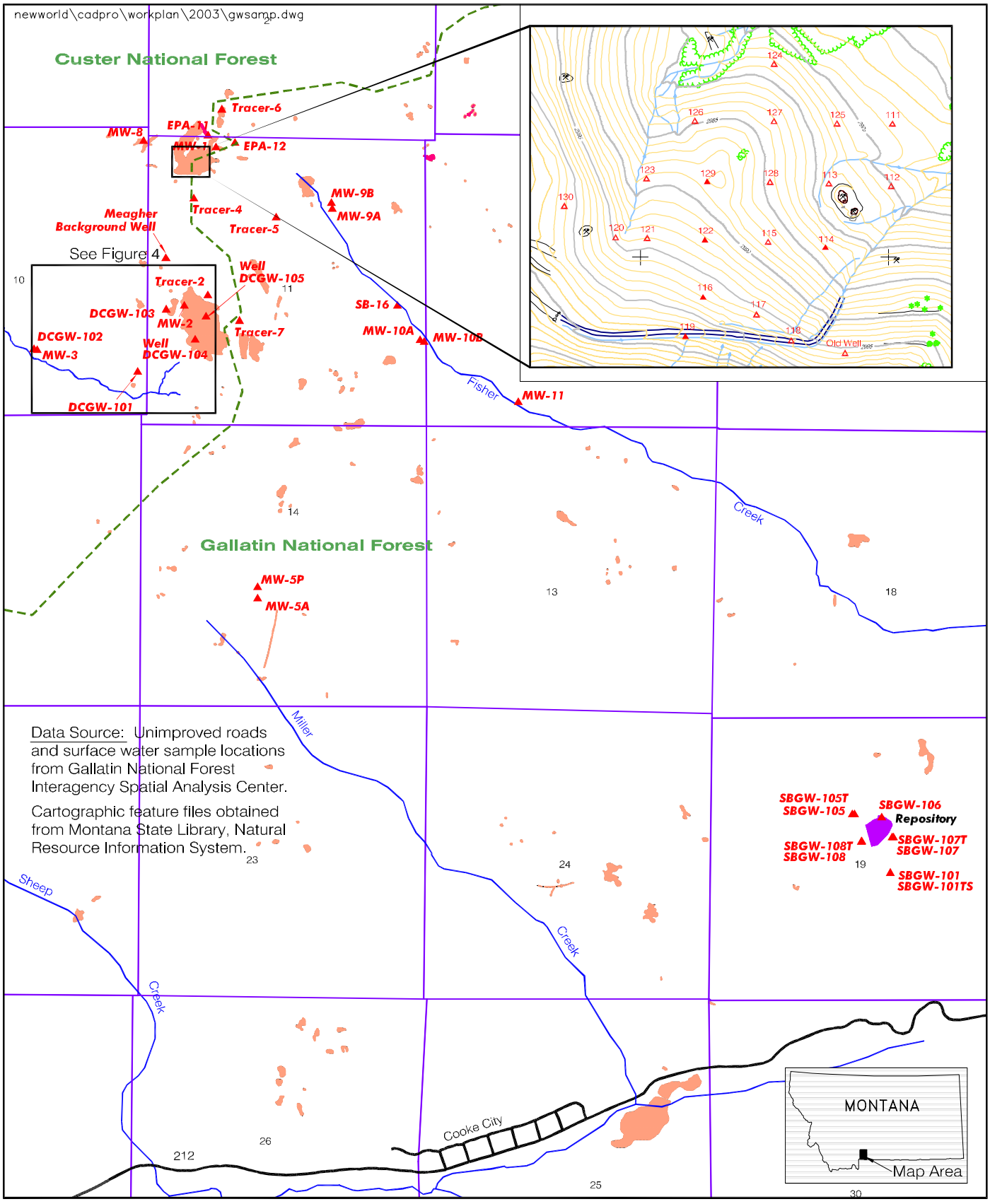
2.2.3 McLaren Pit Hydrogeologic Investigation

Eight monitoring wells (DCGW-101 to -105) were installed in the fall of 2001. An additional 13 monitoring wells (DCGW-106 to –110, and DCGW-131 to –138) were installed during August 2002 as part of the McLaren Pit area hydrogeologic investigation. Figure 4 shows a detailed map of the well locations. Wells were monitored in July, and August through October 2002. Monitoring included measuring depth to water and collecting samples for field measurements of temperature, pH, and specific conductance. In addition to these activities, samples were collected for laboratory analysis in August 2002. Follow-up sampling for laboratory analysis was conducted in several wells in the vicinity of

TABLE 3
2002 GROUNDWATER SAMPLE SITES
New World Mining District Response and Restoration Project

Well No.	Year Installed	Month Sampled			Completion Formation
		July	Aug	Sep	
McLaren Pit Area					
DCGW-101S	2001	X		X	Glacial Till
DCGW-101D	2001	X		X	Lulu Pass Rhyodacite Porphyry
DCGW-102S	2001	X			Glacial Till
DCGW-102D	2001	X			Wolsey Shale
MW-3	1989	X			Wolsey Shale
DCGW-103S	2001	X			Glacial Till
DCGW-103D	2001	X			Wolsey Shale
DCGW-104	2001	X			Waste Rock
DCGW-105	2001	X			Waste Rock
DCGW-106	2002		X		Colluvium
DCGW-107	2002		X		Colluvium
DCGW-108	2002		X	X	Colluvium
DCGW-109	2002		X	X	Colluvium
DCGW-110	2002		X	X	Colluvium
DCGW-131	2002		X		Colluvium
DCGW-132	2002		X		Colluvium
DCGW-133	2002		X	X	Colluvium
DCGW-134	2002		X		Colluvium
DCGW-135	2002		Dry		Colluvium
DCGW-136	2002		X		Colluvium
DCGW-137	2002		X		Colluvium
DCGW-138	2002		X		Colluvium
Tracer-2	1997	X			Fisher Mtn. Instrusive
Como Basin Area *					
EPA-11	1996	X			Tertiary Intrusive Dike
EPA-12	1996	X			Scotch Bonnet Diorite
MW-1	1989	X			Wolsey Shale
MW-8	1989	X			Lulu Pass Rhyodacite
Tracer-6	1997	X			Scotch Bonnet Diorite
Tracer-4	1997	X			Fisher Mtn. Instrusive
Fisher Creek Area					
MW-9A	1990	X			Alluvium
MW-9B	1990	X			Precambrian
MW-10A	1990	X			Alluvium
MW-10B	1991	X			Precambrian
MW-11	1990	X			Precambrian
SB-16	1991	X			Precambrian
Tracer-5	1997	X			Fisher Mtn. Instrusive
Miller Creek Area					
MW-5A	1989	X			Alluvium
MW-5P	1989	X			Wolsey Shale
SB-4B (B) Repository Area					
SB-105T	1999	X			Till
SB-105	1999	X			Granite
SB-107T	1999	X			Till
SB-107	1999	X			Granite
SB-108T	1999	X			Till
SB-108	1999	X			Granite

Notes: X - Sampled
Well locations shown on Figures 3 and 4.
* - Como Basin wells shown in this table were sampled for water quality; other wells in the Como Basin (shown on Figure 3) were not sampled



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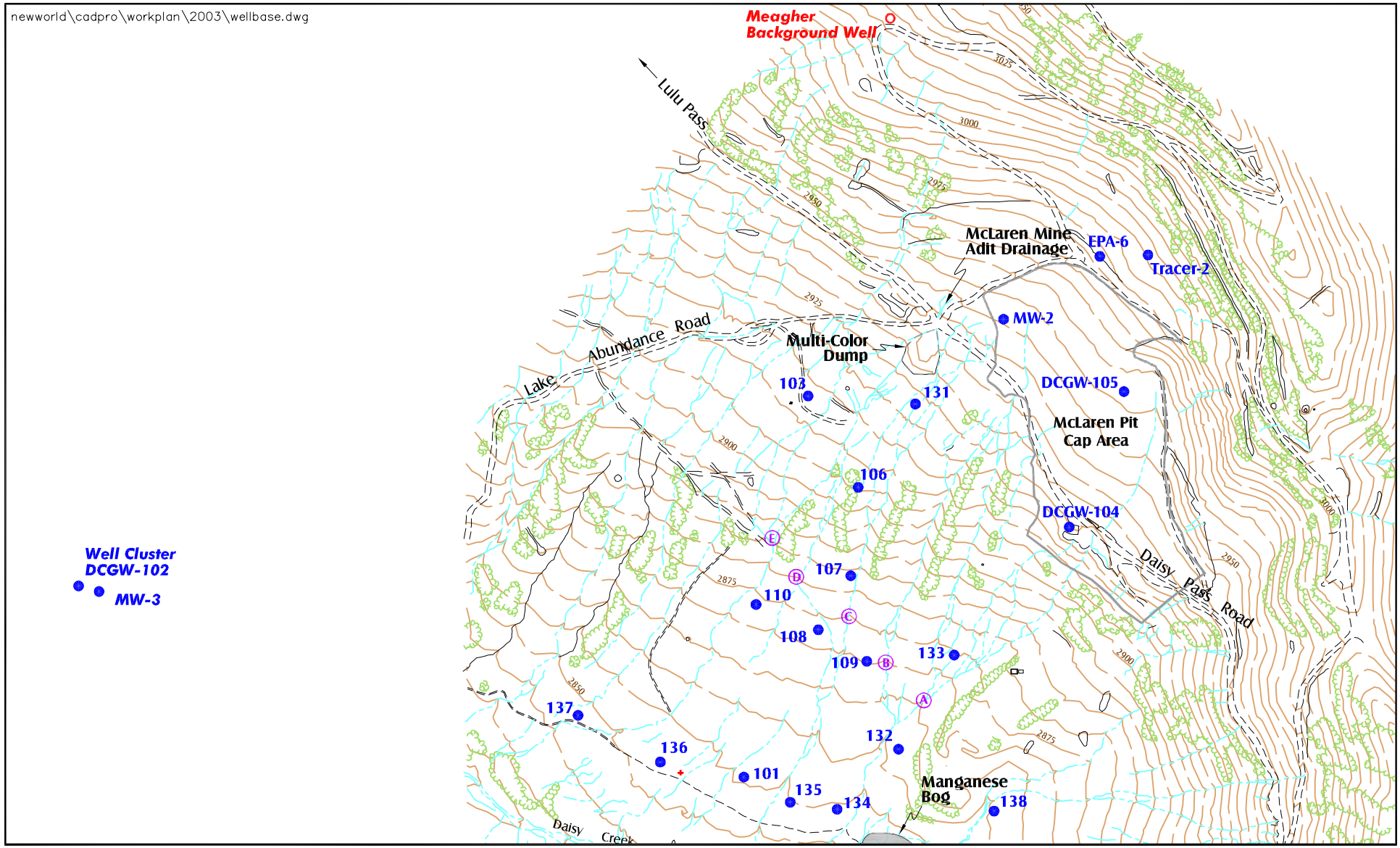
2002 Groundwater Monitoring Stations
New World Mining District
Response and Restoration Project
Cooke City Area, Montana
FIGURE 3



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2002 McLaren Pit Monitoring Wells
New World Mining District
Response and Restoration Project
Cooke City Area, Montana
FIGURE 4

surface water sampling locations DCSW-0905-A through E during September 2002 (Table 3). This was done to compare water quality in nearby wells with surface water quality.

2.2.4 Monitoring Well Abandonment in the McLaren Pit

Nine monitoring wells were abandoned in the McLaren Pit during August 2002 to accommodate regrading and capping of the pit for the McLaren Pit Response Action. Abandoned wells are listed in Table 4. Hillman Drilling of Livingston, Montana, a subcontractor to URS, abandoned the wells in accordance with Montana Board of Water Well Contractor's regulations.

TABLE 4
ABANDONED MCLAREN PIT MONITORING WELLS
New World Mining District Response and Restoration Project

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

Note: Wells were abandoned during August 2002.

2.2.5 Como Basin Hydrogeologic Investigation

Twenty monitoring wells were completed in unconsolidated material in the Como Basin during the summer of 2002. Sixteen of the wells were installed on a 30.5-meter (100-foot) grid covering the basin. Two wells were drilled in an upper diversion ditch and two other wells were installed on the bedrock ridge that forms Lulu Pass and the southwest rim of the basin (near a perennial snowfield). Six of the wells completed in the Como Basin encountered water in August, with the remaining wells being dry. Water-bearing wells included FCGW-114, -116, -119, -122, 126, and -129.

Wells containing water were monitored biweekly from late August until early October. Monitoring involved measuring depth to water and collecting samples for field measurement of pH, specific conductance, and temperature. No samples were collected for laboratory analysis.

2.3 DEVIATIONS FROM 2002/2003 WORK PLAN

Deviations from the 2002/2003 Work Plan are listed below.

- An additional five stations on streams draining the McLaren Pit area were sampled in September 2002. This was done to compare surface and groundwater chemistry as part of the McLaren Pit Hydrogeologic Investigation.

- The background monitoring well was not installed in the McLaren Pit area during the 2002 field season (Figure 4). This was due to the difficulty in contracting with a qualified driller.

- Sampling was conducted at surface water station SW-5 in July to add current water quality data to the database for this station. Water quality in Miller Creek is being evaluated for the Miller Creek Engineering Evaluation/Cost Analysis.

- Additional sampling was completed at the Sheep Mountain No. 1 Adit, the Henderson Mountain No. 7 Adit, and two seeps along the toe of the Gold Dust waste rock dump. This sampling was done to help evaluate alternatives for these sites as part of the preferred alternative for the Fisher Creek Source Area.

3.0 RESULTS

Pertinent surface water and groundwater data collected for the New World Mining District Response and Restoration Project during 2002 are summarized in this section. Field sample forms and laboratory analytical reports are located in separate appendices at the end of this report for the long-term surface water and groundwater monitoring events, for construction monitoring, and for the adit sampling event. Discussions and data concerning the McLaren Pit and Como Basin hydrogeologic investigations are included in a separate technical memorandum, along with associated field forms and laboratory analytical reports (Maxim, 2003a).

3.1 SURFACE WATER

This section presents a discussion of surface water quality data collected during 2002. Laboratory analytical reports, chain of custody forms, and field notes for the 2002 surface water monitoring events are contained in Appendix A (Appendices A-1 through A-6). Included in Appendix A-1 is Table A-1, which summarizes surface water monitoring data collected during 2002. Supplemental surface water data also are included in Table A-1.

Surface water quality data are compared to human health and aquatic standards in the following discussion. For cadmium, copper, lead, and zinc, the discussion of exceedances of acute and chronic aquatic water quality standards takes into consideration the adjustment of the standard for hardness measured at each station for each sampling event. The calculated standard for various hardness values for these metals is shown in the tables presented in the discussion. The formula used to determine the hardness adjusted aquatic standard can be found in MDEQ (2002). Temporary and narrative standards are not adjusted for hardness.

3.1.1 Discussion of Long-Term Surface Water Quality Data - Daisy Creek

Table 5 presents the 2002 surface water analytical results with corresponding regulatory standards for Daisy Creek. The shading or color of the concentrations for each monitoring station indicates which regulatory standard the concentration exceeds (e.g., yellow shading indicates exceedance of the acute aquatic life standard).

Data shown in Table 5 indicate that water quality improves downstream in Daisy Creek. Metals concentrations measured in samples collected from the three Daisy Creek stations in 2002 were below both temporary and narrative water quality standards.

At station DC-2, aluminum, cadmium, copper, iron, lead (for the October 2002 event only), and zinc exceeded both acute and/or chronic aquatic life standards during the April, July, and October 2002 sampling events. The human health standard for copper also was exceeded at station DC-2 in all three sampling events.

At station DC-5, aluminum, cadmium, copper, iron, and zinc exceeded acute and/or chronic aquatic life standards during the July and October 2002 events. The aquatic standards for cadmium and copper also were exceeded during the April 2002 event.

At station SW-7 (the headwaters of the Stillwater River), aluminum and copper exceeded the acute and/or chronic aquatic life standards during July and October 2002. No exceedances of aquatic criteria were measured at this station in April 2002.

3.1.2 Discussion of Long-Term Surface Water Quality Data – Fisher Creek

Table 6 presents the 2002 surface water analytical results with corresponding regulatory standards for Fisher Creek. As in Table 5, shading and/or color of the concentration values for each monitoring station indicates which regulatory standard was exceeded. Data in Table 6 show that water quality in Fisher Creek improves downstream. Metal concentrations measured in samples collected from the four Fisher Creek stations in 2002 were below both temporary and narrative water quality standards with two exceptions. The exceptions were exceedances of the narrative water quality standard for iron and zinc at station SW-3 in October 2002. No human health standards were exceeded in the Fisher Creek stations, except for the aesthetic standards for iron and manganese (0.3 milligrams per liter [mg/L] and 0.050 mg/L, respectively) at SW-3, SW-4, and CFY-2.

At station SW-3, Table 6 shows that aluminum, cadmium, copper, iron, lead (for the April and October 2002 events only), and zinc exceeded the acute and/or chronic aquatic life standards during the April, July, and October 2002 sampling events. Concentrations of copper were essentially the same during both low flow events (April and October); copper concentrations were 35 percent lower in July during high flow.

Exceedances in both acute and/or chronic aquatic life standards for aluminum, cadmium, and copper were noted in at least one of the three monitoring events at downstream stations SW-4, CFY-2, and SW-6 (Clarks Fork of the Yellowstone River) during 2002. In addition, zinc exceeded the acute and chronic aquatic life standards during October 2002 at station SW-4.

3.1.3 Discussion of Long-Term Surface Water Quality Data - Miller Creek

Review of 2002 water chemistry data for Miller Creek station SW-2 (Table A-1) indicates that the acute and/or chronic aquatic life standard for copper (.012 and 0.008 mg/L, respectively, for average hardness of 85 mg/L) was exceeded in the two July monitoring events (0.017 and 0.011 mg/L, respectively). Based on in-stream hardness concentrations, no other metals exceeded regulatory standards at Miller Creek station SW-2.

One sample also was collected in July 2002 at station SW-5, which is near the mouth of Miller Creek. The cadmium concentration measured at this station (0.0009 mg/L) exceeded the chronic aquatic standard (0.0002 mg/L for hardness of 86 mg/L). No other standards were exceeded.

3.1.4 Discussion of Long-Term Surface Water Quality Data - Soda Butte Creek

Water quality data for Soda Butte Creek stations SBC-1, SBC-2, RR-SBSW-102, and SBC-4 are shown in Table A-1. These data show that the furthest upstream station (SBC-1) exhibited no exceedances of regulatory standards in 2002. Total recoverable iron and manganese concentrations in Soda Butte Creek typically increase between stations SBC-1 and SBC-2 as a result of input from the McLaren Millsite and McLaren Tailings. Iron concentrations at station SBC-2 exceeded the chronic aquatic life standard in the April and October monitoring events. In addition, the copper concentration at SBC-2 (0.01 mg/L) exceeded the chronic aquatic life standard (0.008 mg/L adjusted for hardness of 88 mg/L) in the July monitoring event.

Downstream, aluminum concentrations exceeded the chronic aquatic life standard (0.087 mg/L) at stations RR-SBSW-102 and SBC-4. This source of aluminum likely comes from Republic Creek, which is immediately upstream of station RR-SBSW-102 (Figure 2). For the July monitoring event, the zinc concentration at station SBC-4 (0.07 mg/L), which is located at the Yellowstone National Park boundary,

TABLE 5
COMPARISON OF SURFACE WATER RESULTS TO STANDARDS
DAISY CREEK DRAINAGE SAMPLING STATIONS
2002 MONITORING EVENTS

Parameter (mg/l)	Aquatic Life (acute)	Aquatic Life (chronic)	Human Health Standard	DC-2				DC-5			
				Narrative Water Quality Standard(1)	Apr-02	Jul-02	Oct-02	**Temporary Water Quality Standard(2)**	Apr-02	Jul-02	Oct-02
Aluminum	0.75	0.087	NA	**28.4**	10.8	6.2J	13.7	**9.510**	<0.1	1.6J	3.7
Cadmium	0.001054(3)	0.000162(3)	0.005	**0.009**	0.0038	0.0016	0.0038	**0.004**	0.0004	0.0005	0.001
Copper	0.0073(3)	0.00529(3)	1.3	**8.064**	2.2	1.59	2.92	**3.530**	0.024	0.54	0.76
Iron	NA	1	NA	**29.649**	12.1	8.1	11.8	**6.830**	<0.01	2.48	2.07
Lead	0.082(4)	0.0032(4)	0.015	**0.018**	0.003	0.002	0.01	**NA**	<0.001	0.002	0.003
Manganese	NA	NA	NA	**4.088**	1.91	0.57	1.91	**1.710**	0.16	0.19	0.45
Zinc	0.067(3)	0.067(3)	2	**1.104**	0.6	0.25J	0.54J	**0.540**	0.04	0.08J	0.15J
Hardness	NA	NA	NA	NA	246	126	208	NA	183	91	164
pH (s.u.)	NA	NA	NA	**2.7**	4.6	4.8	4	**4.6**	7.6	7.2	6.8
Flow (cfs)	NA	NA	NA	NA	0.31	5	0.381	NA	--	12.6	0.74

Parameter (mg/l)	Aquatic Life (acute)	Aquatic Life (chronic)	Human Health Standard	SW-7			
				Temporary Water Quality Standard(2)	Apr-02	Jul-02	Oct-02
Aluminum	0.75	0.087	NA	**0.670**	<0.1	0.3J	0.1
Cadmium	0.002067(3)	0.001429(3)	0.005	**NA**	<0.0001	<0.0001	0.0001
Copper	0.0073(3)	0.00529(3)	1.3	**0.200**	0.003	0.089	0.019
Iron	NA	1	NA	**1.320**	0.26	0.49	0.23
Lead	0.082(4)	0.0032(4)	0.015	**0.013**	<0.001	<0.001	<0.001
Manganese	NA	NA	NA	**0.086**	0.028	0.024	0.038
Zinc	0.067(3)	0.067(3)	2	**0.049**	<0.01	0.02J	0.06J
Hardness	NA	NA	NA	NA	109	71	115
pH (s.u.)	NA	NA	NA	**5.5**	7.4	7.8	7.7
Flow (cfs)	NA	NA	NA	NA	--	74.6	2.42

NOTES: Shading/coloring indicates exceedance of respectively shaded/colored regulatory standard

* - All metals are reported as Total Recoverable Metals

mg/l = milligrams per liter; s.u. = standard units; cfs = cubic feet per second

-- - No measurement or analysis conducted; NA = not applicable

< - Indicates analyte not detected above laboratory Practical Quantitation Limit (PQL)

J - Indicates value is estimated

(1) - Narrative Water Quality Standards apply to **any point** in affected stream segments. Like the Temporary Water Quality Standards, the Narrative Water Quality Standards are a calculated as the mean concentration plus two (2) standard deviations

(2) - Temporary Water Quality Standards are set in accordance to the rule adopted by the Board of Environmental Review. These standards apply to specific surface water sampling stations and shall not be exceeded more than 3% of the time

(3) - Based on 50 mg/l hardness

(4) - Based on 100 mg/l hardness

TABLE 6
COMPARISON OF SURFACE WATER RESULTS TO STANDARDS
FISHER CREEK DRAINAGE SAMPLING STATIONS
2002 MONITORING EVENTS

Parameter (mg/l)	Aquatic Life (acute)	Aquatic Life (chronic)	Human Health Standard	SW-3				SW-4			
				Narrative Water Quality Standard(1)	Apr-02	Jul-02	Oct-02	**Narrative Water Quality Standard(1)**	Apr-02	Jul-02	Oct-02
Aluminum	0.75	0.087	NA	**4.54**	3.1	1.7J	3.6	**0.740**	< 0.1	0.3J	0.1
Cadmium	0.001054(3)	0.000162(3)	0.005	**0.002**	0.001	0.0003	0.001	**0.001**	0.0003	<0.0001	0.0004
Copper	0.0073(3)	0.00529(3)	1.3	**1.256**	0.83	0.54	0.85	**0.172**	0.03	0.1	0.085
Iron	NA	1	NA	**9.259**	7.1	4.31	**10.6**	**1.726**	<0.01	0.5	0.13
Lead	0.082(4)	0.0032(4)	0.015	**0.01**	0.006	0.003	0.009	**0.005**	<0.001	<0.001	<0.001
Manganese	NA	NA	NA	**1.718**	1.28	0.3	1.48	**0.790**	0.006	0.051	0.088
Zinc	0.067(3)	0.067(3)	2	**0.225**	0.18	0.08J	**0.71J**	**0.660**	0.04	0.02J	0.07J
Hardness	NA	NA	NA	NA	93	26	94	NA	66	37	63
pH (s.u.)	NA	NA	NA	**2.1**	3.4	4	3.4	**5.241**	6.7	7.1	7.2
Flow (cfs)	NA	NA	NA	NA	0.37	7.6	0.29	NA	--	47	1.91

Parameter (mg/l)	Aquatic Life (acute)	Aquatic Life (chronic)	Human Health Standard	CFY-2				SW-6			
				Temporary Water Quality Standard(2)	Apr-02	Jul-02	Oct-02	**Narrative Water Quality Standard(1)**	Apr-02	Jul-02	Oct-02
Aluminum	0.75	0.087	NA	**0.470**	< 0.1	0.3	< 0.1	**0.763**	< 0.1	0.1J	<0.1
Cadmium	0.002067(3)	0.001429(3)	0.005	**NA**	< 0.0001	<0.0001	0.0002	**0.03472**	<0.0001	0.0002	0.0001
Copper	0.0073(3)	0.00529(3)	1.3	**0.110**	0.007J	0.062	0.008	**0.076**	0.004	0.032	0.014
Iron	NA	1	NA	**0.750**	0.02	0.34	0.03	**1.132**	0.06	0.14	0.01
Lead	0.082(4)	0.0032(4)	0.015	**0.002**	<0.001	0.001	<0.001	**ND**	<0.001	0.001	<0.001
Manganese	NA	NA	NA	**0.082**	0.005	0.03	<0.003	**0.03415**	0.003	0.008	0.006
Zinc	0.067(3)	0.067(3)	2	**0.044**	0.03	0.04J	0.03J	**0.11032**	< 0.01	< 0.01J	0.05J
Hardness	NA	NA	NA	NA	59	40	59	NA	33	26	45
pH (s.u.)	NA	NA	NA	**5.7**	7	7	6.9	**5.7**	7.8	7.6	7.4
Flow (cfs)	NA	NA	NA	NA	0.28	13	0.027	NA	0.64	110	3.36

NOTES: Shading/coloring indicates exceedance of respectively shaded/colored regulatory standard

* - All metals are reported as Total Recoverable Metals

mg/l = milligrams per liter; s.u. = standard units; cfs = cubic feet per second

-- - No measurement or analysis conducted; NA = not applicable

< - Indicates analyte not detected above laboratory Practical Quantitation Limit (PQL)

J - Indicates value is estimated

(1) - Narrative Water Quality Standards apply to **any point** in affected stream segments. Like the Temporary Water Quality Standards, the Narrative Water Quality Standards are a calculated as the mean concentration plus two (2) standard deviations

(2) - Temporary Water Quality Standards are set in accordance to the rule adopted by the Board of Environmental Review. These standards apply to specific surface water sampling stations and shall not be exceeded more than 3% of the time

(3) - Based on 50 mg/l hardness

(4) - Based on 100 mg/l hardness

exceeded the acute and chronic aquatic life standard (0.065 mg/L for hardness of 49 mg/L). Iron exceeded the human health standard of 0.3 mg/L at SBC-4 in July and October. No other metals exceeded regulatory standards in the Soda Butte drainage.

3.1.5 Discussion of Response Action Construction Monitoring

Construction activities occurred in the Daisy Creek and Soda Butte drainages during 2002. Construction activities included regrading and drainage control work in the McLaren Pit area, opening of the McLaren Adit, and completion of work at the Selective Source repository. Construction monitoring sites included stations DC-2 and DC-5 in the Daisy Creek drainage, FCT-2 and FCT-11 in the Fisher Creek drainage, and SBT-3 and SBT-6 in the Soda Butte Creek drainage (Table 1).

McLaren Pit Response Action Monitoring

Stations DC-2 and DC-5 on Daisy Creek were monitored on September 18 and 26, 2002. No temporary standards were exceeded during these two events, which were conducted in conjunction with significant earthmoving activities in the pit and draining the McLaren Adit.

Selective Source Response Action Monitoring – Repository Site

Stations SBT-3 and SBT-6, which are located below the mine waste repository and upstream of SBC-1, were monitored numerous times during April, May, and June 2002 (Maxim, 2002b). Monitoring was conducted on a weekly basis following the snowmaking operation that was conducted at the site on April 22, 2002, to dispose of accumulated water in the repository sump. Monitoring at stations SBT-3 and SBT-6 showed that no significant changes in water quality were measured above background conditions (Appendix A-5). Station SBT-3 is located on the tributary south of the repository and directly downgradient of the repository and the area where snowmaking was done. Station SBT-6 is located further downgradient of SBT-3 where the tributary crosses the Lulu Pass road. This station collects water from the reclaimed Rommel tailings site and the repository.

On May 15, 2002, iron and manganese concentrations increased substantially at both stations. The measured iron (3.24 mg/l) and manganese (0.091 mg/l) concentrations exceeded the respective WQB-7 human health standards at station SBT-6 on this date. Although aluminum, copper, and lead concentrations also increased on May 15, regulatory standards for these metals were not exceeded. By May 21, as flows increased during snowmelt, iron and manganese concentrations dropped significantly, with only iron levels above the WQB-7 human health standard (MDEQ, 2002) at stations SBT-6 and SBT-3. A maximum flow of 20.2 cubic feet per second (cfs) was measured at SBT-6 on May 30, and, as flows began to diminish after this date, no other exceedances of water quality criteria were recorded at either station. By June, iron concentrations had dropped to near-background levels. According to WQB-7, iron and manganese human health standards are based on aesthetic properties such as taste, odor, and staining, and the iron and manganese standards (0.3 mg/L and 0.05 mg/L, respectively) are only considered as guidance to determine actual levels that will interfere with specified uses.

It is not apparent that increases in metals concentrations during the May 15 to May 30 period are directly attributed to snowmaking operations or accumulated water leaking from the sump. Turbidity of the water at both stations increased considerably with the onset of runoff, especially at station SBT-6, and suspended sediment associated with natural runoff conditions may be the cause of increased metals concentrations, since total recoverable analytical methods are being used for metals analyses. Suspended sediment in the sump has been very low (Appendix A-5). In August and September, repairs of the repository sump were completed, and construction of the repository was finished in October

2002. The sump was pumped dry on October 9, 2002, and the water disposed at the Cody, Wyoming municipal sewage lagoon.

Selective Source Response Action Monitoring – Reclaimed Sites

Water quality monitoring was conducted at two stations below reclaimed areas in 2002. Station FCT-11, which drains the Como Basin and the reclaimed Spalding dumps, was monitored in June. Flow was measured at 0.65 cfs. By late August, this drainage was dry. The pH at this station was acidic (4.4 s.u.), and aluminum and copper concentrations exceeded their respective acute aquatic standards. This result was not unexpected as the Como Basin is considered the source of these metals. The iron and manganese human health standards also were exceeded at this station in June.

In FCT-2, the mouth of Polar Star Creek (which is downstream of the reclaimed Tredennic dumps), flow during the July sampling was 4.5 cfs (2,020 gallons per minute [gpm]), and was 0.06 cfs (about 27 gpm) in October. No aquatic standards were exceeded in this drainage during either sampling event, and copper, iron, and lead were below their respective analytical practical quantitation limit (PQL) in October. Manganese concentrations were less than the analytical PQL during high flow, but were measured at 0.077 mg/L at low flow, which is above the human health standard for manganese (0.050 mg/L). The pH of the water was neutral to near-neutral during both events.

3.1.6 Discussion of Adit Discharge Monitoring

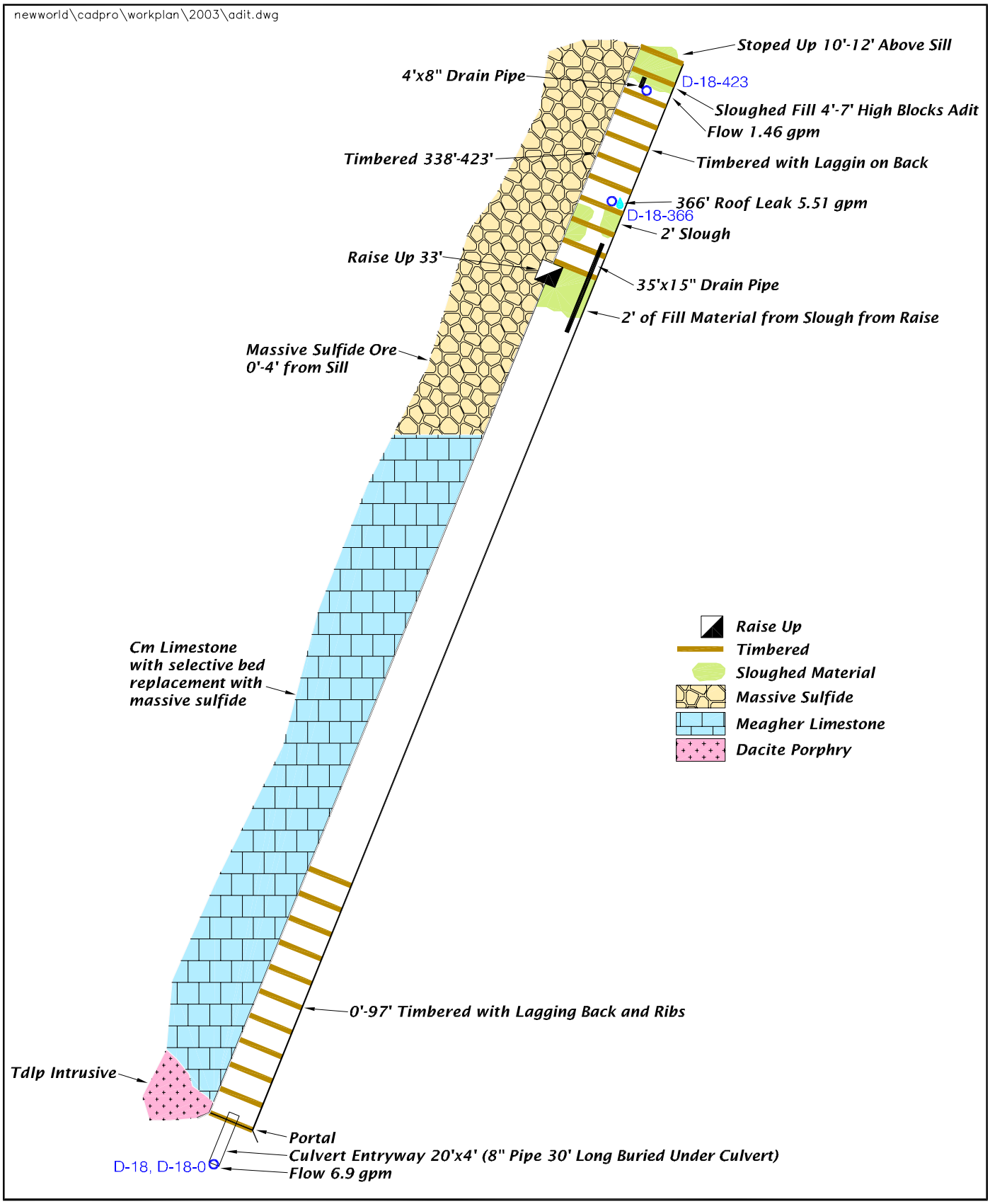
Water samples were collected from five adit discharges in the District in 2002 (Table 2). Water quality data for these discharges are summarized in Table 7, and complete water quality information is presented in Table A-1 in Appendix A. A brief discussion of the adit discharge data is presented below.

McLaren Adit

A detailed discussion of the McLaren Adit reopening work and water quality is presented in a technical memorandum (Maxim, 2003b). In 2002, water flow from the portal was measured at 6.9 gpm. Two inflows were identified in the underground workings, one at 366 feet (D-18-366) from a borehole that had intersected the workings, and the other from the back of the mine (D-18-423). Water flow from a drill hole at 366 feet in the workings was measured at 5.5 gpm, and 1.46 gpm was measured at the back of the workings at 423 feet. Figure 5 shows the location of water samples collected from the McLaren Adit.

Data collected in 2002 from the underground and at the portal show that the pH of the discharge is neutral to near-neutral (Table 7). Water quality collected from the portal (D-18) and the two underground inflows at 366 feet (D-18-366) and 423 feet (D-18-423) show exceedances of the iron and manganese human health standards and chronic aquatic standard (iron only) occur in all samples, with the sample at the back of the mine (423 feet) having the highest iron and manganese concentrations.

At the portal station, chronic aquatic aluminum and copper standards (0.087mg/L and 0.027 mg/L, respectively, for hardness of 354 mg/L) were also exceeded. The acute and chronic standards for cadmium (0.0036 mg/L and 0.00039 mg/L, respectively) and the chronic aquatic standard for copper (0.014 mg/L for hardness 168 mg/L) were exceeded in the sample from the borehole at 366 feet.



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D-18-423 Water Sampling Site

Map of the McLaren Adit
New World Mining District
Response and Restoration Project
Cooke City, Montana
FIGURE 5

Figure 5- back page

TABLE 7
2002 MINE ADIT DISCHARGE DATA
New World Mining District Response and Restoration Project

Site Name	Location	Sample Date	Flow (gpm)	pH Fld (su)	pH Lab (su)	Hard-ness	Al Tr (Al D)	Cd Tr (Cd D)	Cu Tr (Cu D)	Fe Tr (Fe D)	Pb Tr (Pb D)	Mn Tr (Mn D)	Zn Tr (Zn D)
Human Health Standard							**--**	**0.005**	**1.3**	**0.300**	**0.015**	**0.050**	**2.0**
Acute Aquatic Standard (where applicable, calculated for hardness = 50/250)*							0.750	.00105/.0054	.0072/.0331	--	.0337/.262	--	.067/.260
Chronic Aquatic Standard (where applicable, calculated for hardness = 50/250)*							0.087	.00016/.00053	.0051/.0204	1.0	.0013/.0102	--	.067/.260
D-18	McLaren Adit	7/2/02	30	6.44	7	249	JF <0.1	<0.0001	0.017	**6.69**	0.001	**0.49**	JF% 0.02
		10/7/02	5.3	7.08	7.1	354	0.2	0.0004	0.033	**14.7**	0.002	**0.096**	JF% 0.08
		9/26/02	6.9	6.6	6.9	385	(<0.1)	(0.0003)	(<0.001)	**(7.39)**	(<0.001)	**(1)**	(0.02)
D-18-366	McLaren Adit roof leak (366 feet from portal)	9/26/02	5.5	7.1	75	168	(<0.1)	(0.0051)	(0.019)	**(2.13)**	(<0.001)	**(0.65)**	(0.04)
D-18-423	McLaren Adit workings (423 feet from portal)	9/26/02	1.4	6.4	6.5	468	(<0.1)	(<0.0001)	(<0.001)	**(25.7)**	(<0.001)	**(1.28)**	(0.03)
F-8A-0	Glengarry Adit	6/30/02	72	3.16	3	211	JF 20.4	0.0027	**10.3**	**99.8**	**0.028**	**7.21**	JF% 0.07
		10/8/02	36	3.21	3.1	190	7.6	0.0013	<0.001	**59.2**	**0.038**	<0.003	JF% 0.48
F-28	Gold Dust Adit	6/30/02	25	7.12	7.4	378	JF <0.1	<0.0001	0.002	0.18	<0.001	0.029	JF% 0.01
		7/23/02	9	6.3	8	683	<0.1	0.0009	0.002	0.21	0.001	**0.054**	0.01
		10/8/02	5	7.38	7.88	759	<0.1	0.0003	<0.001	0.19	<0.001	0.004	JF% 0.03
FCSI-96-1-S1	Gold Dust waste rock toe seep NE corner	7/23/02	2.8	5.65	7.9	183	<0.1	0.0014	0.003	<0.01	<0.001	<0.003	0.02
FCSI-96-1-S2	Gold Dust waste rock toe seep SE corner	7/23/02	3.4	6.1	8.3	648	<0.1	0.0009	0.001	0.13	<0.001	0.018	0.11
FCSI-99-1	Sheep Mountain No. 1	7/23/02	0.5	5.46	7.7	45	<0.1	0.0009	0.01	0.06	0.004	<0.003	0.07
FCSI-99-68	Henderson Mountain No. 7	7/23/02	0.1	6.41	7.3	94	<0.1	0.001	0.013	**0.87**	<0.001	**0.08**	0.11

Notes:

* - hardness and metal concentrations in milligrams per liter
Fld = field measurement; Lab = lab measurement
(D) = dissolved concentration
Tr = total recoverable concentration
Shading and boldface indicates exceedance of applicable standard

gpm = gallons per minute
< = less than the practical quantitation limit
JF = value estimated due to difference in field duplicate; flagged if value > PQL and less than 5X the PQL
JF% = value estimated; field duplicate results exceed acceptable limits by relative % difference
su = standard units

Gold Dust Adit

The Gold Dust Adit discharge was monitored three times in 2002 (June, July, and October). Flow in the adit ranged from five to 25 gpm. Water quality of the discharge is neutral to near neutral (Table 7). Two standards were exceeded in the July event, the chronic aquatic standard for cadmium (adjusted for hardness of 400 mg/L) and the human health standard for manganese (measured concentration of 0.054 mg/L). In the two waste rock toe seep samples (Table 7), only the chronic aquatic standard for cadmium was exceeded.

Glengarry Adit

The Glengarry Adit discharge was sampled twice in 2002, once during high flow (July) and once during low flow (October). Water flows were typical of those measured historically, with a high flow of about 72 gpm and a low flow of about 35 gpm. The pH was very acidic (about 3.0 s.u.) during both sampling events. For the high flow event, aluminum, copper, iron, and lead exceeded aquatic water quality criteria by several orders of magnitude. Cadmium also exceeded the aquatic standards, but not by as much as the other metals. During the October low flow event, copper concentrations were below the analytical PQL for the method. This concentration was about 10,000 times lower than during the high flow event. Aluminum, cadmium, iron, lead, and zinc exceeded aquatic standards during the low flow event.

Sheep Mountain No. 1 Adit

Flow in July at this adit was less than a gallon per minute, which is typically the high flow for the year. The discharge exceeded the acute and chronic aquatic water quality standards for copper and zinc, and the chronic aquatic standards for cadmium and lead. No human health standard was exceeded for any metal parameter.

Henderson Mountain No. 7 Adit

The flow at this adit was about a tenth of a gallon per minute during the July sampling, which is typically the high flow for the year. The discharge exceeded the chronic aquatic water quality standard for cadmium and copper (0.0002 mg/L and 0.008 mg/L, respectively, for hardness of 94 mg/L). The human health standards for iron and manganese also were exceeded.

3.2 GROUNDWATER

Laboratory analytical reports, chain of custody forms, and field notes for the 2002 groundwater monitoring events are contained in Appendix B. Included in Appendix B-1 is Table B-1, which summarizes groundwater monitoring data collected during 2002.

3.2.1 Long-Term Groundwater Monitoring

Tables 8 and 9 compare 2002 groundwater quality data to historical data for selected wells in the McLaren Pit area and Como Basin, respectively. The wells shown in Tables 8 and 9 were selected as representative of groundwater conditions in each of the different water-bearing formations in these two areas. As mentioned previously, further information on shallow groundwater conditions in the McLaren Pit and Como Basin is available in a technical memorandum (Maxim, 2003a).

TABLE 8
MCLAREN PIT AREA
2002 Groundwater Monitoring Data Comparison

Sample Location	Sample Date	Laboratory Parameters							
		pH	Dissolved Metals (mg/l)†						
		(s.u)†	Aluminum	Cadmium	Copper	Iron	Lead	Manganese	Zinc
Groundwater Standard (1)		NA	NA	0.0050	1.300	0.3	0.015	0.05	2.00
Fisher Mountain Intrusive									
TRACER-2	07/08/2002	3.9	54.3	0.001	5.22	71.6	0.002	0.41	0.15
	MIN*	3.4	40.6	0.0005	3.100	64.1	0.001	0.37	0.15
	MAX*	3.9	55.0	0.0010	5.220	71.6	0.002	0.44	0.17
	MEAN*	NA	50.4	0.0007	4.118	66.2	0.001	0.41	0.16
	N*	4	4	4	4	4	4	4	4
Wolsey Shale									
MW-2	07/09/2002	3.9	43.5	0.0014	0.007	113	0.008	1.19	0.23
	MIN*	2.8	32.6	0.0006	0.006	23.0	0.002	0.62	0.23
	MAX*	4.0	51.0	0.0060	0.910	131.0	0.030	1.30	0.91
	MEAN*	NA	41.9	0.0024	0.280	102.0	0.012	1.03	0.44
	N*	14	15	15	15	15	15	15	15

Notes: * Max, Min, Mean, and N are calculated using data available from the project database
† Metals data in milligrams per liter (mg/l); pH in standard units (s.u.)
(1) Montana Dept. of Environmental Quality, Circular WQB-7, 2002
NA Not Applicable
< The associated value was less than the practical quantitation limit (PQL)

TABLE 9
COMO BASIN AREA
2002 Groundwater Monitoring Data Comparison

Sample Location	Sample Date	Laboratory Parameters							
		pH	Dissolved Metals (mg/l)†						
		(s.u)†	Aluminum	Cadmium	Copper	Iron	Lead	Manganese	Zinc
Groundwater Standard (1)		NA	NA	0.0050	1.300	0.30	0.015	0.050	2.00
Fisher Mountain Intrusive									
EPA-11	07/10/2002	4.5	6.4	0.0076	0.46	344	0.15	19.1	1.03
	MIN*	3.6	1.0	0.0058	0.042	294.00	0.003	10.800	0.92
	MAX*	4.5	6.9	0.0250	0.750	348.00	0.340	19.100	1.61
	MEAN*	4.1	3.9	0.0129	0.369	323.25	0.178	14.800	1.28
	N*	5	8	8	8	8	8	8	8
TRACER-4	07/10/2002	2.9	14.3	0.0025	4.37	125	0.12	10.9	1.45
	MIN*	2.9	0.2	0.0002	0.009	92.00	0.001	7.060	1.23
	MAX*	4.2	14.3	0.0025	4.370	125.00	0.120	10.900	1.96
	MEAN*	3.6	4.2	0.0009	1.242	109.25	0.036	9.658	1.55
	N*	4	4	4	4	4	4	4	4
TRACER-5	07/10/2002	3.8	26	0.0023	3.6	61.1	0.006	1.16	0.39
	MIN*	3.5	18.2	0.0016	3.600	39.70	0.003	0.750	0.31
	MAX*	3.8	26.0	0.0023	9.330	61.10	0.006	1.160	0.43
	MEAN*	3.7	22.2	0.0018	5.768	52.68	0.005	0.910	0.36
	N*	4	4	4	4	4	4	4	4

Notes: * Max, Min, Mean, and N are calculated using data available from the project database
† Metals data in milligrams per liter (mg/l); pH in standard units (s.u.)
(1) Montana Dept. of Environmental Quality, Circular WQB-7, 2002
NA Not Applicable
< The associated value was less than the practical quantitation limit (PQL)

TABLE 9 (continued)
COMO BASIN AREA
2002 Groundwater Monitoring Data Comparison

Sample Location	Sample Date	Laboratory Parameters							
		pH	Dissolved Metals (mg/l)†						
		(s.u)†	Aluminum	Cadmium	Copper	Iron	Lead	Manganese	Zinc
Groundwater Standard (1)		NA	NA	0.0050	1.300	0.30	0.015	0.050	2.00
Wolsey Shale									
MW-1	07/11/2002	3.3	1.6	0.0004	0.22	51.2	0.012	3.3	0.13
	MIN*	3.1	0.1	0.0004	0.010	11.50	0.000	0.990	0.05
	MAX*	4.5	4.4	0.0050	2.580	108.00	0.092	6.760	0.52
	MEAN*	NA	1.4	0.0020	0.461	43.62	0.020	3.464	0.22
	N*	13	14	14	14	14	14	14	14
Scotch Bonnet Diorite									
EPA-12	07/11/2002	7.3	< 0.1	< 0.0001	< 0.001	35.30	< 0.001	1.690	0.04
	MIN*	5.7	0.0	0.0001	0.001	9.22	0.001	1.170	0.01
	MAX*	7.3	0.2	0.0050	0.010	35.30	0.003	1.860	0.07
	MEAN*	NA	0.1	0.0009	0.003	24.80	0.002	1.508	0.04
	N*	7	9	9	9	9	9	9	9
TRACER-6	07/10/2002	5.9	< 0.1	0.0004	0.120	25.40	< 0.001	4.430	0.10
	MIN*	5.9	0.1	0.0004	0.120	11.20	0.001	2.900	0.03
	MAX*	6.2	0.4	0.0010	0.940	25.40	0.003	4.430	0.10
	MEAN*	NA	0.3	0.0007	0.340	18.80	0.002	3.478	0.08
	N*	4	4	4	4	4	4	4	4

Notes: * Max, Min, Mean, and N are calculated using data available from the project database
† Metals data in milligrams per liter (mg/l); pH in standard units (s.u.)
(1) Montana Dept. of Environmental Quality, Circular WQB-7, 2002
NA Not Applicable
< The associated value was less than the practical quantitation limit (PQL)

Table 8 shows two wells completed in different formations. Tracer 2 is completed in the Fisher Mountain Intrusive. Water quality in this well, represented by four years of sampling during high water conditions, is acidic and contains concentrations of copper, iron, and manganese that exceed standards.

In 2002, concentrations of copper and iron had the highest measured concentrations in well Tracer 2 since 1999. For the Wolsey Shale (well MW-2), the water is also acidic, and contains concentrations of iron and manganese that exceed standards. Compared to previous years' sampling, concentrations of metals measured in 2002 were near or below the average measured over 15 different sampling events.

Table 9 shows metal concentrations and pH for wells completed in three formations in the Como Basin area. The Fisher Mountain Intrusive wells (EPA-11, Tracer 4, and Tracer 5) exhibited a range of pH from 2.9 to 4.5 s.u. Exceedances of the groundwater (human health) standards were measured in 2002 for cadmium (EPA-11), copper (Tracer 4 and Tracer 5), iron (all wells), lead (EPA-11 and Tracer-4), and manganese (all wells). Water collected from the well completed in the Wolsey Shale (MW-1) is also acidic, and contains concentrations of iron and manganese that exceeded the respective groundwater standards in 2002. Water quality improves in the Scotch Bonnet Diorite, with a pH in the two wells completed in this formation (EPA-12 and Tracer 6) of 7.3 and 5.9, respectively. The groundwater standards for iron and manganese were exceeded in both wells in 2002.

3.2.2 Selective Source Response Action Groundwater Monitoring

Laboratory analytical results for monitoring of wells surrounding the Selective Source repository are shown in Table B-1 (page 3 of 3) and are summarized on Table 10. Three well pairs, SBGW-105, -107, and -108 were monitored in July, with the shallow well of each pair ("T" designation) completed in glacial till, and the deeper well of the pair completed in pre-Cambrian granite bedrock.

Table 10 summarizes water quality parameters measured in the three well pairs in 2002 and compares these data to water quality data for wells sampled in the repository area in 1999. Of the three well pairs, only the bedrock well SBGW-108 was previously sampled in 1999, although depth to water was measured in the other five wells during an extensive study of groundwater that was completed in 1999 (Maxim, 1999d). Other wells shown in Table 10 that were sampled in 1999 include two other bedrock wells (SBGW-106 and SBGW-101) and a shallow till well (SBGW-101-TS). Water quality in these wells is considered representative of bedrock and till water-bearing units in the repository area prior to constructing the repository. Figure 4 shows the location of these wells. SBGW-106, which was located at the eastern edge of the repository prior to construction, was abandoned in 2001 when repository construction was initiated.

As shown in Table 10, all three well pairs sampled in 2002 had pH values in the neutral to alkaline range, with the highest pH of 8.87 s.u. (field) measured in the upgradient bedrock well, SBGW-105. The highest concentrations of sodium, highest pH, highest total dissolved solids (TDS), highest specific conductance (Sc), and highest sulfate were measured in the upgradient bedrock well (SBGW-105) and a downgradient bedrock well (SBGW-107). For the upgradient bedrock well pair (SBGW-105), the water level was higher (depth to water shallower) in the bedrock well than in the overlying till, indicating an upward hydraulic gradient. This is similar to the condition measured in 1999 in the SBGW-105/SBGW-105T well pair (Maxim, 1999d).

For metals concentrations in 2002, iron and manganese were elevated in two of the bedrock wells (SBGW-105 and SBGW-107), and manganese was elevated in the upgradient till well (SBGW-105T) and the downgradient bedrock well (SBGW-107). In the other downgradient well pair (SBGW-108 and -108T), only iron was detected above the PQL. The manganese standard (0.05 mg/L) was exceeded in

the upgradient till well (SBGW-105T) and the downgradient bedrock well (SBGW-107). The iron standard (0.3 mg/L) was slightly exceeded in the downgradient bedrock well (SBGW-107). The cadmium standard (0.005 mg/L) was slightly exceeded in the downgradient till well.

TABLE 10
GROUNDWATER QUALITY DATA – SELECTIVE SOURCE REPOSITORY AREA
New World Mining District - Response and Restoration Project

Parameter[1]	Stan-dard[2]	Well Designation[3]									
		SBGW-101	SBGW-101-TS	SBGW-106	SBGW-108	SBGW-105	SBGW-105T	SBGW-107	SBGW-107T	SBGW-108	SBGW-108T
		Sampled September 24, 1999				Sampled July 9, 2002					
Depth to Water (feet)	--	2.32	12.23	15.38	13.28	3.52	8.02	11.41	9.58	9.13	8.27
Field pH (s.u.)[4]	--	9.01	6.78	9.61	11.83	8.87	6.56	8.36	6.69	7.39	7.93
Lab pH (s.u.)	--	8.6	7.8	8.4	11.7	10	8.0	8.6	7.3	7.4	7.5
Lab Sc (umhos/cm)[5]	--	237	531	307	570	581	382	1570	386	273	357
TDS	--	153	342	208	180	434	261	1080	291	180	227
Hardness (CaCO3)[6]	--	109	260	83	142	22	215	114	243	169	211
Calcium	--	24	66	25	57	9	58	31	79	53	68
Magnesium	--	12	23	5	1	< 1	17	9	11	9	10
Sodium	--	5	9	32	8	116	6	302	2	2	4
Potassium	--	3	4	3	1	2	2	3	< 1	< 1	< 1
CaCO3 Alkalinity	--	110	204	118	147	437	419	207	194	133	203
CO3 Alkalinity	--	0	0	12	63	0	0	0	0	0	0
HCO3 Alkalinity	--	134	249	118	1	357	511	253	237	162	248
Acidity as CaCO3	--	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Sulfate	--	20	78	46	9	125	37	497	52	18	22
Chloride	--	< 1	3	4	2	2	< 1	6	< 4	< 1	< 2
Aluminum	--	< 0.1	< 0.1	6	< 0.1	0.3	< 0.1	0.2	0.2	< 0.1	< 0.1
Cadmium	0.005	< 0.0001	0.0002	0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0053	< 0.0001	< 0.0001
Copper	1.3	< 0.001	0.012	0.03	< 0.001	0.004	0.002	0.003	0.008	< 0.001	< 0.001
Iron	0.300	< 0.01	< 0.01	5.91	< 0.01	0.29	0.04	0.33	0.17	< 0.01	0.01
Lead	0.015	< 0.001	0.001	0.006	< 0.001	< 0.001	< 0.001	0.001	0.006	< 0.001	< 0.001
Manganese	0.050	0.036	0.19	0.22	< 0.005	< 0.005	0.38	0.38	< 0.005	< 0.005	< 0.005
Zinc	2.0	< 0.01	0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.03	< 0.01	< 0.01

Notes: All chemical constituents are dissolved (filtered through a 0.45-micron filter).
1 units are in milligrams per liter unless otherwise noted
2 human health standard (MDEQ, 2002)
3 well locations shown on Figure 4
4 su = standard units
5 umhos/cm = micromhos per centimeter
6 CaCO3 = calcium carbonate

Monitoring was conducted in these wells to determine if construction and operation of the repository would have any negative impacts on groundwater quality, especially with respect to the problem experienced with the sump in April and May 2002, as discussed in Section 3.1.5. Groundwater quality data collected at the repository wells in 2002 are inconclusive as to whether groundwater concentrations of cadmium, copper, iron, lead, and manganese measured in the downgradient well pair SBGW-107 are related to the repository or natural conditions. Elevated concentrations of copper, iron, lead, and manganese were detected previously in SBGW-106. Concentrations of cadmium, copper, iron, lead, manganese, and zinc were detected above the analytical PQL in a shallow till well (SBGW-101-TS) prior to any work at the repository. Continued monitoring of the SBGW-105, -107, and –108 well pairs will occur in 2003 to document water quality conditions that might indicate an impact from the repository.

4.0 DATA VALIDATION

This section describes the data validation process used to determine the adequacy and quality of laboratory analytical data collected for long-term surface water and groundwater monitoring in 2002. The objective of data validation is to identify any unreliable or invalid measurements and qualify that data for interpretive use. These validations were performed according to guidelines prepared by US EPA (1994).

4.1 SURFACE WATER DATA VALIDATION

The 2002 surface water monitoring events were validated independently as separate sample matrices. Data qualifiers used to flag data are as follows: '<' indicates the material was analyzed for, but not detected above the level of the associated value practical quantitation limit (PQL); 'J' indicates the associated values are an estimated quantity; and, 'R' indicates the data are unacceptable.

4.1.1 Field QA/QC

During the 2002 sampling events field duplicates were prepared and containerized by Maxim field personnel in accordance to the Site-Wide SAP (Maxim, 1999b). Field QA/QC samples collected/ prepared during the 2002 surface water monitoring events are summarized in Table 11.

TABLE 11
2002 Surface Water Quality Control Samples
New World Mining District - Response and Restoration Project

Monitoring Event	QA/QC Sample	Sample Designation
April 2002	Field Duplicate	RR-SBC-4X
July 2002	Field Duplicate	SW-2X
	Field Duplicate	SW-3X
October 2002	Field Duplicate	SW-3X

Field duplicate results aid in the assessment of sampling and analytical accuracy. Analytical results for the original and duplicate samples collected from each sampling event were evaluated using relative percent difference (RPD) and absolute value difference. The RPD between the two samples was calculated when both values of the natural/duplicate pair were greater than five times the PQL for a given analyte. The absolute value difference between the natural and duplicate sample for a given analyte was calculated when one or both values were less than five times the PQL.

RPDs are calculated by dividing the difference between the two reported values for a given parameter by the average of the two parameters. Analytical results of parameters where the RPD was greater than 20 percent are considered estimated concentrations. Field duplicate SBC-4/SBC-4X pair was collected during the April 2002 sampling event. No parameter exhibited RPD values greater than 20 percent in this event. Sample location SW-2/SW-2X pair had total recoverable zinc with an RPD greater than 20 percent for the July 2002 sampling event. Sample location SW-3/SW-3X pair had total recoverable zinc

with a RPD greater than 20 percent for the October 2002 sampling event. Natural samples associated with these two parameters have been flagged as estimated.

Results from natural/duplicate pairs with values less than five times the PQL are considered estimated when the absolute value difference exceeds the PQL. Sample location SW-2/SW-2X from the July 2002 sampling event had total recoverable aluminum with absolute value differences greater than five times the PQL. Natural samples associated with this parameter have been flagged as estimated. No other parameter exhibited absolute value differences greater than the PQL in the April, July, or October 2002 sample events.

4.1.2 Laboratory QA/QC

Northern Analytical Laboratories received surface water samples from the District on March 7; April 24, 25, 30; May 3, 10; June 17; July 9, 15; August 7, 27, 28; September 24, 26; and, October 2, 3, 11, 23, and 25, 2002. All samples arrived at the laboratory cool between (0.1º C and 12.72º C) with the exception of surface water samples received by the laboratory on June 17, laboratory sample group 2002060189. Cooling ice in this sample container arrived melted and sample temperature was 24.6º C. All samples were analyzed within the required holding time.

Northern Analytical Laboratories' quality assurance coordinator reviewed calibration standards, calibration verification, laboratory controls, laboratory duplicates, and laboratory spikes on a daily basis. Review of these indicators showed that all inorganic analyses were in compliance with NAL's QA/QC criteria and within the precision and accuracy guidelines specified in NAL's *Laboratory Quality Assurance Plan* (submitted to MDEQ, June 1997).

Accuracy is measured as the ability of the analytical procedure to determine the actual or known quantity of a particular substance in a sample. Accuracy acceptance or rejection is based on the percent recovery (%R) of the laboratory matrix spike for water samples. To determine accuracy, the %R for each matrix spike is compared to the acceptable range as specified in the applicable laboratory method. Natural results associated with percent recoveries outside acceptable limits are considered estimated. Natural results associated with percent recoveries of less than 50 percent are considered rejected, as recommended by U.S. EPA (1988). An overall assessment of accuracy is made upon completion of the project. Overall accuracy is stated as the mean %R. Under this criterion, all surface water data collected in 2002 are acceptable.

4.1.3 Data Completeness

No data have been rejected on the basis of field QA/QC or laboratory QA/QC in any sampling event. Therefore, a data completeness of 100 percent was achieved for the 2002 surface water monitoring events.

4.2 GROUNDWATER DATA VALIDATION

The July 2002 groundwater monitoring event was validated independently as a separate sample matrix. Data flagging are the same as that used for surface water samples.

4.2.1 Field QA/QC

During the July 2002 sampling event, field duplicates, rinsate blanks, and deionized water blanks were prepared and containerized by Maxim field personnel in accordance with the Site-Wide SAP (Maxim,

1999b). Field QA/QC samples collected/prepared during the 2002 groundwater monitoring events are summarized in Table 12.

TABLE 12
2002 Groundwater Quality Control Samples
New World Mining District - Response and Restoration Project

Monitoring Event	QA/QC Sample	Sample Designation
July 2002	Field Duplicate	DCGW-104X
	Field Duplicate	MW-5PX
	Rinsate Blank	RR-MW-1R
	Rinsate Blank	RR-MW-5PR
	Rinsate Blank	TRACER-5R
	Deionized Water Blank	RR-EPA-12B
	Deionized Water Blank	RR-SB-108B

During the July 2002 sampling event, duplicate samples were collected from well DCGW-104X and MW-5PX. Three rinsate blanks also were prepared and containerized by field technicians while collecting samples from wells MW-1, MW-5, and TRACER-5 and were labeled RR-MW-1R, RR-MW-5PR, and TRACER-5R, respectively. Deionized water blanks were submitted with samples EPA-12 and SB-108. Samples from these locations were labeled RR-EPA-12B and RR-SB-108B.

Field duplicate results aid in the assessment of sampling and analytical accuracy. Analytical results for the original and duplicate samples collected from each sampling event were evaluated using the RPD and absolute value difference. The RPD between the two samples was calculated when both values of the natural/duplicate pair were greater than five times the PQL for a given analyte. The absolute value difference between the natural and duplicate sample for a given analyte was calculated when one or both values were less than five times the PQL.

RPDs are calculated by dividing the difference between the two reported values for a given parameter by the average of the two parameters. Analytical results of parameters where the RPD was greater than 20 percent are considered estimated concentrations. Dissolved zinc in sample location DCGW-104/DCGW-104X pair exhibited a RPD greater than 20 percent for the July sampling event. Total dissolved solids in sample location MW-5P/MW-5PX pair exhibited a RPD greater than 20 percent. No other parameters exhibited an RPD greater than 20 percent in the July 2002 sample event.

Results from natural/duplicate pairs with values less than five times the PQL are considered estimated when the absolute value difference exceeds the PQL. No parameters exhibited absolute differences greater than the PQL.

All blank results (rinsate blank and deionized water blank) for both sampling events were evaluated using the following criteria to determine if any parameter was measured in the samples at detectable concentrations. The blank with the highest detectable concentrations was used for further evaluation in instances where more than one type of blank was contaminated. All results greater than or equal to the PQL but less than five times the concentration of the contaminated blank are considered estimated and are likely biased towards the high end.

Rinsate blank RR-MW-1R had detectable values in the July 2002 sampling event. Rinsate blank RR-MW-1R exhibited contamination for alkalinity as CaCO3 and alkalinity as HCO3 in sample location MW-10A. Acidity as CaCO3 was detected in rinsate blank RR-MW-1R in sample locations EPA-11, EPA-12 and MW-1. All natural samples greater than or equal to the PQL but less than five times the concentration of the contaminated blank were flagged as estimated. No other rinsate blanks exhibited contamination in the July 2002 sample event.

Lab results from samples with deionized water blanks where the blank had analyte values greater than PQL had values flagged as estimated if values were less than five times PQL. Sample location EPA-12B from the July 2002 sample event recorded values for alkalinity bicarbonate as HCO3, alkalinity total as CaCO3, sulfate as S04, total recoverable cadmium, total recoverable copper, and total recoverable lead that exceeded the PQL. Sample location SB-108B from the July 2002 sample event recorded values for alkalinity bicarbonate as HCO3, alkalinity total as CaCO3, dissolved copper, and dissolved zinc that exceeded the PQL. All associated values were flagged as estimated if the values were less than 5 times PQL for this sample event.

4.2.2 Laboratory QA/QC

Northern Analytical Laboratories received groundwater samples from the District on March 7; April 24, 25, 30; May 3, 10; June 17; July 9, 15; August 7, 27, 28; September 24, 26; and, October 2, 3, 11, 23 and 25, 2002. All samples arrived at the laboratory cool between (0.1º C and 12.72º C). All samples were analyzed within the required holding time for the parameters of interest.

Northern Analytical Laboratories' quality assurance coordinator reviewed calibration standards, calibration verification, laboratory controls, laboratory duplicates, and laboratory spikes on a daily basis. Review of these quality indicators showed that all inorganic analyses were in compliance with NAL's QA/QC criteria and within the precision and accuracy guidelines specified in NAL's *Laboratory Quality Assurance Plan* (submitted to MDEQ, June 1997).

Accuracy is measured as the ability of the analytical procedure to determine the actual or known quantity of a particular substance in a sample. Accuracy acceptance or rejection is based on the percent recovery (%R) of the laboratory matrix spike for water samples. To determine accuracy, the %R for each matrix spike is compared to the acceptable range as specified in the applicable laboratory method. Natural results associated with percent recoveries outside acceptable limits will be considered estimated. Natural results associated with percent recoveries of less than 50 percent will be considered rejected, as recommended by U.S. EPA (1988). Under this criterion, all groundwater data collected in 2002 data are acceptable.

4.2.3 Data Completeness

No data have been rejected on the basis of field QA/QC or laboratory QA/QC in either sampling event. Therefore, a data completeness of 100 percent was achieved for the July 2002 groundwater monitoring event.

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APPENDIX A

2002 SURFACE WATER DATA

New World Mining District Response and Restoration Project

APPENDIX A-1

TABLE A-1 2002 SURFACE WATER SUMMARY

New World Mining District Response and Restoration Project

TABLE A-1
2002 SURFACE WATER SUMMARY
NEW WORLD MINING DISTRICT
Response and Restoration Project

Station Name	Sample Date	Flow Rate (cfs)	Anions (mg/L)					Cations (mg/L)								Total Recoverable Metals (mg/L)								
			Acid-idity as CaCO3	Alkalinity as HCO3	Alkalinity as Total CaCO3	Chlor-ide	Sulfate	Calcium	Hard-ness as CaCO3	Magne-sium	Potass-ium	Sod-ium	SC (umhos/cm)	pH (s.u.)	Total Sus-pended Solids (mg/L)	Alum-inum	Arsenic	Cad-mium	Chrom-ium	Copper	Iron	Lead	Manga-nese	Zinc
Drainage: Adits																								
D-18	7/2/2002	0.066	<2	79	65	<4	149	80	249	12	2	2	423	7	17	<JF0.1	--	<0.0001	--	0.017	6.69	0.001	0.49	JF%0.02
D-18	10/7/2002	0.012	<2	71	58	<4	288	109	354	20	3	5	696	7.1	33	0.2	--	0.0004	--	0.033	14.7	0.002	0.096	JF%0.08
D-18-0	9/26/2002	0.0154	<2	83	68	<4	299	123	385	19	3	4	670	6.9	--	<d0.1	--	d0.0003	--	<d0.001	d7.39	<d0.001	d1	d0.02
D-18-366	9/26/2002	0.0123	<2	85	70	<4	95	59	168	5	2	2	328	7.5	--	<d0.1	--	d0.0051	--	d0.019	d2.13	<d0.001	d0.65	d0.04
D-18-423	9/26/2002	0.0033	<2	66	54	<4	447	143	468	27	4	6	822	6.5	--	<d0.1	--	<d0.0001	--	<d0.001	d25.7	<d0.001	d1.28	d0.03
F-8A-0	6/30/2002	0.161	342	<1	<1	<4	501	55	211	18	2	4	1260	3	13	JF20.4	--	0.0027	--	10.3	99.8	0.028	7.21	JF%0.07
F-8A-0	10/8/2002	0.08	175	<1	<1	<4	358	48	190	1	3	<1	1030	3.1	17	7.6	--	0.0013	--	<0.001	59.2	0.038	<0.003	JF%0.48
F-28	6/30/2002	0.058	<2	112	92	<4	233	79	378	44	1	10	619	7.4	<10	<JF0.1	--	<0.0001	--	0.002	0.18	<0.001	0.029	JF%0.01
F-28	7/23/2002	0.02	<2	215	176	<4	405	140	683	81	3	18	993	8	<10	<0.1	--	0.0009	--	0.002	0.21	0.001	0.054	0.01
F-28	10/8/2002	0.011	<2	264	216	<4	591	172	759	8	4	2	1190	7.88	2	<0.1	--	0.0003	--	<0.001	0.19	<0.001	0.004	JF%0.03
FCSI-96-1-S1	7/23/2002	0.0062	<2	27	22	<4	128	42	183	19	<1	3	324	7.9	<10	<0.1	--	0.0014	--	0.003	<0.01	<0.001	<0.003	0.02
FCSI-96-1-S2	7/23/2002	0.0076	<2	215	176	<4	445	131	648	78	3	17	1020	8.3	<10	<0.1	--	0.0009	--	0.001	0.13	<0.001	0.018	0.11
FCSI-99-1	7/23/2002	0.00111	<2	33	27	<4	21	13	45	3	<1	<1	79	7.7	<10	<0.1	--	0.0009	--	0.01	0.06	0.004	<0.003	0.07
FCSI-99-68	7/23/2002	0.00023	<2	46	38	<4	35	18	94	12	<1	<1	156	7.3	<10	<0.1	--	0.001	--	0.013	0.87	<0.001	0.08	0.11
Drainage: Clarks Fork																								
SW-6	4/23/2002	0.64	<2	24	20	<2	14	10	33	2	<1	<1	78	7.8	<10	<0.1	--	<0.0001	--	0.004	0.06	<0.001	0.003	<0.01
SW-6	7/1/2002	110	<2	15	12	<4	14	7	26	2	<1	<1	53	7.6	<11	JF0.1	--	0.0002	--	0.032	0.14	0.001	0.008	<JF%0.01
SW-6	10/8/2002	3.36	<2	21	17	<4	35	13	45	3	<1	2	105	7.4	<3	<0.1	--	0.0001	--	0.014	0.01	<0.001	0.006	JF%0.05
Drainage: Daisy Creek																								
DC-2	4/25/2002	0.31	67	<1	<1	<2	306	72	246	16	2	2	582	4.6	10	10.8	--	0.0038	--	2.2	12.1	0.003	1.91	0.6
DC-2	7/2/2002	5	27	<1	<1	<4	128	34	126	10	<1	<1	275	4.8	30	JF6.2	--	0.0016	--	1.59	8.1	0.002	0.57	JF%0.25
DC-2	9/18/2002	--	121	<1	<1	<2	385	75	261	18	1	2	758	3.4	28	17.6	--	0.0047	--	4.13	15.5	0.006	2.31	0.64

Notes:

cfs - Cubic feet per second
s.u. - Standard units
mg/L - Milligrams per liter
e - Estimated
B - Deionized water blank
R - Rinsate blank
X - Field duplicate
umhos/cm - micromhos per centimeter

-- - Indicates parameter not analyzed
< - Indicates analyte not detected above practical quantitation limit (PQL)
JF% - The associated values are estimated quantities because field duplicate results exceed acceptable limits by relative percent difference determination
JF - The associated values are estimated quantities because the difference between the duplicate and natural values is greater than PQL when one or both values is less than 5 times PQL
JB - The associated values are estimated quantities because results were less than 5 times blank values that exceeded PQL
d - The associated values are dissolved, not total recoverable

TABLE A-1
2002 SURFACE WATER SUMMARY
NEW WORLD MINING DISTRICT
Response and Restoration Project

Station Name	Sample Date	Flow Rate (cfs)	Anions (mg/L)					Cations (mg/L)								Total Recoverable Metals (mg/L)								
			Acid-idity as CaCO3	Alkalinity as HCO3	Alkalinity as Total CaCO3	Chlor-ide	Sulfate	Calcium	Hard-ness as CaCO3	Magne-sium	Potass-ium	Sod-ium	SC (umhos/cm)	pH (s.u.)	Total Sus-pended Solids (mg/L)	Alum-inum	Arsenic	Cad-mium	Chrom-ium	Copper	Iron	Lead	Manga-nese	Zinc
DC-2	9/26/2002	--	116	<1	<1	<4	353	69	255	20	1	2	663	3.8	<10	14.3	--	0.0053	--	4.65	10.1	0.005	2.21	0.64
DC-2	10/9/2002	0.381	93	<1	<1	<4	292	57	208	16	1	3	596	4	27	13.7	--	0.0038	--	2.92	11.8	0.01	1.91	JF%0.54
DC-5	4/25/2002	--	<2	63	52	<2	124	55	183	11	<1	1	354	7.6	<2	<0.1	--	0.0004	--	0.024	<0.01	<0.001	0.16	0.04
DC-5	7/2/2002	12.6	<2	29	24	<4	54	25	91	7	<1	<1	161	7.2	17	JF1.6	--	0.0005	--	0.54	2.48	0.002	0.19	JF%0.08
DC-5	9/18/2002	--	<2	<4	<4	<4	191	60	203	13	<1	1	414	5.9	17	5.9	--	0.0021	--	1.61	3.66	0.003	0.93	0.21
DC-5	9/26/2002	--	<2	88	72	<4	47	37	125	8	<1	2	224	7.8	<10	0.3	--	0.0004	--	0.079	0.25	<0.001	0.086	0.02
DC-5	10/9/2002	0.74	<2	37	30	<4	139	46	164	12	<1	2	332	6.8	23	3.7	--	0.001	--	0.76	2.07	0.003	0.45	JF%0.15
SW-7	4/25/2002	--	<2	93	76	<2	26	32	109	7	<1	1	209	7.4	4	<0.1	--	<0.0001	--	0.003	0.26	<0.001	0.028	<0.01
SW-7	7/2/2002	74.6	<2	63	52	<4	14	20	71	5	<1	1	122	7.8	<10	JF0.3	--	<0.0001	--	0.089	0.49	<0.001	0.024	JF%0.02
SW-7	10/9/2002	2.42	<2	88	72	<4	35	33	115	8	<1	2	210	7.7	<2	0.1	--	0.0001	--	0.019	0.23	<0.001	0.038	JF%0.06
Drainage: Fisher Creek																								
CFY-2	4/26/2002	0.28	<2	12	10	<2	47	17	59	4	<1	2	134	7	<2	<0.1	--	<0.0001	--	0.007	0.02	<0.001	0.005	0.03
CFY-2	7/1/2002	13	<2	17	14	<4	24	11	40	3	<1	<1	77	7	<11	JF0.3	--	<0.0001	--	0.062	0.34	0.001	0.03	JF%0.04
CFY-2	10/8/2002	0.027	<2	27	22	<4	39	17	59	4	<1	2	124	6.9	2	<0.1	--	0.0002	--	0.008	0.03	<0.001	<0.003	JF%0.03
FCT-2	7/1/2002	4.5	<2	8	7	<4	13	5	17	1	<1	<1	38	6.7	<15	<JF0.1	--	<0.0001	--	0.007	<0.01	<0.001	<0.003	<JF%0.01
FCT-2	10/8/2002	0.06	3	5	4	<4	18	6	19	80	<1	24	54	7.6	<2	<0.1	--	0.0001	--	<0.001	<0.01	<0.001	0.077	<JF%0.01
FCT-11	6/30/2002	0.65	14	<1	<1	<4	24	5	17	1	<1	<1	71	4.4	<10	JF1.1	--	<0.0001	--	0.19	0.9	<0.001	0.058	JF%0.01
SW-3	4/26/2002	0.37	54	<1	<1	<2	145	24	93	8	2	5	444	3.4	<2	3.1	--	0.001	--	0.83	7.1	0.006	1.28	0.18
SW-3	7/1/2002	7.6	21	<1	<1	<4	43	7	26	2	<1	1	146	4	22	JF1.7	--	0.0003	--	0.54	4.31	0.003	0.3	JF%0.08
SW-3X	7/1/2002	--	23	<1	<1	<4	43	7	26	2	<1	1	150	4	19	1.7	--	0.0002	--	0.55	4.22	0.003	0.3	0.06
SW-3	10/8/2002	0.29	62	<1	<1	<4	138	26	94	7	2	4	458	3.4	4	3.6	--	0.001	--	0.85	10.6	0.009	1.48	JF%0.71
SW-3X	10/8/2002	--	60	<1	<1	<4	141	22	84	7	2	4	448	3.4	5	3.2	--	0.001	--	0.79	9.74	0.009	1.34	0.16
SW-4	4/26/2002	--	<2	10	8	<2	56	18	66	5	<1	2	149	6.7	<2	<0.1	--	0.0003	--	0.03	<0.01	<0.001	0.006	0.04
SW-4	7/1/2002	47	<2	11	9	<4	28	10	37	3	<1	<1	76	7.1	--	JF0.3	--	<0.0001	--	0.1	0.5	<0.001	0.051	JF%0.02

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TABLE A-1
2002 SURFACE WATER SUMMARY
NEW WORLD MINING DISTRICT
Response and Restoration Project

Station Name	Sample Date	Flow Rate (cfs)	Anions (mg/L)					Cations (mg/L)								Total Recoverable Metals (mg/L)								
			Acidity as CaCO3	Alkalinity as HCO3	Alkalinity as Total CaCO3	Chloride	Sulfate	Calcium	Hardness as CaCO3	Magnesium	Potassium	Sodium	SC (umhos/cm)	pH (s.u.)	Total Suspended Solids (mg/L)	Aluminum	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Zinc
SW-4	10/8/2002	1.91	<2	5	4	<4	61	17	63	5	<1	2	140	7.2	<2	0.1	--	0.0004	--	0.085	0.13	<0.001	0.088	JF%0.07
Drainage: Miller Creek																								
SW-2	4/24/2002	0.27	<2	88	72	<2	44	37	113	5	<1	1	226	7.6	<5	<0.1	--	<0.0001	--	0.006	0.02	<0.001	<0.003	<0.01
SW-2	7/2/2002	14.8	<2	49	40	<4	13	20	62	3	<1	<1	107	7.9	<11	<JF0.1	--	<0.0001	--	0.017	0.15	0.001	<0.003	JF%0.05
SW-2	7/24/2002	2.237	<2	61	50	<4	20	24	76	4	<1	<1	134	8.1	<10	0.1	--	<0.0001	--	0.011	0.08	0.002	<0.003	0.03
SW-2X	7/2/2002	--	<2	49	40	<4	13	19	60	3	<1	<1	112	7.8	<11	0.4	--	0.0005	--	0.065	0.12	0.001	<0.003	0.3
SW-2	10/7/2002	0.63	<2	73	60	<4	36	30	91	4	<1	1	175	8	<4	<0.1	--	0.0001	--	0.006	0.04	0.001	0.004	JF%0.04
SW-5	7/24/2002	1.403	<2	61	50	<4	21	26	86	5	<1	<1	154	8.3	<10	<0.1	--	0.0009	--	0.006	0.06	0.001	<0.003	0.04
Drainage: Soda Butte Creek																								
REPOSITORY SEEP	6/30/2002	--	<2	149	122	<4	108	82	262	14	1	6	455	7.1	<10	<JF0.1	<0.003	<0.0001	<0.001	0.001	0.04	<0.001	<0.003	JF%0.02
REPOSITORY SUMP	5/2/2002	38	<2	1290	1060	8	1030	457	1700	136	9	103	3020	6.5	12	<0.1	<0.003	0.0008	<0.001	0.002	0.94	<0.001	3.55	<0.01
REPOSITORY SUMP	5/21/2002	69	<2	522	428	<4	425	255	867	56	4	30	1360	7.1	10	0.1	0.003	<0.0001	<0.001	0.002	0.64	<0.001	1.79	0.02
REPOSITORY SUMP	6/6/2002	42	<2	522	428	1	377	246	833	53	3	26	1330	6.9	47	0.3	<0.003	<0.0001	<0.001	0.004	0.7	0.003	1.66	0.03
W. REPOSITORY SEEP	6/30/2002	--	<2	149	122	<4	35	52	175	11	<1	4	285	7.5	<10	JF0.2	<0.003	<0.0001	--	0.002	0.4	0.002	0.04	<JF%0.01
SBC-1	4/22/2002	0.66	<2	154	126	<2	11	42	134	7	<1	1	264	8.3	<10	<0.1	--	<0.0001	--	<0.001	<0.01	<0.001	<0.003	<0.01
SBC-1	7/1/2002	9.4	<2	121	99	<4	11	38	128	8	<1	1	198	8.1	<12	<JF0.1	--	<0.0001	--	0.002	0.03	<0.001	<0.003	JF%0.03
SBC-1	10/9/2002	1.04	<2	138	113	<4	12	39	126	7	<1	2	226	8	<2	<0.1	--	<0.0001	--	<0.001	<0.01	<0.001	<0.003	<JF%0.01
SBC-2	4/22/2002	0.53	<2	156	128	<2	86	66	218	13	2	1	414	7.8	<10	<0.1	--	<0.0001	--	<0.001	3.54	<0.001	0.17	<0.01
SBC-2	7/1/2002	33.2	<2	79	65	<4	16	27	88	5	<1	<1	149	8	<11	<JF0.1	--	<0.0001	--	0.01	0.19	<0.001	<0.003	<JF%0.01
SBC-2	10/9/2002	1.09	<2	127	104	<4	38	45	149	9	<1	2	261	7.9	4	<0.1	--	<0.0001	--	<0.001	1.54	<0.001	0.055	JF%0.01
SBC-4	7/1/2002	--	<2	46	38	<4	6	13	49	4	<1	3	85	7.9	22	JF0.4	--	<0.0001	--	0.003	0.92	<0.001	0.008	JF%0.07
SBC-4	10/8/2002	10.94	<2	100	82	<4	<5	26	91	7	<1	6	184	8.3	6	0.3	--	0.0001	--	<0.001	0.91	<0.001	0.012	JF%0.04
SBC-4	4/24/2002	0.32	<2	132	108	<4	12	35	120	8	<1	5	238	8.4	<10	0.2	--	<0.0001	--	<0.001	0.22	<0.001	0.005	<0.01
SBC-4X	4/24/2002	--	<2	133	109	<2	12	34	118	8	<1	5	236	8.4	11	0.2	--	<0.0001	--	<0.001	0.19	<0.001	0.005	<0.01

Notes:

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TABLE A-1
2002 SURFACE WATER SUMMARY
NEW WORLD MINING DISTRICT
Response and Restoration Project

Station Name	Sample Date	Flow Rate (cfs)	Anions (mg/L)					Cations (mg/L)								Total Recoverable Metals (mg/L)								
			Acid-idity as CaCO3	Alkalinity as HCO3	Alkalinity as Total CaCO3	Chlor-ide	Sulfate	Calcium	Hard-ness as CaCO3	Magne-sium	Potass-ium	Sod-ium	SC (umhos/cm)	pH (s.u.)	Total Sus-pended Solids (mg/L)	Alum-inum	Arsenic	Cad-mium	Chrom-ium	Copper	Iron	Lead	Manga-nese	Zinc
SBSW-102	4/22/2002	0.48	<2	73	60	<2	8	16	61	5	<1	5	135	8.2	<10	0.2	--	<0.0001	--	<0.001	0.39	<0.001	0.003	<0.01
SBSW-102	7/1/2002	171.6	<2	46	38	<4	6	11	40	3	<1	3	78	7.9	12	JF0.2	--	<0.0001	--	0.004	0.64	<0.001	<0.003	<JF%0.01
SBSW-102	10/9/2002	4.93	<2	73	60	<4	11	18	70	6	<1	6	134	8	9	0.4	--	<0.0001	--	<0.001	0.97	<0.001	0.016	<JF%0.01
SBT-3	4/22/2002	--	<2	121	99	<2	12	37	117	6	<1	<1	214	7.8	<10	<0.1	<0.003	<0.0001	<0.001	<0.001	<0.01	<0.001	<0.003	<0.01
SBT-3	4/23/2002	0.11	<2	115	94	<2	14	36	110	5	<1	<1	221	8.1	<10	<0.1	<0.003	<0.0001	<0.001	<0.001	<0.01	<0.001	<0.003	<0.01
SBT-3	4/26/2002	--	<2	115	94	<2	12	37	117	6	<1	1	207	7.6	2	<0.1	<0.003	<0.0001	<0.001	<0.001	0.04	<0.001	0.006	<0.01
SBT-3	5/2/2002	0.22	<2	96	79	<2	15	33	103	5	<1	<1	190	7.8	<3	<0.1	<0.003	<0.0001	<0.001	0.001	0.08	<0.001	0.005	<0.01
SBT-3	5/9/2002	0.37	<2	93	76	2	16	33	103	5	<1	<1	202	7.9	3	<0.1	<0.003	<0.0001	<0.001	0.001	0.01	<0.003	<0.003	<0.01
SBT-3	5/15/2002	2.75	<2	84	69	<2	14	29	97	6	<1	<1	173	7.7	14	0.4	<0.003	<0.0001	<0.001	0.004	0.44	0.001	0.008	0.01
SBT-3	5/21/2002	4.13	<2	55	45	<2	15	20	66	4	<1	<1	116	7.9	20	0.5	<0.003	<0.0001	<0.001	0.004	0.55	0.002	0.011	<0.01
SBT-3	5/30/2002	9.1	<2	49	40	<2	8	15	46	2	<1	<1	98	7.7	22	0.2	<0.003	<0.0001	<0.001	0.003	0.32	<0.003	0.006	<0.01
SBT-3	6/6/2002	3	<2	49	40	<1	10	17	55	3	<1	<1	98	7.8	<4	<0.1	<0.003	<0.0001	<0.001	0.004	0.06	<0.001	<0.003	<0.01
SBT-3	6/30/2002	0.44	<2	90	74	<4	13	30	96	5	<1	<1	158	7.8	<10	<JF0.1	<0.003	<0.0001	<0.001	0.002	<0.01	<0.001	<0.003	<JF%0.01
SBT-3	8/20/2002	0.06	<4	143	117	<2	13	43	132	6	2	1	252	8	<10	<0.1	<0.003	<0.0001	<0.001	0.001	<0.01	<0.003	<0.005	<0.01
SBT-6	4/21/2002	--	<2	123	101	<4	12	39	122	6	<1	1	236	8	<10	<0.1	<0.003	<0.0001	<0.001	0.003	0.01	<0.001	<0.003	<0.01
SBT-6	4/23/2002	0.13	<2	127	104	3	14	40	125	6	<1	1	239	8	<10	<0.1	<0.003	<0.0001	<0.001	<0.001	<0.01	<0.001	<0.003	<0.01
SBT-6	4/26/2002	--	<2	121	99	<2	17	40	129	7	<1	1	229	7.8	<2	<0.1	<0.003	<0.0001	<0.001	0.001	0.01	<0.001	<0.003	<0.01
SBT-6	5/2/2002	0.75	<2	110	90	<2	11	35	112	7	<1	1	202	7.9	<3	<0.1	<0.003	<0.0001	<0.001	0.002	0.04	<0.001	<0.003	<0.01
SBT-6	5/9/2002	0.89	<2	115	94	2	12	34	105	5	<1	1	212	8	<3	<0.1	<0.003	<0.0001	<0.001	0.002	0.07	<0.003	<0.003	0.02
SBT-6	5/15/2002	4.7	<2	83	68	<2	11	29	97	6	<1	<1	168	7.9	82	2.4	<0.003	<0.0001	0.002	0.012	3.24	0.014	0.091	0.03
SBT-6	5/21/2002	7.05	<2	66	54	<2	10	21	69	4	<1	<1	118	8	22	0.5	<0.003	<0.0001	<0.001	0.006	0.69	0.002	0.018	<0.01
SBT-6	5/30/2002	20.2	<2	59	48	<2	8	17	55	3	<1	<1	106	7.9	14	0.3	<0.003	<0.0001	<0.001	0.005	0.55	<0.003	0.018	<0.01
SBT-6	6/6/2002	8.5	<2	56	46	<1	10	18	57	3	<1	<1	104	8	<4	<0.1	<0.003	<0.0001	<0.001	0.003	0.06	<0.001	<0.003	<0.01
SBT-6	6/30/2002	1.29	<2	96	79	<4	18	32	105	6	<1	<1	161	8.1	<10	<JF0.1	<0.003	<0.0001	<0.001	0.003	<0.01	<0.001	<0.003	<JF%0.01

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NEW WORLD MINING DISTRICT
Response and Restoration Project

Station Name	Sample Date	Flow Rate (cfs)	Anions (mg/L)					Cations (mg/L)								Total Recoverable Metals (mg/L)								
			Acid-idity as CaCO3	Alkalinity as		Chlor-ide	Sulfate	Calcium	Hard-ness as CaCO3	Magne-sium	Potass-ium	Sod-ium	SC (umhos/cm)	pH (s.u.)	Total Sus-pended Solids (mg/L)	Alum-inum	Arsenic	Cad-mium	Chrom-ium	Copper	Iron	Lead	Manga-nese	Zinc
				HCO3	Total CaCO3																			
SBT-6	8/20/2002	0.133	<4	154	126	<2	9	47	146	7	<1	1	254	8.2	<10	<0.1	<0.003	<0.0001	<0.001	0.002	<0.01	<0.003	<0.005	<0.01
SBT-6	10/7/2002	0.19	<2	160	131	<4	14	45	145	20	<1	5	267	8.2	<2	<0.1	--	0.0002	--	0.033	0.05	<0.001	0.96	<JF%0.01
TRIBUTARYTOSBT-3	5/21/2002	--	<2	55	45	<2	19	22	76	5	<1	<1	135	7.7	<4	<0.1	<0.003	<0.0001	--	<0.001	0.04	<0.001	<0.003	0.02

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APPENDIX A-2

APRIL 2002 SURFACE WATER LABORATORY REPORTS AND FIELD NOTES

New World Mining District Response and Restoration Project

APPENDIX A-3

JULY 2002 SURFACE WATER LABORATORY REPORTS AND FIELD NOTES

New World Mining District Response and Restoration Project

APPENDIX A-4

OCTOBER 2002 SURFACE WATER LABORATORY REPORTS AND FIELD NOTES

New World Mining District Response and Restoration Project

APPENDIX A-5

MCLAREN PIT AND SELECTIVE SOURCE RESPONSE ACTIONS CONSTRUCTION MONITORING FIELD RESULTS AND LABORATORY ANALYTICAL REPORTS

New World Mining District Response and Restoration Project

APPENDIX A-6

2002 ADIT SAMPLING DATA
LABORATORY ANALYTICAL REPORTS AND FIELD NOTES

New World Mining District Response and Restoration Project

APPENDIX B

2002 GROUNDWATER DATA

New World Mining District Response and Restoration Project

APPENDIX B-1

TABLE B-1 – 2002 GROUDWATER DATA SUMMARY

New World Mining District Response and Restoration Project

TABLE B-1
2002 GROUNDWATER SUMMARY
NEW WORLD MINING DISTRICT
Response and Restoration Project

Station Name	Sample Date	Depth to Water (feet)	Anions (mg/L)						Cations (mg/L)									Total Dissolved Metals (mg/L)						
			Acid-idity as CaCO3	Alkalinity as			Chlor-ide	Sulfate	Calcium	Hard-ness as CaCO3	Magne-sium	Potass-ium	Sod-ium	SC (umhos/cm)	pH (s.u.)	Total Dis-solved Solids (mg/L)	Alum-inum	Cad-mium	Copper	Iron	Lead	Manga-nese	Zinc
				HCO3	CO3	Total CaCO3																	
Como Basin Area																								
MW-8	7/11/2002	12.76	<2	253	0	207	<1	111	61	387	57	<1	4	569	7.4	JF%358	<0.1	<0.0001	<0.001	<0.01	<0.001	<0.005	<0.01
TRACER-4	7/10/2002	90.17	330	<1	0	<1	13	443	37	146	13	3	2	1250	2.9	723	14.3	0.0025	4.37	125	0.12	10.9	1.45
TRACER-6	7/10/2002	15.55	<2	55	0	45	<4	797	257	872	56	3	6	1290	5.9	1210	<0.1	0.0004	0.12	25.4	<0.001	4.43	JB0.1
Fisher Creek																								
EPA-11	7/10/2002	96.75	JB540	<1	0	<1	8	1300	214	954	102	5	4	2150	4.5	JF%2150	6.4	0.0076	0.46	344	0.15	19.1	1.03
EPA-12	7/11/2002	21.02	JB22	17	0	14	<2	147	32	133	13	2	3	377	7.3	JF%268	<0.1	<0.0001	<0.001	35.3	<0.001	1.69	0.04
EPA-12B	7/11/2002	--	<2	1	0	1	<4	8	<1	<7	<1	<1	<1	<10	5.7	<20	<t0.1	t0.0001	t0.001	<t0.01	t0.001	<t0.005	<t0.01
MW-1	7/11/2002	55.8	JB117	<1	0	<1	7	372	72	291	27	2	3	957	3.3	JF%587	1.6	JB0.0004	0.22	51.2	0.012	3.3	0.13
MW-1R	7/11/2002	--	113	2	0	2	<2	<5	<1	<7	<1	<1	<1	<10	5.9	<20	<0.1	<0.0001	<0.001	0.02	<0.001	<0.005	<0.01
MW-9A	7/9/2002	6.63	<2	JB2	0	JB2	<4	45	12	42	3	1	3	113	5.4	JB98	<0.1	<0.0001	0.007	0.04	<0.001	0.012	<0.01
MW-9B	7/9/2002	6.63	<2	8	0	7	<2	52	15	58	5	1	4	140	6.2	J105	<0.1	<0.0001	<0.001	1.15	<0.001	0.1	0.02
MW-10A	7/11/2002	3.44	<2	JB5	0	JB4	<2	JB26	8	28	2	<1	2	71	5.8	JF%50	<0.1	<0.0001	0.014	<0.01	<0.001	0.024	<0.01
MW-10B	7/11/2002	--	<2	165	0	135	10	1150	298	1094	85	8	143	1950	7.1	JF%1790	<0.1	<0.0001	0.005	1.94	<0.001	0.24	0.01
MW-11	7/9/2002	10.54	<2	7	0	6	<2	17	4	18	2	<1	1	38	6.2	125	2	0.0004	0.022	1.51	0.008	<0.005	JF%0.01
SB-16	7/11/2002	10.21	<2	134	0	110	3	207	81	276	18	3	18	533	7.5	JF%397	<0.1	<0.0001	JB0.001	0.69	<0.001	0.19	<0.01
TRACER-5	7/10/2002	--	259	<1	0	<1	2	271	7	30	3	2	5	749	3.8	497	26	0.0023	3.6	61.1	0.006	1.16	0.39
TRACER-5R	7/10/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.1	<0.0001	<0.001	<0.01	<0.001	<0.005	<0.01
McLaren Pit Area																								
DCGW-101D	7/10/2002	5.7	<2	115	0	94	<2	126	73	244	15	2	5	412	7.5	414	<0.1	<0.0001	<0.001	0.18	0.003	0.43	<0.01
DCGW-101D	9/5/2002	7.36	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.1	<0.0001	<0.001	<0.01	<0.001	0.23	<0.01
DCGW-101S	7/10/2002	5.6	24	<1	0	<1	<2	103	30	104	7	1	2	256	4.5	180	2.6	0.0003	0.13	0.01	0.001	0.26	JB0.1
DCGW-101S	9/5/2002	6.93	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.2	0.0005	0.13	<0.01	0.003	0.21	0.09

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Station Name	Sample Date	Depth to Water (feet)	Anions (mg/L)						Cations (mg/L)									Total Dissolved Metals (mg/L)						
			Acid-idity as CaCO3	Alkalinity as			Chlor-ide	Sulfate	Calcium	Hard-ness as CaCO3	Magne-sium	Potass-ium	Sod-ium	SC (umhos/cm)	pH (s.u.)	Total Dis-solved Solids (mg/L)	Alum-inum	Cad-mium	Copper	Iron	Lead	Manga-nese	Zinc
				HCO3	CO3	Total CaCO3																	
DCGW-102D	7/8/2002	6.67	<2	209	0	171	<2	40	43	186	19	3	17	363	7.9	242	0.1	0.0001	0.003	0.13	<0.001	0.19	JF%0.01
DCGW-102S	7/8/2002	2.71	<2	204	0	167	<2	38	54	213	19	4	8	358	7.8	242	<0.1	<0.0001	<0.001	<0.01	<0.001	0.54	<JF%0.01
DCGW-103D	7/8/2002	--	<2	206	0	169	<2	129	90	311	21	2	8	521	7.3	373	<0.1	<0.0001	<0.001	0.26	<0.001	0.19	<JF%0.01
DCGW-103S	7/8/2002	--	<2	228	0	187	<2	225	128	418	24	12	10	738	6.8	536	<0.1	<0.0001	0.002	0.08	<0.001	1.15	<JF%0.01
DCGW-104	7/9/2002	20.28	987	<1	0	<1	9	1580	186	806	83	3	10	2540	2.6	2830	114	0.028	47.9	142	0.002	13.4	JF%4.8
DCGW-104X	7/9/2002	--	995	<1	0	<1	8	1600	188	819	85	3	10	2710	2.6	2740	113	0.027	52.1	133	0.002	13.4	3.56
DCGW-105	7/8/2002	14.12	575	<1	0	<1	<2	618	17	84	10	2	3	1480	2.6	1500	28.9	0.0048	14.1	169	0.008	1.68	JF%0.68
DCGW-106	8/19/2002	-1	<4	259	0	212	<2	J268	146	472	26	4	8	838	7.2	649	<0.1	<0.0001	<0.001	2.5	<0.001	0.253	<0.01
DCGW-107	8/19/2002	10.79	<4	117	0	96	6	J195	88	273	13	12	14	586	7.8	568	<0.1	0.0001	<0.001	0.85	<0.001	0.767	<0.01
DCGW-108	8/23/2002	10.55	212	<4	0	<4	<2	J107	27	93	6	3	3	233	5	230	<0.1	0.0005	0.11	0.1	<0.001	0.98	<0.01
DCGW-108	9/5/2002	9.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.2	0.0009	0.18	0.3	<0.001	1.26	0.17
DCGW-109	8/19/2002	7.72	<4	151	0	124	<2	J266	115	357	17	12	9	689	7.7	534	<0.1	0.0001	0.003	<0.01	<0.001	1.96	<0.01
DCGW-109	9/5/2002	6.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.1	0.0002	<0.001	<0.01	<0.001	1.67	0.01
DCGW-110	8/23/2002	6.26	<4	151	0	124	<2	J547	218	660	28	10	9	1220	7.1	1100	<0.1	0.0009	0.014	<0.01	<0.001	8.93	0.01
DCGW-110	9/5/2002	6.24	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.1	0.0008	0.003	<0.01	<0.001	8.62	0.02
DCGW-131	8/23/2002	20.69	<4	212	0	174	<2	J1270	469	1380	51	24	17	2340	6.8	2220	<0.1	0.0005	0.003	5.01	<0.001	3.52	<0.01
DCGW-132	8/22/2002	5.74	523	<1	0	<1	<2	J810	141	558	50	23	9	1470	3.9	1510	22	0.014	3.36	138	0.006	9.77	1.72
DCGW-133	8/22/2002	3.71	404	<1	0	<1	<2	J639	103	360	25	6	4	1470	3	1180	32	0.013	11.3	68	0.007	4.37	1.51
DCGW-133	9/5/2002	3.96	--	--	--	--	--	--	--	--	--	--	--	--	--	--	33.1	0.013	12.4	65.5	0.007	4.05	1.47
DCGW-134	8/22/2002	4.18	121	<1	0	<1	<2	J320	41	135	8	5	6	681	4.3	559	<0.1	0.0002	0.004	0.02	<0.001	1.02	0.04
DCGW-136	8/22/2002	4.03	43	<4	0	<4	<2	J183	62	212	14	2	4	418	5.7	421	<0.1	0.0025	0.11	<0.01	<0.001	1.73	0.29
DCGW-137	8/23/2002	6.46	<4	118	0	97	2	J48	39	134	9	3	5	280	7.9	230	<0.1	<0.0001	0.001	<0.01	<0.001	0.14	<0.01
DCGW-138	8/22/2002	8.73	<4	49	0	40	<2	J150	62	188	8	3	3	425	7.1	520	<0.1	0.0003	0.001	<0.01	<0.001	0.008	0.05
DCGW-139B	8/22/2002	--	14	<4	0	<4	<2	<J5	<1	<7	<1	<1	<1	<10	5.9	38	<0.1	<0.0001	<0.001	0.01	<0.001	<0.005	0.01

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			Acid-idity as CaCO3	Alkalinity as			Chlor-ide	Sulfate	Calcium	Hard-ness as CaCO3	Magne-sium	Potass-ium	Sod-ium	SC (umhos/cm)	pH (s.u.)	Total Dis-solved Solids (mg/L)	Alum-inum	Cad-mium	Copper	Iron	Lead	Manga-nese	Zinc
				HCO3	CO3	Total CaCO3																	
DCGW-140X	8/23/2002	--	<4	J129	0	J106	<2	J45	38	132	9	3	5	294	8	221	<0.1	<0.0001	<0.001	<0.01	<0.001	0.17	<0.01
MW-2	7/9/2002	--	349	<1	0	<1	<2	378	23	94	9	4	4	1040	3.9	786	43.5	0.0014	0.007	113	0.008	1.19	JF%0.23
MW-3	7/8/2002	5.75	<2	206	0	169	<2	38	54	221	21	3	5	371	7.8	380	1.9	<0.0001	0.003	1.37	0.009	0.38	JF%0.01
TRACER-2	7/8/2002	18.51	398	<1	0	<1	<2	436	7	50	8	4	4	987	3.9	766	t54.3	t0.001	t5.22	t71.6	t0.002	t0.41	JF%t0.15
Miller Creek																							
MW-5A	7/10/2002	20.94	<2	55	0	45	<4	JB30	25	75	3	<1	<1	137	7.6	JF%107	<0.1	<0.0001	<0.001	<0.01	<0.001	<0.005	<0.01
MW-5P	7/10/2002	23.28	<2	61	0	50	<2	JB34	31	94	4	<1	1	173	7.5	JF%245	<0.1	<0.0001	<0.001	<0.01	<0.001	<0.005	<0.01
MW-5PX	7/10/2002	--	<2	63	0	52	<2	34	30	91	4	<1	1	169	7.5	113	<0.1	<0.0001	<0.001	<0.01	<0.001	<0.005	<0.01
MW-5PR	7/10/2002	--	<2	2	0	2	<2	<5	<1	<7	<1	<1	<1	<10	6.1	<20	<0.1	<0.0001	<0.001	<0.01	<0.001	<0.005	<0.01
Selective Source Repository																							
SBGW-105	7/9/2002	3.52	<2	357	0	437	2	125	9	22	<1	2	116	581	10	J434	0.3	<0.0001	JB0.004	0.29	<0.001	<0.005	<0.01
SBGW-105T	7/9/2002	8.02	<2	511	0	419	<1	37	58	215	17	2	6	382	8	J261	<0.1	<0.0001	JB0.002	0.04	<0.001	0.38	<0.01
SBGW-107	7/9/2002	11.41	<2	253	0	207	6	497	31	114	9	3	302	1570	8.6	J1080	0.2	<0.0001	JB0.003	0.33	0.001	0.38	<0.01
SBGW-107T	7/9/2002	9.58	<2	237	0	194	<4	52	79	243	11	<1	2	386	7.3	J291	0.2	0.0053	0.008	0.17	0.006	<0.005	0.03
SBGW-108	7/9/2002	9.13	<2	162	0	133	<1	18	53	169	9	<1	2	273	7.4	J180	<0.1	<0.0001	<0.001	<0.01	<0.001	<0.005	<0.01
SBGW-108T	7/9/2002	8.27	<2	248	0	203	<2	22	68	211	10	<1	4	357	7.5	J227	<0.1	<0.0001	<0.001	0.01	<0.001	<0.005	<0.01

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APPENDIX B-2

JULY 2002 GROUNDWATER LABORATORY ANALYTICAL REPORTS AND FIELD NOTES

New World Mining District Response and Restoration Project