



File Code: 2160

Date: January 6, 2010

Bob Bukantis
Supervisor
Water Quality Standards Section
P.O. Box 200901
Helena, MT 59620-0901

Dear Bob:

In your letter dated March 3, 2009 (Attachment #1) you provided guidance on how the Forest Service might proceed with closure of the New World Mine project relative to compliance with Montana's water quality standards. This letter is written in response to your letter and provides answers to your key questions on page 2 of that letter concerning Compliance with Montana's Water Quality Standards and additionally provides as an enclosure, a supporting Water Quality Compliance Report that includes an update on the status of the New World Mine project.

Your key questions were:

Do we need more follow up work to fill data and information gaps?

No. The data set for the New World Mine Site is extensive. Water quality data for surface and groundwater is adequate, spatially covers the entire district, and has been collected for more than 11 years. District-wide impacts to surface water from mine wastes and adit discharges have been characterized. Background water quality has been evaluated using several different techniques. Additionally, macroinvertebrate, fisheries and revegetation monitoring has been ongoing and proposed future monitoring is outlined in the Long Term Operations and Maintenance Plan.

What cleanup or further restoration work, if any, is necessary?

The remaining work at the site, to be completed in 2010, is the closure of the McLaren adit, additional area-wide reclamation work down slope of the adit, and road maintenance work, including revegetation of unstable cut and fill slopes and drainage control. The Final Adit Discharge Engineering Evaluation/Cost Analysis (EE/CA) is being updated with additional data and completed to include this anticipated work.

Can we appropriately characterize as "natural" existing metals loading from legacy mining impacts that we think are not practical to address but that do add metals load to surface water? Montana's definition of natural allows for water quality standard exceedances to be considered "natural" if all reasonable land, soil and water conservation practices have been applied.

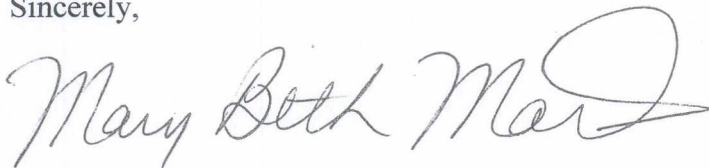
Yes. Innovative, state of the art methodologies have been applied to characterize natural background water quality throughout the district. Although we cannot characterize the remaining discharges from adits as natural because they clearly emanate from mining related features; we have mitigated the impacts from select adits (those on District property) to the



extent practicable by applying effective and reasonable conservation practices. Enclosed is a Water Quality Compliance Report (Attachment #2) which documents the reclamation activities performed at the various mine waste and select adit discharge sites. Most of the remaining adit discharges do not discharge directly to surface water. All discharges have little to no measurable impacts to down gradient receiving waters and analysis has shown that that implementation of conservation practices would not appreciable improve water quality. Additionally, these discharges do not exceed the calculated natural background water quality values, in most instances.

I look forward to working with you to demonstrate compliance with Montana's Water Quality Standards upon completion of the New World Mine project. For your information, the Annual New World Technical meeting is scheduled for February 3, 2010. Please give me a call if you have any questions or require additional information.

Sincerely,

A handwritten signature in cursive script that reads "Mary Beth Marks". The signature is written in dark ink and is positioned above the printed name.

MARY BETH MARKS
On-Scene Coordinator

cc: B.Kirkpatrick/RO, H.Fliniau/USDA, J.Koerth/MDEQ, M.Wireman/EPA, M.Maj/GNF,
A.Kirk /Tetra Tech



Brian Schweitzer, Governor

P.O. Box 200901 • Helena, MT 59620-0901 • (406) 444-2544 • www.deq.state.mt.us

March 3, 2009

Mary Beth Marks
Gallatin National Forest
P.O. Box 130
Bozeman, MT 59771

Dear Mary Beth,

The purpose of this letter is twofold: 1. Provide the Gallatin National Forest (GNF) with our thoughts on how to wrap up the New World Mine Project (NWM) relative to compliance with Montana's water quality standards, and 2. to provide comment on both the Pre-Mining Water Quality Report for the New World Project, and the Long-term Operations and Maintenance Plan for the New World Mine documents.

Compliance with Montana's Water Quality Standards

Currently GNF is conducting remediation under temporary water quality standards (ARM 17.30.630) set to reflect water quality conditions that existed at the time of project initiation, and are due to expire in 2014. We recognize that an important issue for the Gallatin National Forest is demonstration of compliance with Montana's water quality standards at completion of the New World Mine Project. To this end we want to provide you with our perspective on how best to work with us so we can certify compliance with Montana's standards.

A key consideration in the interpretation and implementation of Montana's water quality standards is that natural conditions do not violate Montana's standards (75-5-306 MCA):

1. *It is not necessary that wastes be treated to a purer condition than the natural condition of the receiving stream as long as the minimum treatment requirements established under this chapter are met.*
2. *"Natural" refers to conditions or material present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil, and water conservation practices have been applied.*

The GNF and cooperators have done good work to document water quality, including recent analysis to determine natural, pre-mining conditions. We will continue to work with GNF during the next several years to provide input on NWM project completion and

will use the available technical data and information to characterize natural background relative to interpreting our standards. Key questions that will need to be answered include:

- Do we need more follow up work to fill data and information gaps? Data gaps may dictate future modifications of the Long-term Operations and Maintenance Plan .
- What cleanup or further restoration work, if any, is necessary?
- Can we appropriately characterize as “natural” existing metals loading from legacy mining impacts that we think are not practical to address but that do add metals load to surface water? Montana’s definition of natural allows for water quality standard exceedances to be considered “natural” if all reasonable land, soil and water conservation practices have been applied.

We will continue to work with you to resolve these issues. We think the avenue to certify compliance with Montana’s standards for the New World Mine Project will include assessment of water quality by DEQ, may involve a TMDL 5-year review document, and possible modification of the Cooke City TMDL, or modification of water quality standards as appropriate.

Specific comments on the New World Project Pre-mining Water Quality report

We have identified the following editing issues:

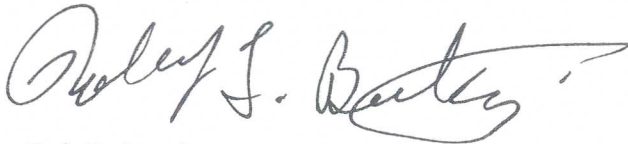
- 1) Footnote 3 in Tables 1-3 and 1-5 for acute and chronic aquatic life values should be footnote 4.
- 2) Footnote 3 for Tables 1-3 through 1-5 should state that pH is between 6.5 to 9.0 instead of 6.6 to 9.0.
- 3) We suggest that you use consistent hardness values to calculate the metal standards for Fisher Creek in the data display tables. A hardness value of 50 mg/l was used to calculate the metal standards for Fisher Creek in Tables 1-3 and 1-4; while, a hardness value of 100 mg/l was used to calculate the metal standards for Fisher Creek in Tables 1-5 and 4-3.

Specific comments on the “Long-term Operations and Maintenance Plan”

We agree with Section 2.3.1 in the Long-Term Operations and Maintenance Plan that dissolved metals should be added to the parameter list for all sites (Table 1) to allow further evaluation of reclamation success. We also agree that aquatic/biological monitoring which is addressed in Section 2.5 of the long-term plan should occur at the seven stations required for monitoring for compliance with the temporary water quality standards after remediation is finished. This data can be compared to baseline data that were collected prior to remediation activities. It will also be useful to evaluate trends that might be attributable to improvement of conditions over time. We recommend that macroinvertebrate, diatom, and sediment metal samples should be collected once per year in August for 3 consecutive years from 2012-2014; 2018-2020; and 2024-2027.


We appreciate the fine collaborative work that you have done with the USGS to quantify the contribution of natural background to the metals loading in the New World Mining, and feel this effort will provide important supporting information to move forward. Please call if you have any questions. Please contact me at 444-5320 on interpretation of natural in our standards, or George Mathieus (444-7423) for additional information.

Sincerely,

A handwritten signature in cursive script that reads "Bob Bukantis". The signature is written in dark ink and is positioned above the typed name.

Bob Bukantis
Supervisor
Water Quality Standards Section

Talked to John Koerth 3/31/09
John has no additional comment
on documents.



**Final
Water Quality Compliance Report
New World Response and Restoration
Project**

New World Mining District, Park County, Montana

Prepared for:

**USDA Forest Service
Northern Region
Missoula Montana**

Prepared by:

Tetra Tech

*851 Bridger Drive
Bozeman, MT 59715*

Tetra Tech Project No. 1157561506A

January 2010

TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
1.1	REPORT ORGANIZATION	1
1.2	PROJECT BACKGROUND	2
1.3	PROJECT LOCATION.....	3
2.0	MONTANA WATER QUALITY STANDARDS	6
3.0	RECLAMATION ACTIVITIES.....	7
3.1	WASTE REMOVAL AND CONSOLIDATION	7
3.2	ADIT DISCHARGES.....	8
3.2.1	Glengarry Adit.....	8
3.2.2	Glengarry Mill Site Adit	11
3.2.3	Gold Dust Adit.....	11
3.2.4	Lower Tredennic Dump 1 Adit	12
3.2.5	Black Warrior Adit.....	12
3.2.6	Little Daisy Adit	13
3.2.7	Henderson Mountain Dump 7 Adit	13
3.3	AREA-WIDE RECLAMATION AND CLOSURES	14
3.3.1	McLaren Pit Closure and McLaren Subsurface Drains	14
3.3.2	Como Basin Closure.....	16
4.0	ADDITIONAL 2010 RECLAMATION / CLOSURE WORK.....	17
4.1	MCLAREN ADIT	17
4.2	MCLAREN ADIT AREA WIDE RECLAMATION	18
4.3	ROADS.....	18
5.0	SURFACE WATER QUALITY IN THE DISTRICT.....	19
5.1	EXISTING WATER QUALITY IN DAISY CREEK DRAINAGE	19
5.1.1	Daisy Creek Water Quality	19
5.1.2	Daisy Creek Point Source Discharge Water Quality	22
5.2	EXISTING WATER QUALITY IN FISHER CREEK DRAINAGE	25
5.2.1	Fisher Creek Water Quality	25
5.2.2	Fisher Creek Point Source Discharge Water Quality	28
5.3	EXISTING WATER QUALITY IN MILLER CREEK DRAINAGE	31
5.3.1	Miller Creek Water Quality.....	31
5.3.2	Point Source Discharge Water Quality	31
5.4	PRE-MINING WATER QUALITY	33
5.4.1	Qualitative Evidence of Pre-Mining Acidic, Metal-Rich Surface Water Quality	33
5.4.2	Estimation of Pre-Mining Water Quality from Empirical Ferricrete-Based Equations	36
5.4.3	Estimation of Pre-Mining Water Quality Based on Existing Water Quality in Non-Mined Areas.....	41
5.4.4	Comparison of Ferricrete-Based Estimations and Current Water Quality.....	47
5.4.5	Potential for Additional Water Quality Improvement Through Further Reclamation	48

6.0 CONCLUSIONS..... 50

6.1 COMPARISON OF POINT SOURCES IN DAISY CREEK WITH NATURAL WATER QUALITY 50

6.2 COMPARISON OF POINT SOURCES IN FISHER CREEK WITH NATURAL WATER QUALITY 51

6.3 COMPARISON OF POINT SOURCES IN MILLER CREEK WITH NATURAL WATER QUALITY 52

6.4 SUMMARY OF CONCLUSIONS 53

7.0 REFERENCES..... 54

LIST OF TABLES

Table 3-1 Adit Discharges in the New World Mining District..... 10

Table 5-1 Selected Water Quality Data for Daisy Creek Monitoring Station DC-2 21

Table 5-2 Selected Water Quality Data for Daisy Creek Monitoring Station DC-5 21

Table 5-3 Selected Water Quality Data for McLaren Adit Discharge 27

Table 5-4 Selected Water Quality Data for McLaren Pit Subsurface Drains 27

Table 5-5 Selected Water Quality Data for Fisher Creek Monitoring Station SW-3..... 29

Table 5-6 Selected Water Quality Data for Fisher Creek Monitoring Station SW-4..... 29

Table 5-7 Selected Water Quality Data for Fisher Creek Monitoring Station CFY-2 30

Table 5-8 Selected Water Quality Data for Fisher Creek Point Sources 30

Table 5-9 Selected Water Quality Data for Miller Creek Monitoring Station SW-2 32

Table 5-10 Selected Water Quality Data for Miller Creek Monitoring Station SW-5 32

Table 5-11 Selected Water Quality Data for Miller Creek Point Sources..... 33

Table 5-12. Summary of Water Quality in Surface Water from Mineralized Areas. 44

Table 5-13. Summary of Groundwater Quality Wells Upgradient of Mining Disturbance in the Daisy Creek Drainage..... 45

Table 5-14. Summary of Groundwater Quality Wells Upgradient of Mining Disturbance in the Fisher Creek Drainage..... 46

Table 5-15 Calculated Pre-mining Water quality at DC-2 without loading from McLaren Pit drains or adit. 49

Table 5-16 Calculated Pre-mining Water quality in Fisher Creek without loading from adits. ... 49

LIST OF FIGURES

Figure 1. Project Vicinity Map 5

Figure 2. Surface Water Monitoring Stations 15

Figure 3. Average Changes to Water Quality at DC-2 After Completion of McLaren Pit Cap 20

Figure 4. Metal Loads Calculated for McLaren Pit Subsurface Drains at DC-2. 23

Figure 5. Average Changes to Water Quality at SW-3 After Glengarry Adit Closure 26

Figure 6. Map Showing Study Reaches and Locations of Ferricrete Study Sampling Sites in the New World Mining District (Nimick et al. (2009))..... 36

Figure 7. Downstream Profiles of pH and Copper Concentrations in Daisy Creek..... 38

Figure 8. Downstream Profiles of pH and Copper Concentrations in Fisher Creek..... 40

LIST OF APPENDICES

APPENDIX A Surface Water Monitoring Data

APPENDIX B Comparison of Pre- and Post Reclamation Surface Water Quality in Daisy and Fisher Creeks

1.0 INTRODUCTION

The USDA-Forest Service - Northern Region (Forest Service) is conducting remediation activities in the New World Mining District (District) under temporary water quality standards due to expire in 2014. The Forest Service wishes to demonstrate compliance with Montana's water quality standards at the completion of the project. It is clear that concentrations of some metals in Daisy and Fisher Creek as well as discharging point sources currently exceed numeric standards listed in Circular DEQ-7 (MDEQ, 2008). However, it is possible that conditions in segments of Daisy and Fisher Creeks are reflective of natural conditions that existed prior to historic mining activity in the District. This has implications for additional reclamation work to stem or treat flow from mining related point sources discharging water in the District. Specifically, Montana's regulations (75-5-306 MCA) do not require the treatment of water if it is of equal or better quality compared to natural condition of receiving streams, even if natural conditions are themselves of poor quality.

This report has been prepared to evaluate whether compliance with water quality standards is currently being met in the District.

1.1 REPORT ORGANIZATION

This report is organized in seven sections and two appendices that include:

Section 1.0 - Introduction – describes the report organization and purpose, and presents brief summaries of the project background and location.

Section 2.0 – Montana Water Quality Regulations – presents State of Montana water quality regulations that are relevant with respect to the demonstration of District compliance.

Section 3.0 – Reclamation Activities – describes completed reclamation activities in the District that have the potential to influence surface water quality.

Section 4.0 – Additional 2010 Reclamation and Closure Work - describes pending reclamation/closure activities in the District that have the potential to influence surface water quality.

Section 5.0 – Surface Water Quality in the District – describes existing water quality in the District including existing point source discharges. Estimations of pre-mining water quality in District Streams are also presented.

Section 6.0 - Conclusions – presents conclusions regarding compliance of District point source discharges with Montana water quality standards.

Section 7.0 – References – lists the references cited in the document.

Appendices -
Appendix A – Surface Water Monitoring Data
Appendix B – Comparison of Pre- and Post Reclamation Surface Water Quality in Daisy and Fisher Creeks

1.2 PROJECT BACKGROUND

On August 12, 1996, the United States signed a Settlement Agreement (Agreement) with Crown Butte Mines, Inc. (CBMI) to purchase CBMI's interest in their New World Mining District (District) holdings. This transfer of property to the U.S. government effectively ended CBMI's proposed mine development plans and provided \$22.5 million to cleanup historic mining impacts in the District. In June 1998, all interested parties and CBMI signed a Consent Decree (Decree) (US Department of Justice 1998). The Decree, approved by the United States District Court, finalized the terms of the Agreement and made available the funds that are being used for mine cleanup. As specified in the Decree, monies available for cleanup will be spent first on District Property, which, as defined, includes all property or interests in property that CBMI relinquished to the United States. Under the Decree, once District Property has been cleaned up to the satisfaction of the United States, the United States would issue a "Notice of District Property Work Completion" verifying that the work they conducted had addressed "(i) releases or threats of release of hazardous substances, pollutants or contaminants that are related to District Property; (ii) natural resources lost as a result of, injured or destroyed by, releases or threats of release of hazardous substances, pollutants or contaminants that are related to the District Property; and, (iii) conditions affecting water quality and natural resources in Miller, Fisher and Daisy Creeks and their tributaries, from the headwaters of each creek to the confluence of each with , respectively Soda Butte Creek, Lady of the Lake Creek, and the Stillwater River (US Department of Justice, 1998, pages 12 and 13). And if in addition to the "Notice of District Property Work Completion", the State of Montana issues a "Certificate of Completion", certifying "that the portions of the completed work relating to lands administered by USDA satisfy the applicable substantive requirements under CECRA" (Comprehensive Environmental Cleanup Responsibility Act) (US Department of Justice, 1998, page 2), then impacts from other sources on non-District Properties within the District may be addressed with any remaining funds.

The USDA Forest Service, as the lead agency responsible for implementing the cleanup, has assembled a management team and has published objectives to guide reclamation and restoration of the historic mining impacts in the District. Under their Superfund authority, the USDA Forest Service continues to execute the response and restoration project by following guidance provided by the Environmental Protection Agency (EPA) for non-time-critical removal actions (EPA, 1993). Non-time-critical removal actions are defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) as actions that are implemented by the lead agency to respond to "the cleanup or removal of released hazardous substances from the environment ... as may be necessary to prevent, minimize, or mitigate damage to the public health or welfare or to the environment..." (EPA, 1993).

In 1995, EPA began a site investigation after the initial announcement of the property transfer from CBMI. The EPA investigation included, among other things, the installation of monitoring wells, surface water sampling, groundwater monitoring, and completion of a groundwater tracer study. In October 1998, the USDA Forest Service assisted CBMI in completing and submitting a Support Document and Implementation Plan in conjunction with the CBMI's petition for temporary modification of water quality standards. Under the Decree and Agreement, CBMI is required to submit petitions regarding temporary standards if requested by the USDA Forest Service. The Support Document and Implementation Plan (Stanley and Maxim, 1998) was submitted to the State of Montana Board of Environmental Review (Board) on January 22, 1999. The petition for the adoption of temporary standards for Fisher Creek, Daisy Creek, and a portion of the upper Stillwater River was accepted by the Board and noticed for public hearing.

The proposed rule was modified to reflect public comment and the temporary water quality standards were approved and adopted by the Board on June 4, 1999. The temporary water quality standards (ARM 17.30.630) were set to reflect water quality conditions that existed at the time of the project initiation. The goal of the temporary standards is to allow the project to proceed so that water quality in Fisher Creek, Daisy Creek, and the Stillwater River can be improved to the point where these streams meet beneficial uses for waters classified B-1 under classification standards established by the State of Montana.

The temporary standards can be changed as improvements in water quality are realized. The standards are reviewed every three years to determine if changes are desirable. The first review occurred in July 2002 when the Board held a hearing on July 26, 2002, to review the long-term water quality data collected since the standards became effective in June 1999 and to compare project progress with that presented in the implementation plan (Maxim, 2002). As a result of this review, the Board took no action to modify the temporary standards as originally defined in June 1999. A second tri-annual review hearing on temporary water quality standards was held by the Board on June 3, 2005, with the same result. A third tri-annual review was held before the Board on May 30, 2008, and again resulted in no adjustment to the existing temporary water quality standards.

Currently, the USDA-Forest Service conducts remediation under these adopted temporary water quality standards. The temporary water quality standards are due to expire in 2014.

1.3 PROJECT LOCATION

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

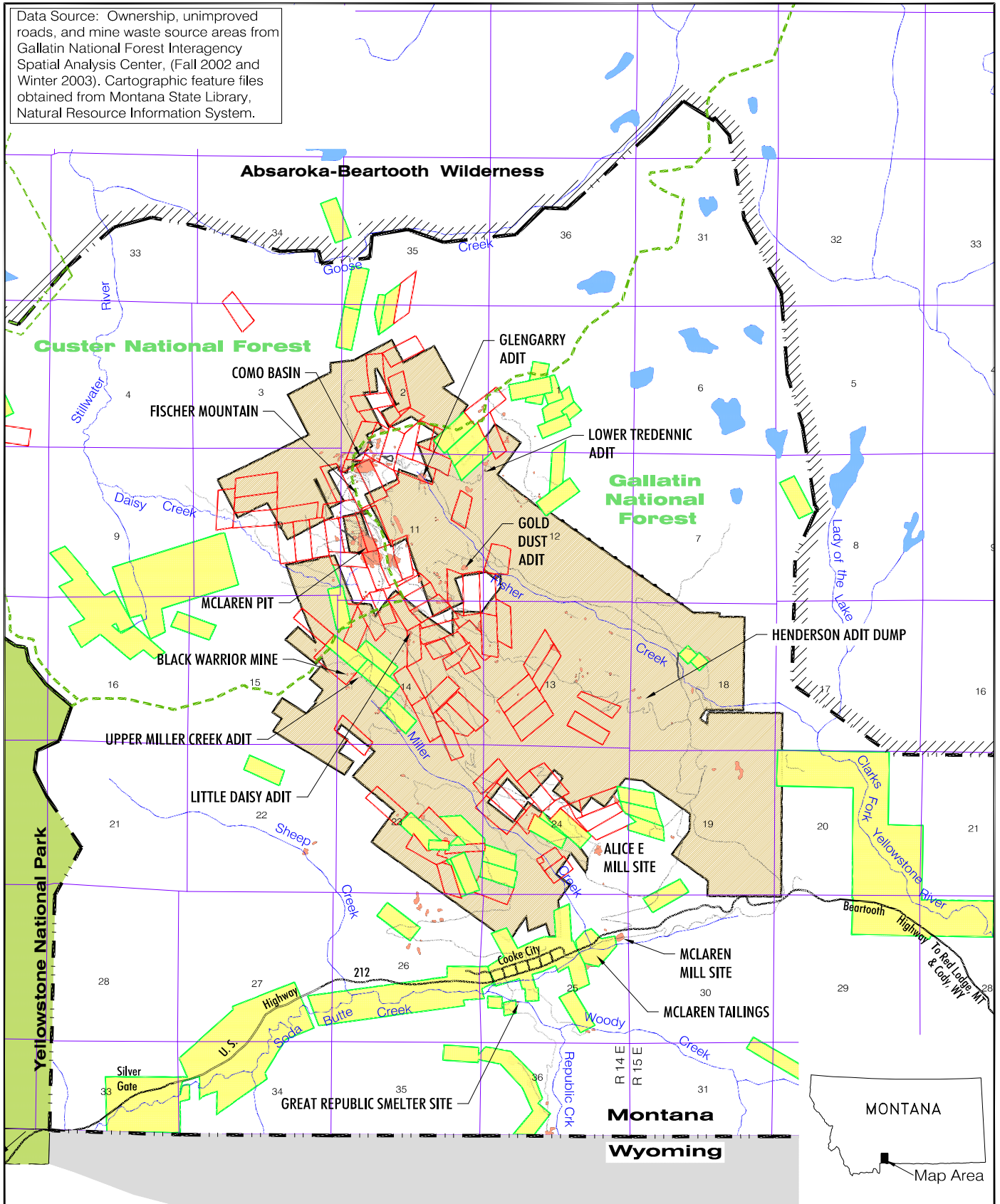
The communities of Cooke City and Silver Gate, Montana, are the only population centers near the District. The neighboring communities of Mammoth, Wyoming, and Gardiner, Montana, are located about 80 kilometers (50 miles) to the west. Red Lodge, Montana, is located about 105 kilometers (65 miles) to the northeast via the Beartooth Highway, and Cody, Wyoming, is located 95 kilometers (60 miles) to the southeast.

The District is located at an elevation that ranges from 2,400 meters (7,900 feet) to over 3,170 meters (10,400 feet) above sea level. The site is snow-covered for much of the year and only one route of travel is open on a year-round basis -- the highway between Mammoth and Cooke City. The Sunlight Basin road permits access to the District from northwestern Wyoming during the spring, summer, and fall but only allows access to within a few miles of the District in winter. The Beartooth Highway allows access to the District from the northeast but is closed during winter.

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. Large mining disturbances on non-District Property include the McLaren Tailings and the reclaimed McLaren Mill-Site, which cover an additional 6.9 hectares (17 acres) immediately east of the town of Cooke City.

The topography of the District is mountainous with dominant glacial erosional and depositional features, and is situated at the headwaters of three river systems that all flow into the Yellowstone River. The three tributaries are the Clarks Fork of the Yellowstone, the Stillwater, and the Lamar. The Lamar River flows through Yellowstone Park. The major tributary streams in the District include Daisy, Miller, Fisher, Goose, Sheep, Lady of the Lake, Republic, Woody, and Soda Butte creeks.

Data Source: Ownership, unimproved roads, and mine waste source areas from Gallatin National Forest Interagency Spatial Analysis Center, (Fall 2002 and Winter 2003). Cartographic feature files obtained from Montana State Library, Natural Resource Information System.



0 Meters 1500



-  New World Mining District Boundary
-  District Property Boundary
-  Wilderness Boundary
-  Unimproved Road
-  National Forest Boundary
-  Mine Waste Source Area
-  District Property (Patented Claims)
-  District Property (Unpatented Claims)
-  Private Property



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

2.0 MONTANA WATER QUALITY STANDARDS

Circular DEQ-7 (MDEQ, 2008) contains numeric water quality standards for Montana's surface and ground waters. The standards were developed in compliance with Section 75-5-301, MCA of the Montana Water Quality Act and Section 303(c) of the Federal Clean Water Act (CWA). Generally, surface waters are not in compliance with Montana standards when their metal concentrations or other constituents exceed those listed in DEQ-7. However, natural conditions do not violate Montana's standards (even if metal concentrations exceed standards listed in DEQ-7) as described in section 75-5-306 MCA;

(1) It is not necessary that wastes be treated to a purer condition than the natural condition of the receiving stream as long as the minimum treatment requirements established under this chapter are met.

(2) "Natural" refers to conditions or material present from runoff or percolation over which humans have no control or from developed land where all reasonable land, soil, and water conservation practices have been applied.

This report present empirical data and methodologies used at the New World project site for estimating or determining with varying degrees of accuracy, likely pre-mining water quality. The pre-mining period is a time during which humans had no control or impact on the District's water quality. The report also presents summaries of reclamation and restoration activities conducted on the site to date, as well as proposed future work, as a means of reviewing land, soil, water conservation and BMPs practices used at the site.

This report has also been prepared to evaluate whether compliance with water quality standards is currently being met in the District. Specifically with respect to Montana's regulations (75-5-306 MCA) it may be that water within the district does not require additional treatment if it is of equal or better quality compared to natural condition of receiving streams, even if natural conditions are themselves of poor quality.

The Montana Department of Environmental Quality may have at least two regulatory approaches to recognition of the pre-mining water quality as a means of determining whether water quality standards are being met within the District. These include:

1. The adoption of site specific standards for various stream segments that recognize natural background or pre-mining water quality within the District, or
2. Adjustment of the Total Maximum Daily Load's (TMDL) allowable for water quality in stream segments during one of the five-year review period cycles.

Where TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. These water quality standards are set by States, Territories, and Tribes. They identify the uses for each water body, for example, drinking water supply, contact recreation (swimming), and aquatic life support (fishing), and the scientific criteria to support that use. A TMDL is therefore, the sum of the allowable loads of a single pollutant from all contributing point and non-point sources. The calculation must include a margin of safety to ensure that the water body can be used for the purposes the State has designated. The calculation must also account for seasonal variation in water quality. The Clean Water Act, section 303, establishes the water quality standards and TMDL programs.

Both of these approaches assume that the State agrees with, and accepts that for developed land ".....that all reasonable land, soil and water conservation practices have been applied."

3.0 RECLAMATION ACTIVITIES

Previous reclamation in the District generally consisted of three different categories of activities. The first was removal and consolidation of numerous waste rock dumps scattered through the District in Daisy, Fisher, and Miller Creeks. This work focused on eliminating impacts to surface water due to contaminated sediment transport and mobilization of metals and acidity from waste piles. In addition to the reclamation of mine waste piles in-situ, this work also included construction of an engineered repository with a geotextile bottom liner and capping system for waste storage.

The second category of reclamation included large-scale, area-wide reclamation activities undertaken in the McLaren Pit and Como Basin areas designed to minimize the infiltration of precipitation and snowmelt through mineralized materials. In the case of the McLaren Pit, outlying mining wastes were consolidated into an historically operated, waste backfilled open-pit mine. Following this, a composite geotextile/soil cover was constructed to minimize infiltration of precipitation and snowmelt through the mine waste backfill and underlying ore deposit. The Como Basin area has an un-mined massive sulfide ore deposit exposed at the surface. In this case, an engineered composite geotextile/soil cover system was installed in the Como Basin area to prevent contact between precipitation / snowmelt and the naturally occurring yet acidic and metal-laden soils and underlying consolidated mineralized rock present in the basin located at the headwaters of Fisher Creek.

The last category of reclamation included actions to stem or infiltrate the flow of contaminated water from discharging adits. The goal of this work was to eliminate impacts to surface water from metal-laden, acidic mine drainage. This type of work included a major action at the Glengarry mine to stem the flow of contaminated adit discharge to the Fisher Creek drainage, and the regrading or removal of mine wastes with adit drainage collected and diverted into buried infiltration basins at other adit sites.

3.1 WASTE REMOVAL AND CONSOLIDATION

Reclamation activities began in the District in 2001 with construction of the Selective Source Repository and consolidation of mine wastes into the repository. This initial cleanup project involved removing approximately 32,000 cubic yards of mine waste rock and mill tailings from nine (9) mine waste areas located in the Fisher Creek drainage, disposing of these wastes in the repository, and revegetation of about 4.6 acres of the former waste areas. These waste sites represented about 9% of the total acreage and about 8% of the total volume of waste on District Property. An additional 5,700 cubic yards of waste rock from the Gold Dust Adit portal area in Fisher Creek was removed and placed into the repository in 2005, although a small portion of the waste was left for historic interpretation purposes.

In 2002, a similar clean-up action was conducted in the Daisy Creek drainage where approximately 70,000 cubic yards of mine wastes located adjacent to and down-gradient of the McLaren Pit were relocated, consolidated and placed into the open pit as backfill. Follow-on reclamation activities in the McLaren Pit area are discussed further in the Area Wide Reclamation and Closure Section (**3.3.1**) below .

Most waste rock dumps in the Miller Creek drainage are located above the valley floor, well away from surface water, and have very little potential to impact surface water quality. Impacts

typically result from transported sediment mobilized during times of considerable runoff that accompanies peak springtime snow melt. Many of these waste dumps were not treated during reclamation activities. Two other waste rock piles, the Black Warrior and Little Daisy, contained approximately 1,700 cubic yards or about 46% of the waste within the Miller Creek drainage, and 5% of the total wastes on District Property. Due to the large size of these two dumps, and the location of the Black Warrior dump in proximity to surface water, these wastes were removed to the Selective Source Repository in 2005. Four smaller waste piles were in direct contact with surface water Miller Creek. These piles were pulled back from the creek, regraded, amended in place with lime, and revegetated (USDA-FS, 2006).

3.2 ADIT DISCHARGES

Adits located in the three District drainage basins can be organized into three groups based on whether water (if any) discharges perennially or seasonally and whether the discharge exceeds water quality standards (**Table 3-1**). Most adits in the District either do not discharge water (or have only small seasonal discharges) or have water quality that meets standards, and therefore, do not impact water quality in adjacent creeks or streams. Where necessary, these adits have been treated using physical closure methods to restrict entry by humans and wildlife. In some cases infiltration basins have been constructed to expedite the infiltration of discharge into the ground so that no direct contact between adit discharge and surface water occurs.

Prior to reclamation, 11 adits in the District discharged poor quality water that did not meet water quality standards (**Table 3-1**). Two of these adits (Sheep Mountain #1 and Upper Miller Creek Dump Adits) are not located on District property while a third (Henderson Mountain Adit) is located on a hillside where the adit discharge infiltrates to groundwater distal from surface water streams. The McLaren Adit currently discharges poor quality water in proximity to surface water (i.e. Daisy Creek) and has not been reclaimed at the time of this writing. Flow from the remaining seven adits with poor quality discharges have been reclaimed or addressed as described in the following sections.

3.2.1 Glengarry Adit

The Glengarry Adit, located at an elevation of approximately 9,320 feet at the base of the eastern flank of Fisher Mountain (**Figure 1**), was actively being driven in 1925 (Lovering, 1929). The adit was driven 2,300 feet towards Lulu Pass in an attempt to intercept mineralization beneath the Spalding Tunnels located on the south-facing flank of Scotch Bonnet Mountain. In the early 1930s, two nearly vertical raises were constructed from a new 700-foot long heading driven to the southwest from a “Y” intersection 1900-feet in from the portal in the Glengarry adit. One of the raises extends 130 meters (425 feet) upward and surfaced in the Como Basin at the foot of the north flank of Fisher Mountain. The top of this raise passes through a 50-foot thick massive sulfide ore deposit hosted in the Meagher Limestone formation. Outflow from the Glengarry Mine was a major source of contaminated water and metal loading to surface water in the Fisher Creek drainage.

A grout/plugging project to limit the inflow to and discharge from the Glengarry Adit was completed in 2005 as part of the Como Basin/Glengarry Adit/Fisher Creek Response Action (Maxim, 2002b). The Como Basin raise collar and a major fault system that were directing water into the underground mine were grouted in 2003. In 2004, a watertight raise plug and two adit plugs were constructed and portions of the raise and adit were backfilled for ground support around the plugs. Two additional plugs and another cement backfilled portion of the adit were

constructed in 2005. The simple (non-watertight) portal closure plug was constructed in 2005 and additional maintenance work was done on the portal plug in 2009. This action decreased flow from the Glengarry Adit from as much as 38 gallons per minute (gpm) prior to grouting and plugging to flows less than 3 gpm beginning in October, 2005 (Table A-4 in **Appendix A**). Flow has recently decreased to an immeasurable seep during the June, 2008 monitoring event. Overall flow from the Glengarry adit (and adit discharge loading to Fisher Creek) has been reduced by almost 98%. As a result of the success of the closure for the Glengarry Adit and Como Raise, no further response actions are planned for this adit.

**Table 3-1
Adit Discharges in the New World Mining District**

Adit Station #	Site Name	Drainage	Status	Flow Type ¹	Flow (gpm)		Last pH (s.u.)	Water Quality ²
					Range	Recent		
F-8A	Glengarry Adit	Fisher	Reclaimed 2005	Perenn	2.9-38 ³	0.0	3.4	Al Cu Fe Mn*
F-8B	Glengarry Mill Site Adit	Fisher	Reclaimed 2008	Perenn	1.1-26.9 ⁴	3.1 ⁴	3.4	Al Cu Fe Mn*
F-28	Gold Dust Adit	Fisher	Reclaimed 2005; Flowing	Perenn	1.3-250	4.4	6.9	Mn*
FCSI-96-5	Lower Tredennic Dump 1	Fisher	Reclaimed 2001	Perenn	0.6-5	1.4	5.9	Mn*
FCSI-99-1	Sheep Mountain #1 (NDP)	Fisher	Flowing	Perenn	0.003-10	0.003	7.3	Pb
D-18	McLaren Adit	Daisy	Flowing	Perenn	1.8-29.6	5.9	5.9	Cu Fe Mn*
M-8	Black Warrior Adit	Miller	Reclaimed 2005 and 2008; Flowing	Perenn	0.1-10	0.269	7.1	Cd
MCSI-96-3	Upper Miller Creek Dump (NDP)	Miller	Flowing	Perenn	0.2-2	0.269	5.9	Cd
M-1	Little Daisy Adit	Miller	Reclaimed 2005; Flowing	Perenn	0.5-220	8.9	6.8	Cd Fe Mn* Zn
M-25	Henderson Mt Adit	Miller	Flowing	Perenn	0-25	0.045	7.0	Al Cu Pb
AE-17	Henderson Mountain Dump 7	Fisher	Reclaimed 2004	Season	0-5	Dry	6.9	Al Cu Fe, Mn*
FCSI-99-73	Henderson Mountain Dump 13	Fisher	Flowing	Perenn	5-15	15	6.6	None
DCSI-96-3-1	Daisy Pass Dump 1	Daisy	Flowing	Perenn	<0.1-2	1.0	6.8	None
SBSI-99-74	Woody Ck. Mine Dump 1 (NDP)	Woody	Flowing	Perenn	3.1-10	4.0	6.9	None
SBSI-99-85	Alice E. Millsite seep (NDP)	Soda Butte	Flowing	Perenn	0-10.0	4.0	5.4	None
SBSI-99-87	Soda Butte Dump 8 (NDP)	Soda Butte	Flowing	Perenn	3-100	3	6.9	None
FCSI-96-15-1	Upper Tredennic Dump 1	Fisher	Dry; reclaimed 2001	Season	0-1.0	Dry	3.3	--
FCSI-96-15-2	Upper Tredennic Dump 2	Fisher	Dry; reclaimed 2001	Season	0-0.5	Dry	2.9	--
FCSI-96-6	Middle Tredennic Dump 1	Fisher	Dry; reclaimed 2001	Season	0-10	Dry	4.8	--
F-2	Lower Spalding Dump	Fisher	Dry; reclaimed 2001	Season	0-0.9	Dry	2.6	--
FCSI-96-7	Middle Spalding	Fisher	Dry; reclaimed 2001	Season	--	Dry	--	--
FCSI-99-71	Henderson Mountain Dump 10	Fisher	Dry; reclaimed 2004	Season	0-12	Dry	7.5	--
F-8	Glengarry Middle Adit	Fisher	Dry	Season	0-1.4	Dry	3.5	--
DCSI-99-102	Near McLaren Pit	Daisy	Dry	Season	0	Dry	--	--
DCSI-96-6	West of Como Dump 1	Daisy	Dry	Season	0	Dry	--	--
M-10	Upper Little Daisy Adit	Miller	Dry	Season	0-5.8	--	7.84	--
AE-12	Reeb #1	Soda Butte	Dry	Season	0	Dry	3.3	--
SBSI-99-95	Soda Butte Dump 1 (ND))	Soda Butte	Dry	Season	0 0.1	Dry	7.4	-

Notes:

- ¹ Perenn = perennial flow; Season = seasonal flow
- ² Exceeded chronic standard in most recent sampling event (hardness = 100 milligrams/liter where applicable); Al-aluminum; Cd-cadmium; Cu-copper; Fe-iron; Mn-manganese; Pb-lead; Zn-zinc; * indicates exceeds human health guideline for Mn (manganese has no aquatic standard)
- ³ Data shown for Glengarry Adit are prior to adit closure and exclude data collected during closure activities.
- ⁴ Data shown for Glengarry Mill Site Adit are from August 2008, prior to adit closure.

NDP = non District Property; gpm = gallons per minute; s.u. = standard units

3.2.2 Glengarry Mill Site Adit

The Glengarry Mill Site Adit, located immediately south of the main Glengarry Adit, consisted of a single horizontal adit extending approximately 40 feet from its portal. This adit appeared to have been driven to serve as an extended storage area, possibly for explosives. The adit itself was in good condition and had a gate constructed of steel bars, which was buried by about two feet of ferrihydroxide mud. The ferrihydroxide mud extended to the back of the workings and was mixed with debris along the adit floor. Seepage from the Glengarry Mill Site Adit typically flowed at low rates, ranging from 0.8 to 5.0 gpm and averaging 4 gpm. However, a maximum flow of 26.9 gpm was measured in September 1989. Water from the adit flowed over an extensive ferricrete bench outside of the portal, down across the mill site, and infiltrated into colluvial materials below the mill site approximately 150 feet from Fisher Creek. This shallow groundwater, which had low pH and elevated iron and manganese concentrations, likely surfaced in Fisher Creek.

The adit was reclaimed in summer of 2008. Reclamation of the Glengarry Mill Site Adit consisted of reopening the adit and removing mud, rock fall debris, and ferricrete deposits from the adit sill. The fracture-controlled source(s) of water entering the tunnel were located and three grout rings were installed from within the tunnel to stem flow from fractures. A portal plug with an infiltration basin was constructed and the portal area was regraded and revegetated. Flow from the adit was reduced from 8.1 gallons per minute immediately prior the construction period to 2.3 gallons per minute at the end of the one month construction period. This represents a 72% reduction in flow and load to groundwater and ultimately to the receiving surface waters of Fisher Creek. No additional work is planned for the Glengarry Mill Site Adit.

3.2.3 Gold Dust Adit

The Gold Dust Adit is located on the southwest side of the Fisher Creek Valley, at an elevation of 9,220 feet on the east flank of Henderson Mountain (**Figure 1**). The adit was driven between 1920 and 1925 and drifts to the southwest for about 2,300 feet. The adit is driven in Precambrian granite for the first 900 feet, and then crosses into monzonite porphyry intrusion breccia of the Homestake stock. CBMI executed an underground drilling program from the Gold Dust Adit to delineate mineralization in the middle and lower portion of the breccia pipe by drilling angle holes from four drill stations. Approximately 23,331 feet of drilling were completed in 23 drill holes. Drill holes that were making water when drilled were closed with mechanical packers. The portal was closed with a series of timber sets, a locking steel gate, and a wooden door.

The mine discharged water prior to being rehabilitated by CBMI, with an average discharge of about 13 gpm following exploration work. Since the time of drilling, at least two of the packers had failed and these holes were producing a combined flow of about 8 gpm when last measured in 2004 (Maxim, 2005a). Two or three other holes were also making small amounts of water (combined flow of about 3 gpm). During August and September of 2005, the USDA-FS contracted with Denver Grouting to reenter the Gold Dust Adit, remove packers from drill holes, and grout and plug all drill holes producing water. After successful completion of this work, flow from the Gold Dust Adit portal was reduced to an average flow of 9.1 gpm. This decrease in flow represents a 41% reduction from the average flow prior to closure and a commensurate reduction in loading from the discharge to tributaries of Fisher Creek.

In 2006, the Forest Service completed surface reclamation and restoration of the Gold Dust portal area. The restoration work was undertaken to preserve various aspects of the site for cultural resource purposes. Activities at the portal included: backfilling of the portal with coarse

rock for about 15-20 feet, removal of approximately 7,000 cubic yards of high-sulfide-bearing waste from the portal pad waste rock dump to the selective source repository, construction of portal timber façade, and construction of a rock armored diversion ditch for adit discharge to the south of the remaining low-sulfide waste rock pile at the portal.

3.2.4 Lower Tredennic Dump 1 Adit

The Tredennic Mines were operated by the Tredennic Development Company on claims located on the southeast flank of Scotch Bonnet Mountain. The Lower Tredennic Dump # 1 Adit (**Figure 1**) was collared at an elevation of 9,480 feet with 810 feet of workings driven as a cross-cut in un-mineralized or weakly mineralized rock. A number of short adits lying at higher elevations on Scotch Bonnet Mountain were also affiliated with the Tredennic Mines. No significant production has occurred from any of the Tredennic workings and all but the Lower Tredennic Dump # 1 Adit are normally dry or produce only small occasional seepage flows. Even historically, the seepage from the Lower Tredennic Dump # 1 Adit infiltrated into colluvial / slope-wash surficial materials before reaching the nearest surface water in Polar Star Creek.

A mine drainage control system was constructed in front of the collapsed adit on the regraded and revegetated waste rock dump surface to allow capture and controlled discharge of the perennial flow from the adit (seasonal variation between 0.6 to 5 gpm). This system consists of a small fabric/soil covered gravel infiltration basin placed near the mouth of the collapsed adit and a gravel-lined drainage channel. Additional earth work at the adit (i.e. placement of rock in and along the portal drainage channel) was completed in summer 2009 to ensure that water discharging from the portal is completely directed to the infiltration basin at the site. No additional work is planned for the Tredennic mine areas.

3.2.5 Black Warrior Adit

The Black Warrior Mine lies near the headwaters of Miller Creek (**Figure 1**). It consists of an underground adit about 425 feet in length and an 80-foot tall raise to surface. The adit was driven to the north-northeast along a high angle fracture or fault that is likely a splay of the Crown Butte Fault zone. The collar of the raise to surface occurs at an elevation of about 9,490 feet and lies just to the southeast of Bull-of-the-Woods Pass. The raise was closed by CBMI for safety reasons by backfilling with adjacent dolomitic rock. A soil cover was placed over the disturbed portion of the raise site and the site was seeded and fertilized.

Typically small rates of water flow, ranging from about 0.09 gpm to 5.9 gpm have been measured at the adit portal. Flows up to 10 gpm have occasionally been measured. Water from the adit seep flowed around the east side of the waste rock dump and from there flowed on the surface for about 100 feet before joining a small tributary of Miller Creek. Waste rock was removed from the site in 2005 by the USDA-FS as part of the Miller Creek Removal Action, and a mine drainage control system, consisting of a gravel basin placed near the mouth of the collapsed adit was constructed in 2005. In 2008, a small rock/soil collection apron was constructed at the portal site to direct remaining adit discharge to the previously constructed infiltration basin. Willow cuttings were also planted along the old adit discharge and buried infiltration basin channels during the 2008 field season. No additional work is planned for the Black Warrior adit area.

3.2.6 Little Daisy Adit

The Little Daisy Adit (**Figure 1**), is collared at an elevation of about 9,840 feet. Its trend is east-northeast and the workings are approximately 1,400 feet in length. Only about 1,200 feet of these workings were accessible in the early 1920's (Lovering, 1929). This adit is connected by a raise about 200 feet in height to the Homestake Adit driven from the east flank of Henderson Mountain. Drilling by CBMI between 1990 and 1993 identified ore grade mineralization in the Homestake Breccia Pipe (a phreatic explosion vent to the surface). The Daisy Adit penetrates Henderson Mountain about 60 feet above the elevation of ore-grade mineralization of the Homestake Breccia Pipe.

The Little Daisy Adit portal was historically partially backfilled and access blocked with mine wastes, although seepage continues to discharge from the adit through the backfill. In the early 1990s the portal was accessed through the upper open, un-backfilled portion, and CBMI pumped water from behind the portal berm for core drilling. This information suggests that there may be a considerable amount of water backed-up into the workings behind the portal backfill. Water from the adit discharged across the Henderson Mountain road and infiltrated into mine waste and talus immediately below the road prior to 2005.

Waste rock was removed from the portal site by the USDA-FS in 2005. The dump area was reclaimed and a mine drainage control system, which consists of a small gravel infiltration basin, was constructed near the mouth of the collapsed adit on the opposite side of the access road along Henderson Mountain. Adit discharge currently comes to surface along the steep side-hill below the adit, where it flows on the surface to a point in the break in slope where it enters an infiltration basin. At the point of infiltration, the discharge is some 2000 feet from the nearest surface water in Miller Creek and there are no measurable impacts to surface water from the infiltrated water along this reach of the creek. No additional work is currently planned for the Little Daisy Adit area.

3.2.7 Henderson Mountain Dump 7 Adit

Two adits are located immediately adjacent to one another, at the southeast terminus of Henderson Mountain, at an elevation of approximately 9,120 feet (Henderson Mountain Dump 7 adit, **Figure 1**). Both of these adits were developed in stockwork fracture zones in the Cambrian Flathead Sandstone. The only obvious sulfide mineral present is pyrite, although abundant iron-oxide occurs on fractured rock surfaces. Based on the size of the waste rock dumps, neither adit extended more than about 60 feet (and perhaps considerably less) into the side of Henderson Mountain. Numerous other similar small prospect pits occur throughout the immediate area. These adits were closed in August 2004 as part of the Fisher and Miller Creek Surface Controls Response Action. One of the adits was dry but the second adit, Henderson Mountain Dump # 7, discharged less than 1 gpm of seepage. A mine drainage control system consisting of a small gravel infiltration basin placed at the mouth of the adit was constructed at this site as part of the response action. Infiltrated drainage from the adit likely flows in groundwater over a lengthy mixing zone prior to discharging as base-flow into a tributary to Fisher Creek approximately 1500 feet away. There are no measurable impacts to down gradient surface water. No additional work is currently planned for the Henderson Mountain Dump Adit area.

3.3 AREA-WIDE RECLAMATION AND CLOSURES

3.3.1 McLaren Pit Closure and McLaren Subsurface Drains

Prior to reclamation, the McLaren Pit (**Figure 1**) was the largest mining related disturbance in the District and comprised about 67% of the total waste present on District Property. This historically mined open-pit is located on Daisy Creek, a headwaters tributary of the Stillwater River, and it was one of the major contributors to surface water quality degradation in this drainage.

Planning and preparation for the McLaren Pit Response Action began in 1999. A considerable amount of environmental and engineering data was collected during the 2000 field season. The USGS, working under an arrangement with the Forest Service, conducted an ionic tracer study of metals loading in Daisy Creek in 2000, and the Forest Service's primary contractor, Maxim Technologies, collected data in the McLaren Pit that would support the preparation of an EE/CA. Hydrologic and metals loading models were completed with these data, indicating that the McLaren Pit contributed from 20% to 50% of the metals load in Daisy Creek. A draft of the McLaren Pit Response Action EE/CA was prepared and released to the public in May 2001, the document was finalized in December and an Action Memorandum written in January of 2002.

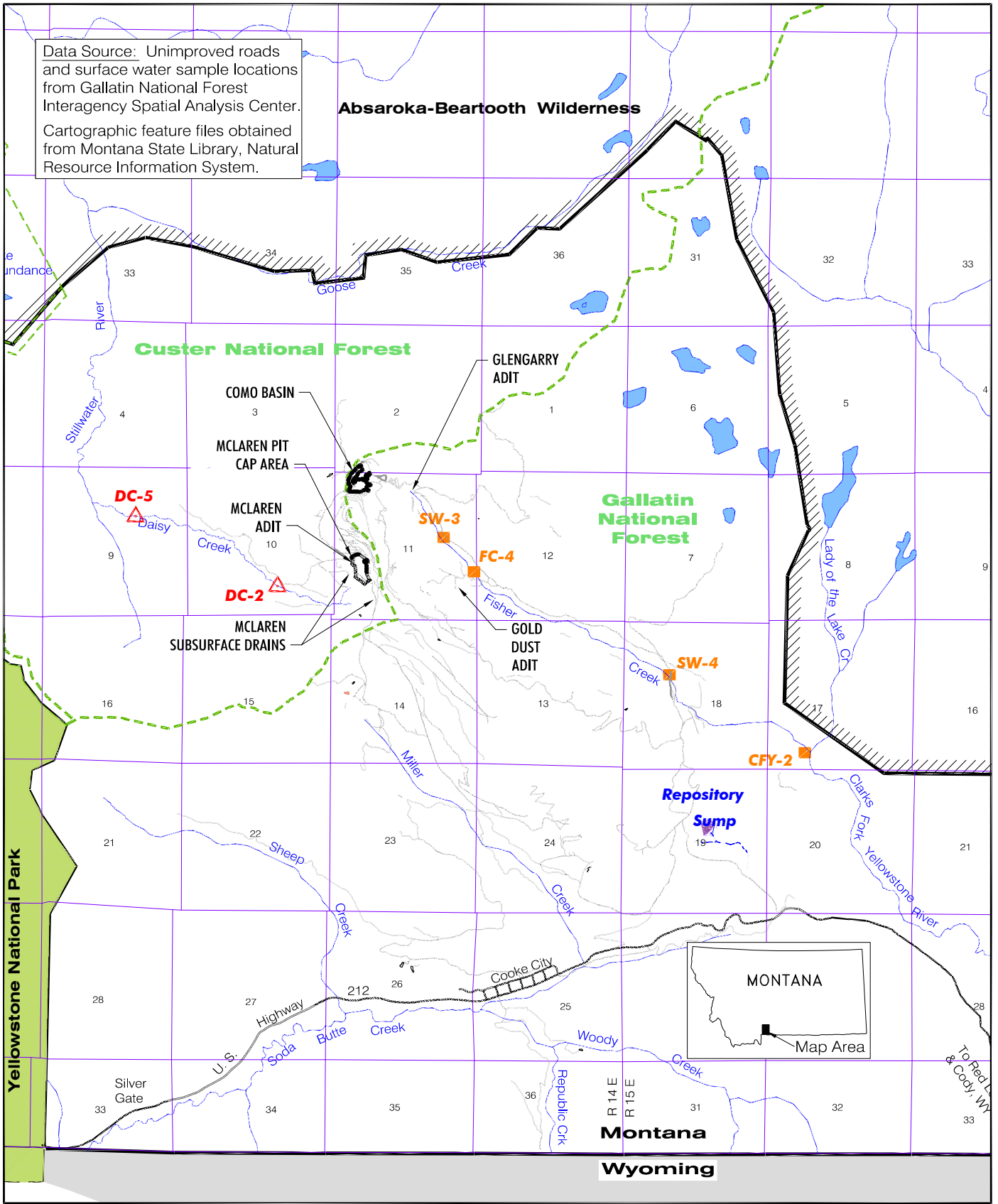
An engineering design and construction package for the McLaren Pit response action was completed in March 2002. The construction project was initiated in 2002, with construction of the multi-layered cover completed by October 2003. Cleanup work at this site involved consolidating approximately 70,000 cubic yards of outlying waste rock into the waste backfilled pit, re-contouring the wastes, compacting the waste surface, and constructing an impermeable composite geomembrane, drainage layer and soil cover over the consolidated waste rock and the disturbance area of the pit. The 11-acre capping system was reclaimed by incorporating compost into the soil cover, adding fertilizer, seeding with native grasses, and covering the entire site with erosion control blanket. Finally, surface run-on and run-off channels were constructed to convey water around and off of the capped wastes.

Monitoring of Daisy Creek surface water station DC-2 (**Figure 2**) (the first station on Daisy Creek down gradient of the McLaren Pit) during 2008 indicated a continued improvement in water quality since emplacement of the McLaren Pit cap in October 2003. With the cap in place, there is a greater contribution of uncontaminated water during the Spring snowmelt period in upper Daisy Creek. Also, infiltration of snowmelt has been greatly reduced into metal and sulfide rich soil, waste materials, and bedrock of the McLaren Pit. In addition, this lack of infiltration and associated lower volume of recharge of groundwater in the McLaren Pit area results in lower stream flow of the tributaries to upper Daisy Creek during "low flow" periods (August to May) (Maxim 2005).

Surface water monitoring indicates that there has been an overall decrease of 62% in metal concentrations and 38% in metal loads (aluminum, cadmium, copper, iron, lead, manganese, and zinc) in high flows averaged since capping of the McLaren pit. There has been overall decrease of 10% in metal concentrations and 49% in metal loads in low flows averaged since capping. Average stream flow during low flow periods, after capping of the McLaren pit, was 64% lower than the average stream flow during low flow periods, before capping. This decline in stream flow has resulted in substantial decreases in metal loads during low flow periods. The average concentration of zinc increased slightly (about 5%) during the post-capping, low flow category. No additional work is planned for the McLaren Pit proper.

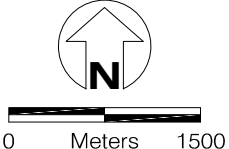
Data Source: Unimproved roads and surface water sample locations from Gallatin National Forest Interagency Spatial Analysis Center. Cartographic feature files obtained from Montana State Library, Natural Resource Information System.

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Surface Water Monitoring Stations on Daisy and Fisher Creeks New World Mining District Response and Restoration Project Cooke City Area, Montana

FIGURE 2



- District Boundary
- Unimproved Road
- National Forest Boundary
- Wilderness Boundary
- Fisher Creek Monitoring Stations
- Daisy Creek Monitoring Stations

During waste rock regrading operations in the McLaren Pit, several wet areas were encountered that were formed by groundwater seeps and springs from bedrock exposures within the pit, particularly near the base of the high wall. Other bedrock spring sources were found in the lower portion of the pit (Civil Consulting Services, 2006). These wet areas were excavated and filled with coarse drain rock, and a drain pipe was inserted in the rock to facilitate draining water from the wet areas so that regrading could proceed. There were four subsurface drains constructed, and the ends of these drains were terminated in two runoff channels down-gradient of the pit. One of the drain pipes was covered in the channel with rock, but the terminal ends of three drain pipes remain accessible. Water draining from these locations, DCSW-101, DCSW-102, and DCSW-103, collectively referred to as the McLaren Pit subsurface drains, is of poor quality with low pH and high metal concentrations. The water quality of these subsurface drains is discussed further in section 5.1.2 below.

The discharge from the subsurface drains continues in these channels down the steep slope below the McLaren pit to the prominent break in slope along the floor of the Daisy Creek valley, where the discharge from DCSW-102 and DCSW-103 channel infiltrates to groundwater on the 1000-foot wide, low-gradient, colluvial/slope-wash slopes adjacent to the creek. Presumably this groundwater moves down-gradient through colluvial and bedrock materials to contribute base-flow to Daisy Creek. Discharge from the channel carrying water from DCSW-101 however, flows all the way to a perennial tributary of Daisy Creek (DCT-8).

3.3.2 Como Basin Closure

The Como Basin source area (**Figure 1**) was a 5.5-acre area of metal-rich residual soil developed on a weathered in-place massive sulfide ore deposit that oxidized to form an acidic, metal-laden leachate, which in turn, was mobilized and impacted the quality of surface water and groundwater within and down-gradient of the basin. An Engineering Evaluation / Cost Analysis (EECA) was completed (Maxim 2002b) and an Action Memorandum was prepared in December of 2002 to construct a composite geomembrane/soil cover system to reduce the infiltration of surface water, precipitation and snowmelt, and thereby minimized the mobility of metal and acid contaminants from the weathered soils in the basin (Maxim, 2002b).

Material at the Como basin was capped with a composite geosynthetic / amended soil cover. A 60-mill high-density polyethylene (HDPE) liner and a geonet drainage layer was placed over the regraded and compacted waste. The soil portion of the cap consisted of acidic/metal contaminated native material stripped from the area to be capped that was amended with lime to neutralize acidity. Run-on surface water currently moves across the liner/soil cover in two constructed channels fed by lateral drains along benches directing incident rainfall on the cap to these channels. Subsurface-drains control groundwater flow beneath the cap and a drainage system of constructed gravel cover drains with geocomposite liners control water that infiltrates the soil cover above the liner. A lined upgradient surface water diversion channel was also constructed. The entire disturbed area was amended with organic matter, fertilized and seeded, and covered with erosion control mat. The cover was completed in August, 2006. No additional work is planned for the Como Basin.

4.0 ADDITIONAL 2010 RECLAMATION / CLOSURE WORK

4.1 MCLAREN ADIT

The McLaren Adit (or the Winter Tunnel) was driven to the northeast from the northwest corner of the McLaren Pit. It collars at about 9,640 feet in elevation near the junction of the main county road with the Lake Abundance road (**Figure 2**). Based on the size of a waste rock dump located near the portal and the dimensions of the adit, it is estimated that the length of workings would be approximately 1,770 feet including crosscuts and drifts and/or stopes developed in the mine.

The USDA-FS reopened the McLaren Adit in September of 2001 using a track-mounted excavator to explore the workings and look for sources of the water inflow. No water sources other than an occasional drip were observed in the first 350 feet, but water was flowing over a meter (3.5 foot) high dam at a caved-in section of the mine at 423 feet, and flowing down an exploration borehole drilled from the surface that had intersected the adit at about 366 feet. Because the mine flows year-round, it was assumed that a significant inflow must occur at some point further into the mine. In a successful effort to reduce flow into the adit, the drill hole that penetrated the adit from the surface was plugged in September 2003, reducing the flow from the borehole to zero thus reducing the flow discharged at the portal from 13 gpm to 6 gpm. However, flow does continue and discharges by way of a tributary to Daisy Creek.

Water from the McLaren Adit has near neutral pH and exceeds chronic and/or acute aquatic life standards for copper and iron and human health guidelines for iron and manganese (**Table 5-3** and Table A-3 in **Appendix A**). The quality of adit discharge is better than that typically measured down gradient at DC-2 (**Figure 2**.) during both high and low flow conditions. Particularly, concentrations of cadmium, copper, and zinc are lower in adit discharge than in samples collected at DC-2. Iron concentrations tend to be greater in adit discharge than in DC-2 samples, however, iron is not conserved in solution from the adit, but rather precipitates out of mine waters as a ferri-hydroxide coating on streambed substrate.

Additional work is scheduled by the Forest Service for the McLaren Adit during the summer of 2010, and includes; backfilling the adit portal with coarse rock and installing a drain-pipe inward of the rock plug to capture and direct adit discharge into an infiltration basin located outside and down gradient of the adit. Tetra Tech prepared non-degradation calculations for the potential infiltration gallery (basin) to treat seepage water from the McLaren adit. According to ARM 715.30.715, discharges are “not significant” if the resulting **change** in concentration does not exceed the trigger value. Review of the data and non-degradation calculations shows that only the trigger value for zinc would be exceeded in groundwater beneath the infiltration gallery, but no applicable DEQ-7 ground or surface water quality standards for zinc would be exceeded. Some portion of the zinc load in McLaren adit seepage likely originate from a zinc plated galvanized steel culverts and grates previously installed in the adit and beneath the roadway. These culverts will be replaced with a corrugated HDPE culverts during construction proposed for 2010. Dilution of aluminum, copper, and manganese concentrations in groundwater would occur upon mixing with adit seepage. Therefore, the calculated non-degradation values show that discharges from the proposed infiltration gallery will result in “non-significant” changes in water quality, except for zinc.

The construction package for the McLaren Adit is anticipated to include the following features:

- Adit subsurface-drain collection system (to collect adit drainage),
- Portal closure (pyramid shaped coarse-rock backfill),

- Portal area reclamation (back-filled and regraded to near original topographic contours) and revegetated, and
- Infiltration basin system

4.2 MCLAREN ADIT AREA WIDE RECLAMATION

The McLaren Adit area (**Figure 1**) includes approximately 6.2 acres of disturbed and unproductive soils requiring revegetation. The soils in this area are acidic, and will need conditioning to promote optimum germination potential. Conditioning of the soil requires lime additions, organic compost and dry mineral fertilizer amendments to be spread and incorporated within the upper six inches of soil. Following soil amendment application, the Forest Service approved seed mixture will be broadcast at the prescribed application rate and the entire revegetated area will be covered by a biodegradable straw fiber erosion control mat.

4.3 ROADS

Areas of known and potential acid production and other areas of anomalous metal concentrations in soil and bedrock are sources of contamination, which are exacerbated by surface disturbances such as roads that expose these materials to ongoing erosion both on roadbeds and cut and fill slopes. Roads throughout the District have been identified as major contributors of sediment to Fisher, Daisy, and Miller creeks, with some of this sediment enriched in metals from roads crossing actual mining disturbances or other natural source areas for metals. Sediments derived from roads and trails impact both surface water quality and aquatic habitat, and reducing sediment derived from roads and trails would likely significantly improve these resources.

The Miller Creek EE/CA (Maxim 2003) examined restoration actions to respond to impacts to natural resources that are related to sediment contamination derived from roadways throughout the District. At the request of the Forest Service, a preliminary set of specifications and a bid package for road remediation and reclamation in the District roads was prepared by Tetra Tech in 2007. In 2010, the Forest Service intends to contract for road reconstruction and restoration activities, as well as other restoration work throughout the District. This work will include improved drainage control along roads and stabilization of cut and fill banks with vegetation to lower the erosion from the roads. Also included in the contract will be revegetation of disturbed areas which continue to contribute sediment in the streams and closure of the McLaren Adit (**MCLAREN ADIT AREA WIDE RECLAMATION** above). The Lake Abundance trail, which accesses the Lake Abundance road from Daisy Pass, was also identified as a site that contributes sediment and the reconstruction of this trail has been completed.

5.0 SURFACE WATER QUALITY IN THE DISTRICT

Samples of surface and groundwater have been collected in the District (i.e. Daisy, Fisher, and Miller Creek drainages) and analyzed for water quality parameters since the late 1980s. A number of long-term monitoring stations are monitored three times per year (**Figure 2.**) to monitor and assess the effects of reclamation activities. Results of these annual monitoring programs were reported most recently by Tetra Tech (2009a) and are summarized in the sections below along with discussion of point source discharge water quality. More detailed discussion of water quality and the effects of reclamation in the District is provided in the Draft Adit Discharge Engineering Evaluation / Cost Analysis (Tetra Tech, 2006).

Water quality data were also used, along with data from other sources, to estimate surface water quality conditions in the District prior to mining disturbances (Tetra Tech, 2009b). A summary of this study is provided in Section 5.4.

Appendix A provides a summary of the most recent monitoring data collected from adit locations, as well as the complete record of all surface water monitoring data collected from adits and surface water monitoring stations on Daisy, Fisher, and Miller Creeks.

5.1 EXISTING WATER QUALITY IN DAISY CREEK DRAINAGE

5.1.1 Daisy Creek Water Quality

Surface water in Daisy Creek is monitored at two locations; DC-2, located immediately down-gradient of the reclaimed McLaren Pit, unreclaimed McLaren Adit and McLaren Pit subsurface drains discharge points; and DC-5, located farther downstream above the confluence of Daisy Creek and the Stillwater River (**Figure 2**).

Comparison of average water quality data collected before and after construction of the McLaren Pit impermeable membrane/soil composite cap in October 2003 shows the cap has been successful in reducing metal concentrations and loads at DC-2 (**Figure 3**) (Table 5-1 and Table B-1 in **Appendix B**). With the cap in place, more melt water during the spring and early summer snowmelt period runs off to upper Daisy Creek without first becoming contaminated by passing through historically mine wastes. The cap prevents snowmelt, precipitation and surface water from infiltrating into the underlying metal and sulfide rich soil, waste materials, and mineralized bedrock and thus reduces the load of metals and acid contributed from this area to groundwater and surface waters of Daisy Creek. In addition, this large reduction of infiltration (recharge) into the McLaren Pit mine waste has resulted in the lowering of groundwater levels within the pit backfill and is believed to result in the observed lower stream flow of the tributaries to upper Daisy Creek during “low flow” periods (August to April) (Maxim, 2005b).

Water quality at DC-2 is poor and acidic ($\text{pH}_{(\text{mean})} = 4.5$) during low flow periods (Table A-2 in **Appendix A**). During high flow conditions the pH of water sampled at this station is only slightly acidic ($\text{pH}_{(\text{mean})} = 6.1$), and concentrations of all metals except lead and iron are much lower (**Figure 3**). Cadmium, copper, iron, and zinc exceeded acute and/or chronic aquatic life standards during the three 2008 monitoring events (April, July, and September) at DC-2 (**Figure 3**) (**Table 5-1**). In addition, lead exceeded the chronic aquatic life standard during June and September events. Human health standards and/or guidelines for copper, iron, and manganese were also exceeded in most samples collected at DC-2 in 2008. At station DC-5, pH of the water is notably higher than that measured at station DC-2 due to the addition of more carbonate-rich water from bedrock and tributary sources located downstream.

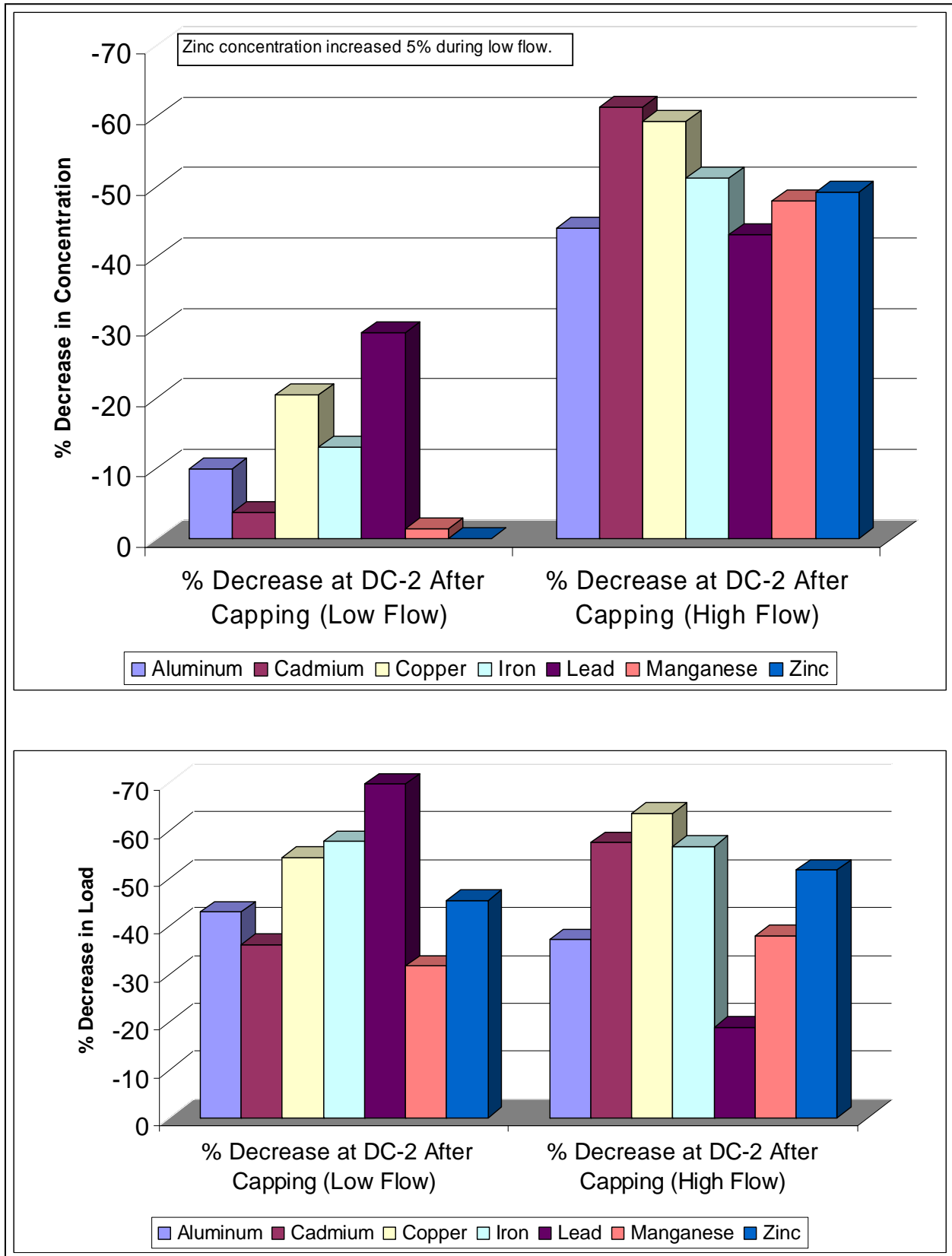


Figure 3. Average Changes to Water Quality at DC-2 After Completion of McLaren Pit Cap

**Table 5-1
Selected Water Quality Data for Daisy Creek Monitoring Station DC-2**

Parameter (mg/l)	Aquatic Life (acute)	Aquatic Life (chronic)	Human Health Standard (Iron & Manganese values are guidelines)	DC-2 (Total Recoverable)			
				Narrative Water Quality Standard ⁽¹⁾	Apr-08	Jul-08	Sep-08
Aluminum ⁽³⁾	0.75	0.087	NA	28.4	8.53	2.30	14.1
Cadmium	0.00213 ⁽⁴⁾	0.00027 ⁽⁴⁾	0.005	0.009	0.0035	0.0005	0.0040
Copper	0.0140 ⁽⁴⁾	0.0093 ⁽⁴⁾	1.3	8.064	1.79	0.52	3.54
Iron	NA	1	0.3	29.649	13.3	2.32	10.30
Lead	0.082 ⁽⁴⁾	0.0032 ⁽⁴⁾	0.015	0.018	0.003	0.002	0.005
Manganese	NA	NA	0.05	4.088	1.93	0.29	2.12
Zinc	0.1198 ⁽⁴⁾	0.1198 ⁽⁴⁾	2	1.104	0.50	0.08	0.56
Hardness	NA	NA	NA	NA	235	83	217
pH (s.u.)	NA	NA	NA	2.7	4.8	6.8	4.0
Flow (cfs)	NA	NA	NA	NA	0.022	9.229	0.395

**Table 5-2
Selected Water Quality Data for Daisy Creek Monitoring Station DC-5**

Parameter (mg/l)	Aquatic Life (acute)	Aquatic Life (chronic)	Human Health Standard (Iron & Manganese values are guidelines)	DC-5 (Total Recoverable)			
				Temporary Water Quality Standard ⁽²⁾	Apr-08	Jul-08	Sep-08
Aluminum ⁽³⁾	0.75	0.087	NA	9.510	1.19	0.89	6.53
Cadmium	0.00213 ⁽⁴⁾	0.00027 ⁽⁴⁾	0.005	0.004	0.0007	0.0002	0.0013
Copper	0.0140 ⁽⁴⁾	0.0093 ⁽⁴⁾	1.3	3.530	0.310	0.180	1.480
Iron	NA	1	0.3	6.830	1.30	0.98	5.34
Lead	0.082 ⁽⁴⁾	0.0032 ⁽⁴⁾	0.015	NA	<0.001	0.002	0.005
Manganese	NA	NA	0.05	1.710	0.37	0.110	0.710
Zinc	0.1198 ⁽⁴⁾	0.1198 ⁽⁴⁾	2	0.540	0.09	0.03	0.21
Hardness	NA	NA	NA	NA	171	66	203
Lab pH (s.u.)	NA	NA	NA	4.6	7.7	7.8	7.4
Flow (cfs)	NA	NA	NA	NA	0.25	17.66	0.641

Notes for Table 5-1 and Table 5-2.

Shading/coloring indicates exceedance of respectively shaded/colored regulatory standard.

¹ Narrative Water Quality Standards apply to any point in affected stream segments and are included in the rule for temporary water quality standards. As with the temporary standards, narrative standards are calculated as the mean plus 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 Aluminum standard applies to dissolved concentrations in water with a pH between 6.6 to 9.0 s.u.

⁴ Based on 100 mg/l hardness.

At station DC-5, pH of the water is notably higher than that measured at station DC-2 due to the

At station DC-5, pH of the water is notably higher than that measured at station DC-2 due to the addition of more carbonate-rich water from bedrock and tributary sources located downstream of DC-2. Total recoverable trace metal concentrations are also considerably lower at DC-5 (**Table 5-2**) compared to DC-2 (**Table 5-1**) because of dilution from tributary inflows, settling of some of the suspended metal-rich particulates, and metals co-precipitation with ferric-hydroxide complexes that precipitate from the relatively high pH water of the upstream reach.

Copper and iron exceeded acute or chronic aquatic life standards during the two or three 2008 monitoring events at DC-5 (**Table 5-2**). Cadmium and zinc exceeded acute or chronic aquatic life standards in at least one of the three monitoring events. Iron and manganese exceeded human health guidelines during two or three sampling events.

At both monitoring stations, metal concentrations are lowest and pH greatest during high flow conditions in June.

5.1.2 Daisy Creek Point Source Discharge Water Quality

Point source discharges in the Daisy Creek Drainage include the three McLaren Pit subsurface drains; DCSW-101, DCSW-102, and DCSW-103 (refer to Section 3.3.1) (**Figure 2**) and the McLaren Adit (see section 4.1).

McLaren Pit Subsurface Drains

Water quality in discharge from each of the three subsurface drains is very poor (**Table 5-4** and **Table A-6** in **Appendix A**). Human health standards or guidelines for cadmium, copper, iron, lead, manganese, and zinc are exceeded by each of the drains as are applicable acute and chronic aquatic life standards for these same metals. Despite poor water quality, discharge from the drains tends to flow at overall low and seasonally variable rates. Recorded discharge from DCSW-102 ranges from 0.1 gpm to 15.4 gpm with a mean flow of 7.8 gpm (0.017 cfs). Recorded discharge from DCSW-103 ranges from 0.7 gpm to 1.6 gpm with a mean flow of 1.3 gpm (0.003 cfs). Flow rates are greater at DCSW-101, ranging from 5.8 gpm to 21.5 gpm and averaging 13.2 gpm (0.029 cfs).

The McLaren subsurface drains were fitted with continuous water flow instrumentation in August of 2008. Subsequent interpretation of the data has defined the period and magnitude of flow occurring from the McLaren drains. In the data collection period of August 12, 2008 to September 28, 2009, the following flow rates were observed:

- The drains ceased flowing between September 25, 2008 (DCSW-102) and November 17, 2008 (DCSW-101)
- The drains started flowing between May 17, 2009 (DCSW-101) and May 21, 2009 (DCSW-102)
- Peak flows occurred between June 22 and July 7, 2009

The calculated total volume of flow between August 12, 2008 and August 12, 2009 is the following:

- DCSW-101 – 2,641,587 gallons
- DCSW-102 - 1,147,675 gallons
- DCSW-103 - 218,675 gallons

Therefore, the total discharge for the stated period is 4,007,937 gallons. As can be seen from this data, the subsurface drains are completely dry beginning in late-fall (November 17th) until

the spring run-off season (May 17th). By comparison, typical in-stream flow at DC-2 (the nearest down-gradient surface water monitoring site) ranges from 9.229 cfs (4,142.3 gpm) during the spring (early July) run-off sampling period, to about 0.395 cfs (177.3 gpm) during the fall (late September) sampling event. The subsurface drains, therefore contribute only a very small portion of the overall flow at DC-2: 0.93% (38.5 gpm/4142.3 gpm) at high flow, and 3.7% (6.6 gpm / 177.3 gpm) at low flow.

Figure 4 illustrates high and low flow metals load contribution from the subsurface drains to the downstream Daisy Creek surface water station DC-2 in terms of percent. Each bar represents an average of the particular metal's load contribution at station DC-2 over the years between 2005 and 2009. The combined average metal load contribution of the subsurface drains calculated prior to installation of the continuous flow meters at high flow was 29% and at low flow was 19%. Adjusting these data for measured flow values in 2008-2009 indicates that actual average metal load contribution from the subsurface drains is much closer to 23% at high flow and 15% at low flow. When compared with perennial loading values previously calculated from the drains on year around flow estimates, the revised total annual load is reduced by almost 19% by decreasing the number of low flow months from ten to four, due to the ephemeral nature of flow from the drains.

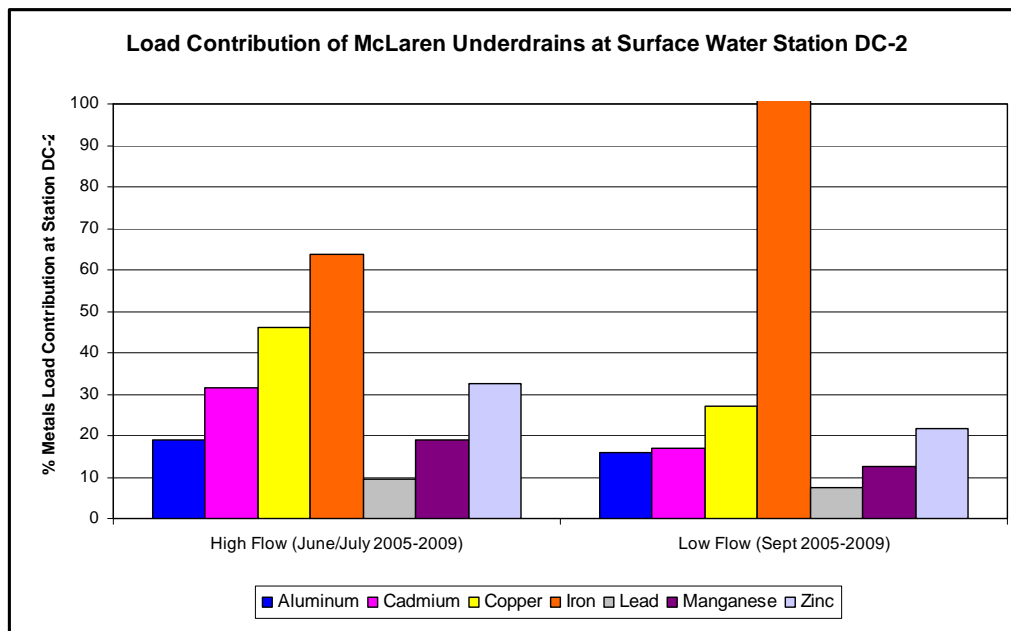


Figure 4. Metal Loads Calculated for McLaren Pit Subsurface Drains at DC-2.

Low flow iron is 102.5%.

Subsurface Drains Water Treatment Alternatives

In the *Draft Adit Discharge Engineering Evaluation/Cost Analysis (EE/CA): New World Mining District Response and Restoration Project* (Tetra Tech, 2006) several alternative treatment technologies for acid rock drainage (ARD) and acid mine drainage (AMD) were evaluated and the recommended treatment technology was selected for each source in the New World Mining District.

The recommended treatment technology for the collective flow from the McLaren Pit subsurface drains was a passive or semi-passive bioreactor system (Tetra Tech, 2006). Passive or semi-passive treatment of acid mine drainage has been shown to be a relatively effective and low-maintenance alternative to active treatment under favorable conditions including providing an

acceptable energy source and proper water quality conditions conducive for bacterial growth as discussed in detail in this report. This type of treatment takes advantage of natural chemical and biological processes and is particularly suited for remote locations and those which may be inaccessible during a portion of the year as is the case for the McLaren subsurface drains and the McLaren Adit discharge.

Subsequent to the release of the Draft EECA, an additional more detailed technical reexamination of the anaerobic bioreactor system proposed for the McLaren drains in the EE/CA was undertaken by Jen Hudson, a Water and Waste Water Treatment Engineer with Tetra Tech and reported on in a Technical Memorandum entitled *McLaren Subsurface Drain Anaerobic Bioreactor System Review* dated December 18, 2008. In this report a passive solid substrate bioreactor (SSBR) and a semi-passive liquid substrate bioreactor system (LSBR) are compared. The water flow rate and water quality data for each source were reevaluated. An estimated cost analysis for bench scale pilot studies was presented, and the sensitivity of the system to changing flow and chemistry conditions was discussed. Finally, the construction, operations and maintenance cost analysis presented in the EE/CA was updated to provide further detail and refined cost estimates for the SSBR and LSBR systems based on these analyses.

While the results of the analysis of the two treatment systems (SSBR and LSBR) indicated a significant overall metals reduction from the McLaren under-drains, there was still a major contribution of metals loading from other non-point sources (approximately 80%). The total metals loading to DC-2 before treatment from the subsurface-drains is about 22 percent (calculations performed prior to installation of the continuous flow meters on pre-2007 data). This contribution drops to a total metals contribution post-SSBR treatment to 2.2 percent and post-LSBR treatment to 0.8 percent. While this reduction shows that the bioreactor treatment system is both appropriate and successful at metals removal from this type of discharge, the overall results indicate that the total metals loading to Daisy Creek will not be significantly reduced by implementing this technology.

The impact to the DC-2 sampling station after biological treatment indicates that the total metals loading from all sources to DC-2 prior to bioreactor treatment of the McLaren under-drains is 3,653 kilograms per month (kg/month). After SSBR treatment of the McLaren under-drains, the total metals contribution from all sources to DC-2 drops to 2,915 kg/month, an overall reduction in loading of only 20.2 percent. After LSBR treatment of the McLaren under-drains, this value drops to 2,873kg/month total metals loading resulting in an overall total metals reduction to DC-2 of 21.4 percent.

These results indicate that the ideal situation of meeting or attempting to meet the Circular WQB-7 for aquatic life standards at stations DC-2 in Daisy Creek is unrealistic through treatment of the McLaren subsurface-drain discharges using either the SSBR or the LSBR.

The results clearly indicate that the \$1.75 million and \$1.21 million expenditures for the SSBR or LSBR system, respectively, would do little to bring the water quality in Daisy Creek near the values, which would make a significant impact. The only benefit from implementation of a bioreactor treatment system would be some modest improvement in the overall water quality to the creek.

McLaren Adit

Point source discharge from the McLaren adit and its impact to surface water quality were discussed in section 4.1 above as related to additional work proposed for 2010. Water quality data for the McLaren adit are summarized in **Table 5-3**.

5.2 EXISTING WATER QUALITY IN FISHER CREEK DRAINAGE

5.2.1 Fisher Creek Water Quality

Three locations are monitored on the main stem of Fisher Creek: SW-3 near the head of the drainage below the Glengarry and Glengarry Mill-site adit locations, SW-4 at the Lulu Pass road bridge crossing, and CFY-2 above the confluence with the Clark's Fork of the Yellowstone (**Figure 2**).

Water quality improved at SW-3 following closure of the Glengarry Adit in 2004 with decreases in metal concentrations as large as 82% (**Figure 5** and Table B-2 in **Appendix B**). However, water quality remains poor, and acidic conditions persist in the headwaters of Fisher Creek. Total recoverable cadmium, copper, iron, lead, and zinc exceeded acute and/or chronic aquatic life standards during at least two of the three 2008 monitoring events (**Table 5-5**). Human health guidelines for iron and manganese were exceeded during all three 2008 monitoring events.

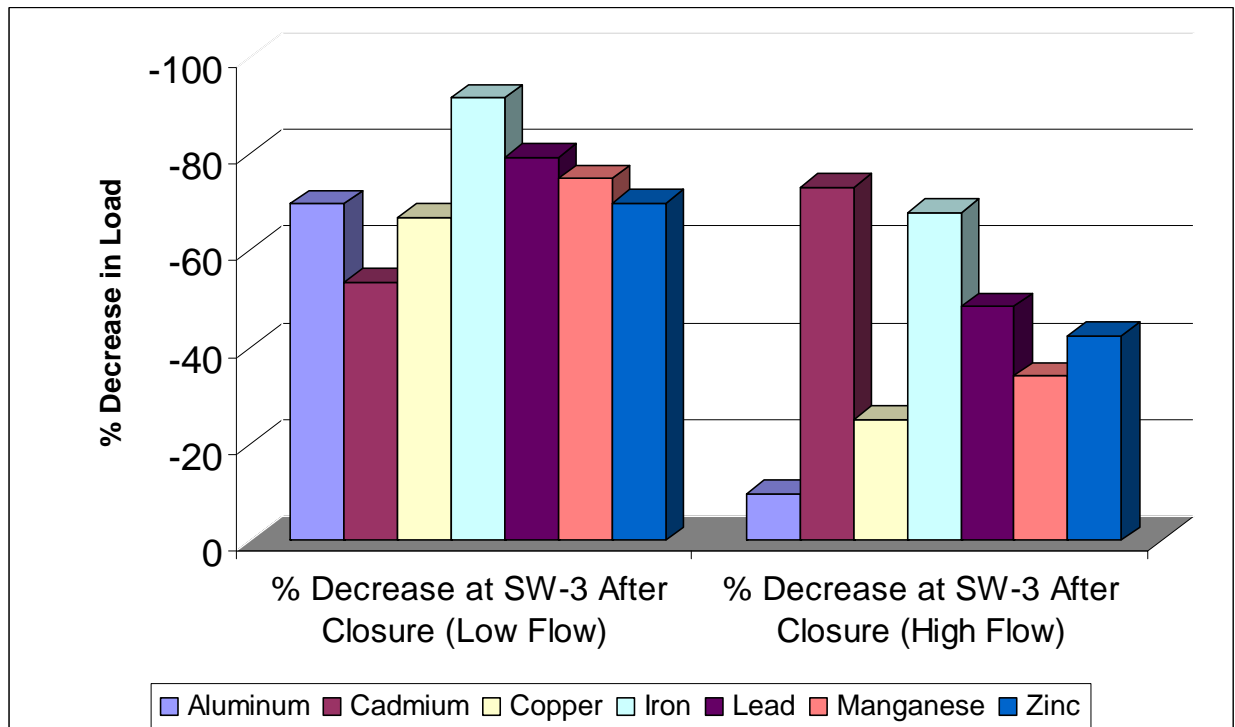
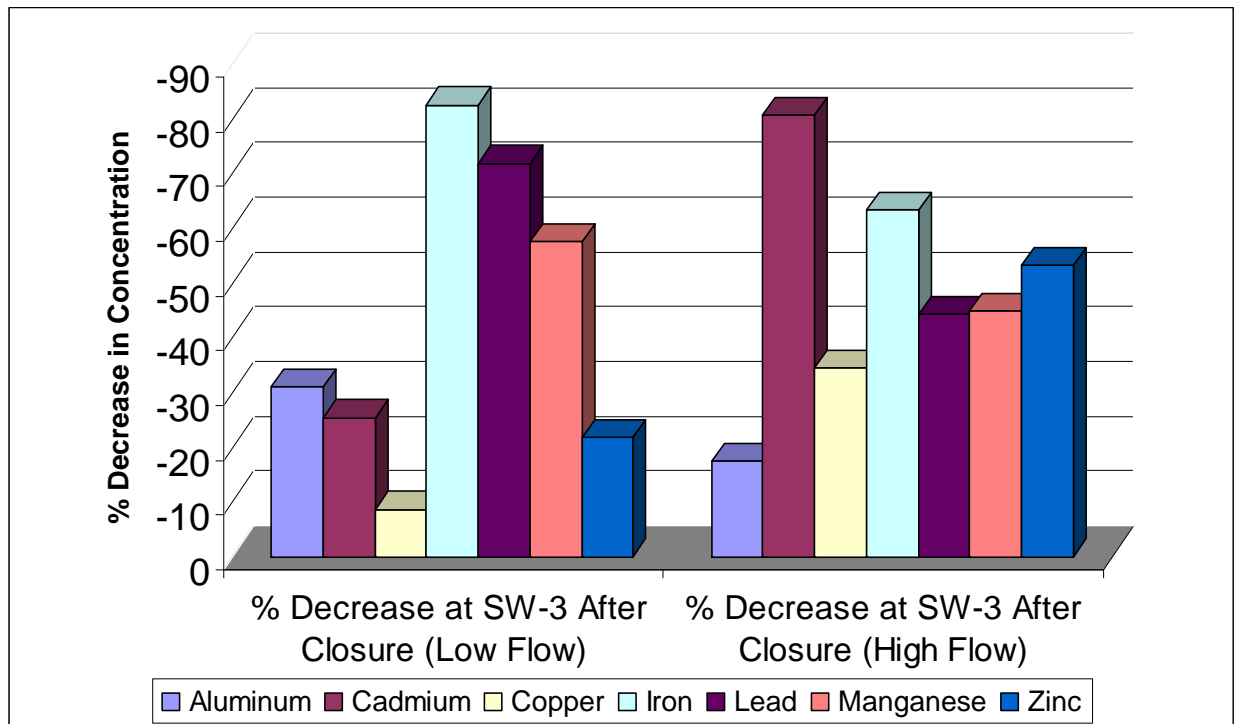


Figure 5. Average Changes to Water Quality at SW-3 After Glengarry Adit Closure

**Table 5-3
Selected Water Quality Data for McLaren Adit Discharge**

Parameter (mg/l)	Aquatic Life (acute)	Aquatic Life (chronic)	Human Health Standard (Iron & Manganese values are guidelines)	Narrative Water Quality Standard at DC-2 ⁽¹⁾	Adit Discharge Water Quality (Total Recoverable)
					(average of data collected after September 2003)
Aluminum ⁽²⁾	0.75	0.087	NA	28.4	0.27
Cadmium	0.00213 ⁽³⁾	0.00027 ⁽³⁾	0.005	0.009	< 0.0001
Copper	0.0140 ⁽³⁾	0.0093 ⁽³⁾	1.3	8.064	0.03
Iron	NA	1	0.3	29.649	26.5
Lead	0.082 ⁽³⁾	0.0032 ⁽³⁾	0.015	0.018	0.002
Manganese	NA	NA	0.05	4.088	1.10
Zinc	0.1198 ⁽³⁾	0.1198 ⁽³⁾	2	1.104	0.06
Hardness	NA	NA	NA	NA	429
pH (s.u.)	NA	NA	NA	2.7	6.39
Flow (cfs)	NA	NA	NA	NA	0.01

**Table 5-4
Selected Water Quality Data for McLaren Pit Subsurface Drains**

Parameter (mg/l)	Aquatic Life (acute)	Aquatic Life (chronic)	Human Health Standard (Iron & Manganese values are guidelines)	Narrative Water Quality Standard at DC-2 ⁽¹⁾	Average of All Data (Total Recoverable)		
					DCSW-101	DCSW-102	DCSW-103
Aluminum ⁽²⁾	0.75	0.087	NA	28.4	28.3	29.9	89.4
Cadmium	0.00213 ⁽³⁾	0.00027 ⁽³⁾	0.005	0.009	0.010	0.016	0.024
Copper	0.0140 ⁽³⁾	0.0093 ⁽³⁾	1.3	8.064	13.7	16.9	34.8
Iron	NA	1	0.3	29.649	135	141	417
Lead	0.082 ⁽³⁾	0.0032 ⁽³⁾	0.015	0.018	0.010	0.003	0.003
Manganese	NA	NA	0.05	4.088	3.1	4.6	12.6
Zinc	0.1198 ⁽³⁾	0.1198 ⁽³⁾	2	1.104	1.75	2.64	4.30
Hardness	NA	NA	NA	NA	142	211	645
pH (s.u.)	NA	NA	NA	2.7	2.9	2.7	2.6
Flow (cfs)	NA	NA	NA	NA	0.03	0.02	0.003

Notes for Table 5-3 and Table 5-4.

Shading/coloring indicates exceedance of respectively shaded/colored regulatory standard. Standards shown are applicable at DC-2.

¹ Narrative Water Quality Standards apply to Daisy Creek monitoring station DC-2 and DO NOT apply to discharge from the McLaren Adit or Subsurface Drains. These standards are shown here for comparison purposed only.

² Aluminum standard applies to dissolved concentrations in water with a pH between 6.6 to 9.0 s.u.

³ Based on 100 mg/l hardness.

At station SW-4, cadmium concentrations exceed the chronic aquatic life standard during the April and September monitoring events in 2008 (and 2007) and copper concentrations consistently exceed the chronic and acute aquatic life standards (Table 5-6). However, water quality at SW-4 is considerably better than at station SW-3, with a higher pH (toward the near-

neutral range) that allows metals to precipitate in the stream. Dilution from tributaries and settling of the precipitated metals results in an order of magnitude reduction in aluminum, copper, iron, and manganese concentrations at SW-4.

Decreases in metal concentrations and increases in pH values continue in the reach of stream between SW-4 and CFY-2. At station CFY-2, only total recoverable copper concentrations exceed the chronic and acute aquatic life standards (**Table 5-7**).

5.2.2 Fisher Creek Point Source Discharge Water Quality

There are four adits located in the Fisher Creek drainage with discharges that do not meet DEQ-7 water quality standards (**Table 3-1**); the Gold Dust Adit, Lower Tredennic Dump #1 Adit, Sheep Mountain Adit (located on non-District property), and the Henderson Mountain Dump 7 Adit. The Glengarry and Glengarry Mill Site Adits, which are also located in the Fisher Creek drainage, have been reclaimed, no longer represent point source discharges to Fisher Creek, and are not considered for additional reclamation (see Sections 3.2.1 and 3.2.2 above).

With an average discharge rate of 8.5 gpm, the Gold Dust adit discharges more water than from the Lower Tredennic Dump #1, Sheep Mountain, and Henderson Mountain Dump 7 Adits combined. While the Gold Dust contributes more flow than these other point sources, water quality in Gold Dust Adit discharge is generally good with neutral pH and regular exceedences only of guidelines for iron and manganese. The average lead concentration reported in **Table 5-8** (0.002 mg/L) results from inclusion of one anomalous lead concentration of 0.005 mg/L measured from a sample collected in June 2006. This was the greatest lead concentration measured since 1995 and other more recent data show that lead concentrations in Gold Dust Adit discharge are typically less than 0.002 mg/L and are often below the detection limit of 0.001 mg/L (Table A-4 in **Appendix A**). Reclamation and closure activities associated with the Gold Dust adit are described above in section 3.2.3 above.

Discharge from the Sheep Mountain #1 Adit, which is located on non-District property, has neutral pH but exceeds chronic aquatic life standards for cadmium, copper, iron, lead, and zinc. Acute aquatic life standards are exceeded for copper, lead, and zinc. Measured flow rates from this adit are typically low and have not been greater than 4 gpm since 1999. In fact, flow from this adit has typically been measured at rates less than 0.5 gpm, even during July when maximum flow rates would be expected due to infiltrating snowmelt. No reclamation or closure work has been undertaken at Sheep Mountain #1 adit because it is located on non-district property.

At 1.8 gpm, the Lower Tredennic Dump #1 Adit has the third greatest average discharge rate compared to the other adits in the Fisher Creek drainage. Flow from this adit was greater than that from the Sheep Mountain #1 Adit during most monitoring events however peak flows measured at the Lower Tredennic Dump #1 Adit were lower than those at Sheep Mountain #1. Discharge water quality at the Lower Tredennic Dump #1 Adit is similar to that at the Gold Dust Adit in that pH values are circum-neutral, and metal concentrations are low (relative to other adit discharges) with average concentrations of cadmium and lead exceeding chronic aquatic life standards and manganese concentrations exceeding the human health guideline (**Table 5-8**). Reclamation and closure activities associated with the Lower Tredennic Dump # 1 adit are described above in section 3.2.4 above.

**Table 5-5
Selected Water Quality Data for Fisher Creek Monitoring Station SW-3**

Parameter (mg/l)	Aquatic Life (acute)	Aquatic Life (chronic)	Human Health Standard (Iron & Manganese values are guidelines)	SW-3 (Total Recoverable)			
				Narrative Water Quality Standard ⁽¹⁾	Apr-08	Jul-08	Sep-08
Aluminum ⁽²⁾	0.75	0.087	NA	4.54	2.13	0.74	2.95
Cadmium	0.001054 ⁽³⁾	0.000162 ⁽³⁾	0.005	0.002	0.0011	0.0001	0.0007
Copper	0.0073 ⁽³⁾	0.00516 ⁽³⁾	1.3	1.256	0.97	0.21	0.67
Iron	NA	1	0.3	9.259	1.01	0.72	1.69
Lead	0.0338 ⁽³⁾	0.0013 ⁽³⁾	0.015	0.01	0.001	0.001	0.002
Manganese	NA	NA	0.05	1.718	0.54	0.1	0.58
Zinc	0.067 ⁽³⁾	0.067 ⁽³⁾	2	0.225	0.14	0.02	0.11
Hardness	NA	NA	NA	NA	56	24	59
pH (s.u.)	NA	NA	NA	2.1	3.9	5.3	4.0
Flow (cfs)	NA	NA	NA	NA	0.085	8.17	0.37

**Table 5-6
Selected Water Quality Data for Fisher Creek Monitoring Station SW-4**

Parameter (mg/l)	Aquatic Life (acute)	Aquatic Life (chronic)	Human Health Standard (Iron & Manganese values are guidelines)	SW-4 (Total Recoverable)			
				Narrative Water Quality Standard ⁽¹⁾	Apr-08	Jul-08	Sep-08
Aluminum ⁽²⁾	0.75	0.087	NA	0.740	<0.05	0.13	0.11
Cadmium	0.001054 ⁽³⁾	0.000162 ⁽³⁾	0.005	0.001	0.0002	<0.0001	0.0002
Copper	0.0073 ⁽³⁾	0.00516 ⁽³⁾	1.3	0.172	0.044	0.049	0.065
Iron	NA	1	0.3	1.726	0.02	0.18	0.02
Lead	0.0338 ⁽³⁾	0.0013 ⁽³⁾	0.015	0.005	<0.001	<0.001	<0.001
Manganese	NA	NA	0.05	0.790	0.011	0.022	0.046
Zinc	0.067 ⁽³⁾	0.067 ⁽³⁾	2	0.660	0.04	<0.01	0.03
Hardness	NA	NA	NA	NA	45	33	59
pH (s.u.)	NA	NA	NA	5.241	7.0	7.3	7.1
Flow (cfs)	NA	NA	NA	NA	0.448	46.5	1.46

Notes for Table 5-5 and Table 5-6.

Shading/coloring indicates exceedance of respectively shaded/colored regulatory standard.

¹ Narrative Water Quality Standards apply to any point in affected stream segments and are included in the rule for temporary water quality standards. As with the temporary standards, narrative standards are calculated as the mean plus 2 standard deviations.

² Aluminum standard applies to dissolved concentrations in water with a pH between 6.5 to 9.0 s.u.

³ Based on 50 mg/l hardness.

Parameter (mg/l)	Aquatic Life (acute)	Aquatic Life (chronic)	Human Health Standard (Iron & Manganese values are guidelines)	CFY-2 (Total Recoverable)			
				Temporary Water Quality Standard ⁽¹⁾	Apr-08	Jul-08	Sep-08
Aluminum ⁽²⁾	0.75	0.087	NA	0.470	<0.05	0.06	<0.05
Cadmium	0.001054 ⁽³⁾	0.000162 ⁽³⁾	0.005	NA	<0.0001	<0.0001	<0.0001
Copper	0.0073 ⁽³⁾	0.00516 ⁽³⁾	1.3	0.110	0.007	0.033	0.012
Iron	NA	1	0.3	0.750	<0.01	0.14	<0.01
Lead	0.0338 ⁽³⁾	0.0013 ⁽³⁾	0.015	0.002	<0.001	<0.001	<0.001
Manganese	NA	NA	0.05	0.082	<0.003	0.016	0.006
Zinc	0.067 ⁽³⁾	0.067 ⁽³⁾	2	0.044	0.01	<0.01	0.01
Hardness	NA	NA	NA	NA	42	36	52
pH (s.u.)	NA	NA	NA	5.7	7.2	7.3	7.2
Flow (cfs)	NA	NA	NA	NA	0.74	60.5	1.67

Parameter (mg/l)	Aquatic Life (acute)	Aquatic Life (chronic)	Human Health Standard (Iron & Manganese values are guidelines)	Narrative Water Quality Standard ⁽⁴⁾	Average of All Data (Total Recoverable)			
					Gold Dust Adit ⁽⁵⁾	Lower Tredennic Dump # 1	Sheep Mountain #1	Henderson Mountain Dump 7
Aluminum ⁽²⁾	0.75	0.087	NA	0.740	0.106	0.117	0.404	0.103
Cadmium	0.001054 ⁽³⁾	0.000162 ⁽³⁾	0.005	0.001	< 0.0001	0.0002	0.0006	0.0012
Copper	0.0073 ⁽³⁾	0.00516 ⁽³⁾	1.3	0.172	0.003	0.004	0.055	0.017
Iron	NA	1	0.3	1.726	0.79	0.28	1.768	1.173
Lead	0.0338 ⁽³⁾	0.0013 ⁽³⁾	0.015	0.005	0.002	0.002	0.067	0.005
Manganese	NA	NA	0.05	0.790	0.112	0.150	0.082	0.096
Zinc	0.067 ⁽³⁾	0.067 ⁽³⁾	2	0.660	0.02	0.04	0.08	0.06
Hardness	NA	NA	NA	NA	313	98	88	79
pH (s.u.)	NA	NA	NA	5.241	6.9	6.5	6.8	6.7
Flow (cfs)	NA	NA	NA	NA	0.02	0.004	0.005	0.003

Notes for Table 5-7 and Table 5-8.

Shading/coloring indicates exceedance of respectively shaded/colored regulatory standard.

¹ 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.

² Aluminum standard applies to dissolved concentrations in water with a pH between 6.5 to 9.0 s.u.

³ Based on 50 mg/l hardness.

⁴ Standards reported in Table 5-8 apply to Fisher Creek monitoring station SW-4 and DO NOT apply to discharge from the listed adits. These standards are shown here for comparison purposed only.

⁵ Data collected after September 2005 when drill holes leaking into adit were grouted closed.

The Henderson Mountain Dump 7 Adit is often dry but when it is discharging, the flow has near neutral pH values yet exceeds standards for a number of metals (**Table 5-8**). On average, discharge from this adit exceeded chronic aquatic life standards for cadmium, copper, iron, and lead. Acute aquatic life standards are also exceeded for cadmium and copper, and human health guidelines are exceeded for iron and manganese. Reclamation and closure activities associated with the Gold Dust adit are described above in section 3.2.7 above.

5.3 EXISTING WATER QUALITY IN MILLER CREEK DRAINAGE

5.3.1 Miller Creek Water Quality

No temporary standards are in place for Miller Creek, as water quality in Miller Creek is generally of high quality with circumneutral pH and metals concentrations that tend to be low (Maxim, 2003; Cleasby and Nimick, 2002). Water quality data for Miller Creek monitoring stations SW-2 and SW-5 show cadmium, copper, iron, manganese, lead, and zinc have occasionally exceeded water quality standards, particularly under high flow conditions in June and July (Table A-2 and in **Appendix A**) although copper is the only metal that exceeded standards (acute and/or chronic aquatic life) in recent monitoring (**Table 5-9** and **Table 5-10**). These exceedances likely result from the influence of suspended sediments on total recoverable metals analyses. It should be noted that cadmium and lead concentrations are usually below detection at both stations.

5.3.2 Point Source Discharge Water Quality

There are four adit discharges in the Miller Creek drainage (**Table 3-1**); the Black Warrior, Henderson Mountain (M-25), Upper Miller Creek (on non-District property), and Little Daisy Adits.

Adits discharging to Miller Creek tend to have low flows. Maximum flows from the Black Warrior Adit were measured three times at 10 gpm (in 1996, 1999, and 2004) but have been below 5 gpm during most monitoring events including those during spring time when the highest flow rates would be expected. Similar flow conditions exist at the Henderson Mountain Adit (M-25) where maximum flows of 12 to 25 gpm were only measured during 1997 monitoring events. Flows measured prior to and after that year were 5 gpm or less and the most recent flow measured (August 2007) was 0.04 gpm. The Henderson Mountain adit is developed only a short distance into the hill side and may only be an excavated seep or spring developed to capture water for other uses. It has a very small waste rock volume and the discharge infiltrates to groundwater immediately down hill of the portal. In addition access to the portal is by foot trail only. Flow from the Upper Miller Creek Dump Adit, located on non-District Property, was 2 gpm or less during all monitoring events.

The greatest adit discharge rates in the Miller Creek drainage are from the Little Daisy Adit with a mean flow of 16.4 gpm which is biased by an anomalously high flow rate of 179.5 gpm reported for September 1989 (Table A-5 in **Appendix A**). Disregarding the September 1989 data, average flow from the Little Daisy Adit is 7.8 gpm and ranges from 0.5 to 20 gpm.

Adit discharge water quality tends to be poor compared to that of Miller Creek. Values of pH in discharge from these four adits range from 4.5 to 8.2 s.u., although near neutral values are measured during most monitoring events. Discharge from the Henderson Mountain Adit tends to have lower pH than at the other three adits. Elevated metal concentrations have also been recorded (**Table 5-11** and Table A-5 in **Appendix A**).

Reclamation and closure activities associated with the Black Warrior adit are described above in section 3.2.5 above, and those for the Little Daisy adit are described in section 3.2.6. No reclamation activities have been undertaken at the Upper Miller Creek Dump Adit (located on

Non District Property) because it is located on non-District Property, and none have been undertaken at the Henderson Mountain adit because of its inaccessibility and because the discharge infiltrates to groundwater some 1500 feet from the nearest surface water in Miller Creek.

**Table 5-9
Selected Water Quality Data for Miller Creek Monitoring Station SW-2**

Parameter (mg/l)	Aquatic Life (acute)	Aquatic Life (chronic)	Human Health Standard (Iron & Manganese values are guidelines)	SW-2 (Total Recoverable)		
				Apr-08	Jul-08	Sep-08
Aluminum ⁽¹⁾	0.75	0.087	NA	<0.05	<0.05	<0.05
Cadmium	0.001054 ⁽²⁾	0.000162 ⁽²⁾	0.005	<0.0001	<0.0001	0.0003
Copper	0.0073 ⁽²⁾	0.00516 ⁽²⁾	1.3	0.010	0.015	0.006
Iron	NA	1	0.3	0.07	0.06	0.03
Lead	0.0338 ⁽²⁾	0.0013 ⁽²⁾	0.015	<0.001	<0.001	<0.001
Manganese	NA	NA	0.05	0.004	<0.003	0.003
Zinc	0.067 ⁽²⁾	0.067 ⁽²⁾	2	<0.01	<0.01	<0.01
Hardness	NA	NA	NA	103	60	99
pH (s.u.)	NA	NA	NA	7.6	7.9	8.1
Flow (cfs)	NA	NA	NA	0.201	23.90	0.762

**Table 5-10
Selected Water Quality Data for Miller Creek Monitoring Station SW-5**

Parameter (mg/l)	Aquatic Life (acute)	Aquatic Life (chronic)	Human Health Standard (Iron & Manganese values are guidelines)	SW-5 (Total Recoverable)		
				Apr-08	Jul-08	Sep-08
Aluminum ⁽¹⁾	0.75	0.087	NA	<0.05	<0.05	<0.05
Cadmium	0.001054 ⁽²⁾	0.000162 ⁽²⁾	0.005	<0.0001	<0.0001	<0.0001
Copper	0.0073 ⁽²⁾	0.00516 ⁽²⁾	1.3	0.003	0.011	0.002
Iron	NA	1	0.3	<0.01	0.09	<0.01
Lead	0.0338 ⁽²⁾	0.0013 ⁽²⁾	0.015	<0.001	<0.001	<0.001
Manganese	NA	NA	0.05	0.01	<0.003	<0.003
Zinc	0.067 ⁽²⁾	0.067 ⁽²⁾	2	<0.01	<0.01	<0.01
Hardness	NA	NA	NA	110	62	110
pH (s.u.)	NA	NA	NA	8.0	8.1	8.2
Flow (cfs)	NA	NA	NA	0.0022	--	0.425

Notes for Table 5-9 and Table 5-10.

Shading/coloring indicates exceedance of respectively shaded/colored regulatory standard.

-- Flow was too rapid to gage at SW-5 in July, 2008.

¹ Aluminum standard applies to dissolved concentrations in water with a pH between 6.5 to 9.0 s.u.

² Based on 50 mg/l hardness.

**Table 5-11
Selected Water Quality Data for Miller Creek Point Sources**

Parameter (mg/l)	Aquatic Life (acute)	Aquatic Life (chronic)	Human Health Standard (Iron & Manganese values are guidelines)	Average of All Data (Total Recoverable)			
				Black Warrior Adit	Henderson Mountain Adit	Little Daisy Adit	Upper Miller Ck. Dump Adit
Aluminum ⁽¹⁾	0.75	0.087	NA	14.9	0.31	0.1	6.7
Cadmium	0.001054 ⁽²⁾	0.000162 ⁽²⁾	0.005	0.0036	0.0008	0.0005	0.0048
Copper	0.0073 ⁽²⁾	0.00516 ⁽²⁾	1.3	0.04	0.44	0.016	0.02
Iron	NA	1	0.3	17.5	0.14	7.1	11.8
Lead	0.0338 ⁽²⁾	0.0013 ⁽²⁾	0.015	0.29	0.024	0.03	0.32
Manganese	NA	NA	0.05	0.45	0.02	1.49	1.5
Zinc	0.067 ⁽²⁾	0.067 ⁽²⁾	2	0.89	0.09	0.12	0.85
Hardness	NA	NA	NA	149	25	510	83
pH (s.u.)	NA	NA	NA	7.5	6.0	6.82	6.62
Flow (cfs)	NA	NA	NA	0.008	0.022	0.036	0.002

Notes for Table 5-11.

Shading/coloring indicates exceedance of respectively shaded/colored regulatory standard. Standards shown are applicable at SW-2 and SW-5.

¹ Aluminum standard applies to dissolved concentrations in water with a pH between 6.5 to 9.0 s.u.

² Based on 50 mg/l hardness.

5.4 PRE-MINING WATER QUALITY

Multiple methods were used to quantify surface water quality in the District as it existed prior to historic mining operations (Tetra Tech, 2009b). Water quality estimates based on these methods, which are summarized in the following sections, are useful for determining the natural conditions of receiving streams in the District. These data can subsequently guide decisions regarding the efficacy of additional reclamation actions (e.g. adit closures) with respect to the provisions and requirements of 75-5-306 MCA (Section 2.0).

5.4.1 Qualitative Evidence of Pre-Mining Acidic, Metal-Rich Surface Water Quality

Several lines of qualitative evidence specific to the New World District supports the hypothesis that acidic metal-laden surface water existed prior to mining disturbance in the Daisy and Fisher Creek drainages. These lines of evidence include an examination of District geology, studies of stream sediments and ferricrete deposits, historic accounts describing a naturally occurring copper bog near the present location of the Glengarry Adit, the presence of a manganese-rich (and other metals) bog located along the Crown Butte Fault in the headwaters of Daisy Creek upgradient of the McLaren deposit, and identification of metal-rich acidic inflows during synoptic studies of Daisy and Fisher Creeks.

Geological evidence

Mineral deposits in the New World District occur principally in stratiform carbonate-hosted, massive sulfide/iron-oxide and skarn-replacement deposits (Kirk and Kirk 2002, and 2005), some of which are exposed at the surface. The majority of the rocks that comprise the deposits

at are acid generating while neutralization potential varies spatially (Kirk and Kirk 2005). In particular, disseminated sulfide mineralization in the intrusive porphyry rocks and the massive-sulfide replacement deposits in limestones are strongly acid generating, but locally portions of the limestone-hosted replacement/skarn deposits are net neutralizing. Generally, the exposed and near surface portions of the McLaren, Como, and Fisher Mountain deposits are strongly acid generating. Similar mineralization occurs in the un-mined Miller Creek deposit; however because this deposit does not outcrop and is below the regional groundwater table, sulfide oxidation likely is restricted and consequent acid production from this deposit is limited. It is reasonable to assume that this scenario of net acid generation of exposed massive sulfide replacement deposits and exposed disseminated sulfides in intrusive stocks would exist in the absence of mining or under pre-mining conditions.

Evidence based on stream sediments

A study conducted in Fisher Creek by Hren et al. (2001) examined copper and iron concentrations in fine-grained overbank stream sediments deposited before and after mining. The relative timing of sediment deposition was determined using a flood surface model developed during the study. The study found that leachable iron and copper concentrations in pre-mining sediments were greatest 3 to 4 km downstream of the Glengarry Adit, but these concentrations decreased to lower levels farther downstream. Mean and peak copper concentrations measured in pre-mining stream sediments between 3 and 4 km downstream of the Glengarry Adit were about 1,500 and 2,700 ppm respectively, very similar to concentrations measured in post-mining sediments in this same stretch of stream. The mean iron concentration of about 46,000 ppm was also similar to that of post-mining sediments in this reach. Hren et al. (2001) concluded that while pre-mining sediments displayed a greater decrease in copper and iron concentrations at distances beyond 4 km, both pre- and post-mining sediments had similar mean concentrations of copper and iron (about 1,200 and 30,000 ppm, respectively) in the upper 3 km of the stream. The authors supported their conclusion (i.e. that metal-rich sediments, similar in copper and iron concentrations to those deposited post-mining, had been deposited prior to mining) with radiocarbon dating of 860 and 8,220 year-old organic materials found in iron- and copper-rich layers at one of their study sites. In addition, they observed iron-rich sediments located beneath tree roots dated between 100 and 125 years old.

Evidence based on the presence of ferricrete deposits

Ferricrete is a common geologic deposit in both mined and unmined mineralized areas (Lovering, 1929; Pardee and Schrader, 1933; Miller and McHugh, 1994; Logsdon et al., 1996; Yager et al., 2000; Verplanck et al., 2007). Ferricrete forms when alluvial or colluvial material is cemented by iron-hydroxide precipitates that form as acidic water rich in ferric iron is neutralized, or as reduced (anoxic) water rich in ferrous iron is oxidized. Holocene ferricrete deposits in metal-mining districts have been widely recognized as indicators of ancient acid rock drainage (Bassett et al., 1992; Plumlee et al., 1995; Furniss et al., 1999; Yager et al., 2000; Wirt et al., 2007).

Prominent alluvial ferricrete deposits occur along the valley bottoms and as terraces along Fisher and Daisy Creeks, and colluvial ferricrete deposits probably deposited from springs are found higher on the valley walls (Lovering, 1929; Furniss and Hinman, 1998). Logs, twigs, algae, moss, and Mt. Mazama ash are locally preserved within the ferricretes. The ages of the ferricrete deposits were established using ¹⁴C-dating of co-deposited wood fragments. Based on the ages of over 20 samples, natural acidic drainage has occurred in upper Daisy and Fisher Creeks over the last 8,840 years (Furniss and Hinman, 1998; Furniss et al., 1999; Hren et al., 2001).

Evidence based on the presence of copper bogs

The area immediately downstream of the Glengarry adit was the location of a “copper bog” containing native copper described by Lovering (1929). The bog was located in alluvium just downstream from the abrupt change in gradient at the valley head. The copper bog deposits were at least 5 feet thick and were located near (downstream) but predated the Glengarry adit, which was driven in 1925 (Lovering, 1928). Lovering (1928) hypothesized that the copper deposited in the organic-rich layers of the bog was derived from pyritic copper ore that crops out about a half mile above the bog in the Como basin. He noted that the copper (and acid) would have been released by sulfide oxidation in the Como basin, but that the copper could only have reached the downstream bog if the surface water carrying the copper remained acidic. Once these solutions reached the bog, copper was precipitated by chemical reduction within the abundant organic material contained in muds interbedded with gravel and slope wash (Lovering, 1928). Native copper was also observed in alluvium near the bog. Similar undisturbed “copper bogs” have been identified in the vicinity and have been determined to be fens fed by copper-rich ground water. Peat deposits in the fens have up to 2.2% copper (MacHardy-Mitman, 2002; Joe Gurrieri, U.S. Forest Service unpublished data).

Evidence based on synoptic stream monitoring

Detailed synoptic sampling studies were conducted during low flow in Fisher Creek in 1997 by Kimball et al. (1999) and in Daisy Creek in 1999 by Nimick and Cleasby (2001). These studies identified and quantified the sources of metal loading contributed by surface and subsurface (groundwater) inflows to these streams. Metal-rich and acidic inflows from areas not affected physically or hydrologically by mining were identified and are evidence of conditions likely to have existed prior to mining.

In Daisy Creek, Nimick and Cleasby (2001) found metal-rich subsurface inflows located upstream and downstream from the tributaries draining the McLaren Mine area. The existence of these flows indicates that bedrock both to the south and north of the McLaren Mine area is a source of acid rock drainage not related to mining. The smaller of these subsurface inflows was thought to be derived from the Chimney Rock area, near the north end of Henderson Mountain. The other inflow, which contributed a larger subsurface metal load, may be derived from Fisher Mountain; however, shallow groundwater monitoring data (i.e., wells DCGW-103S, DCGW-106, DCGW-137, and MW-3) do not confirm the presence of acidic or metal-rich groundwater in this area.

Nimick and Cleasby (2001) also reported that Daisy Creek received a substantial copper load (10,100 ug/s) originating from a manganese bog located adjacent to the creek, and south (upstream) of the McLaren Pit. This source of loading accounted for 20% of the dissolved copper load contributed to Daisy Creek in 1999 from surface and subsurface inflows, including those from the McLaren Mine. This bog is located along the Crown Butte fault, near the lowest point in the valley and just above where the fault intersects Daisy Creek. The Crown Butte fault offsets the McLaren massive-sulfide replacement deposit down-dropping the deposit some 280 feet on the west side of the fault. Historical open-pit mining occurred exclusively to the east of the fault plane on the up-thrown side of the fault. Based on tracer studies (EPA, 1998), the Crown Butte fault is known to be a major conduit for water flow through mineralized rock. Given these relationships, loading of copper and perhaps other metals has likely been occurring from this fault-controlled bog location since glacial erosion scoured the existing topography, well before mining started. Flow along the fault has not likely been impacted significantly by historical mining.

In Fisher Creek, the metal-loading investigation conducted by Kimball et al. (1999) showed that only 32% of the copper load in Fisher Creek came from the Glengarry adit and that substantial

metal loading occurred from other more diffuse, or non-point, sources in reaches not immediately adjacent to or affected by historical mines. For instance, loading occurred upstream of the Glengarry adit from natural weathering of sulfidic rocks. Similarly, groundwater inflow contributed metals to a reach of Fisher Creek upstream from the Gold Dust tributary. For example, groundwater inflows from seeps at 786 and 1,134 meters from the head of the stream had pH values of 4.44 and 3.85, respectively, and dissolved copper concentrations of 323 and 375 µg/L, respectively. The postulated source of this diffuse loading is assumed to be groundwater that has flowed through the sulfide-rich Fisher Mountain Intrusive Complex (rhyodacite-porphry) under parts of Fisher Mountain and Henderson Mountain.

5.4.2 Estimation of Pre-Mining Water Quality from Empirical Ferricrete-Based Equations

Nimick et al. (2009) developed a method whereby the difference in trace metal content between Fe-precipitates currently forming on the streambed and ferricrete deposits along the adjacent valley floor in Daisy and Fisher Creeks (**Figure 6**) provides the basis for distinguishing between natural acid rock drainage and anthropogenic acid mine drainage. The method uses the downstream spatial variation in geochemical characteristics of ferricrete and Fe-precipitates to estimate longitudinal profiles of pre-mining pH and dissolved copper concentrations during base-flow conditions in acidic streams affected by mining. A summary of that work is presented below while more detail is provided in the original report (Nimick et al., 2009) and in Tetra Tech, 2009b.

To use the method, stream-specific estimation equations are generated from relations between either pH or dissolved copper concentration in stream water and the Fe/Cu concentration ratio in Fe-precipitates presently forming in the stream. The equations and Fe/Cu ratios for pre-mining deposits of alluvial ferricrete then are used to reconstruct estimated longitudinal profiles for pH and dissolved copper in that would have existed in the sampled streams prior to mining.

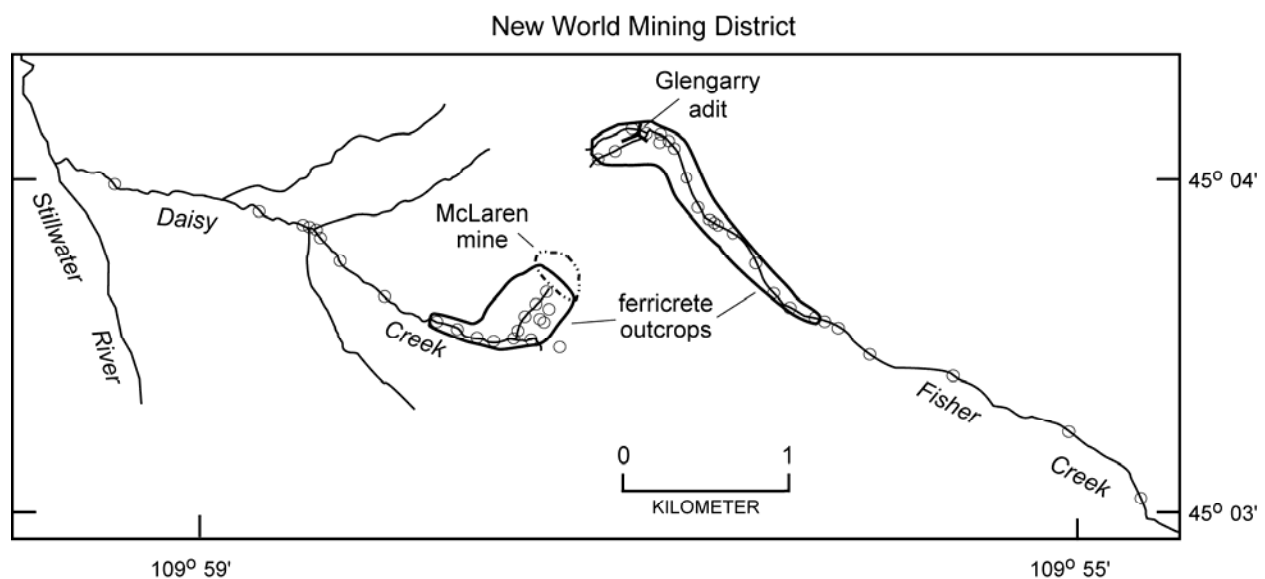


Figure 6. Map Showing Study Reaches and Locations of Ferricrete Study Sampling Sites in the New World Mining District (Nimick et al. (2009))

Estimated pre-mining conditions in Daisy Creek

The profile of estimated pre-mining pH for Daisy Creek (**Figure 7**) shows values with a mean of 3.8 (range = 3.4-4.2 from 0 to 481 m) which is greater than the measured (post-mining) pH in the tributary draining the McLaren Pit area between the county road and main stem of the Daisy Creek (mean pH = 3.16; range = 3.01-3.44). The pre-mining and measured pH profiles merge downstream from 481 m and maintain essentially the same value to the end of the ferricrete deposits at 1,105 m, which is also the location of DC-2. The estimated pre-mining pH values were 4.2 to 4.4 between 545 and 1,105 m, similar to the one measured pH value (4.32 at 703 m) in this reach as well as the September 2008 pH value at DC-2 of 4.0 (**Table 5-1**).

The profile of estimated pre-mining copper concentrations for Daisy Creek (**Figure 7**) shows that the highest concentrations (mean = 8.5 mg/L; range = 4.1-14 mg/L) were just downstream from the McLaren mine in an area where an extensive ferricrete apron formed over glacial till between 0 and 481 m. The measured concentrations in this reach (mean = 11.7 mg/L; range = 4.66-15.6 mg/L) were, on average, almost 40% higher than the estimated pre-mining values. Farther downstream, the neutral ground-water inflows currently near the toe of the ferricrete apron likely existed in the past and, as occurs today, caused a decrease in copper concentration downstream from 481 m. The pre-mining concentrations then remained at nearly the same level (2.9 to 3.9 mg/L) for the remaining part of the ferricrete deposits (545-1,105 m), and closely matched the measured concentrations of 3.54 at 703 m and 2.81 downstream from the ferricrete reach at 1,600 m. These values also were similar to the September 2008 value at DC-2 (1,105 m) of 3.54 mg/L (**Table 5-1**).

Daisy Creek

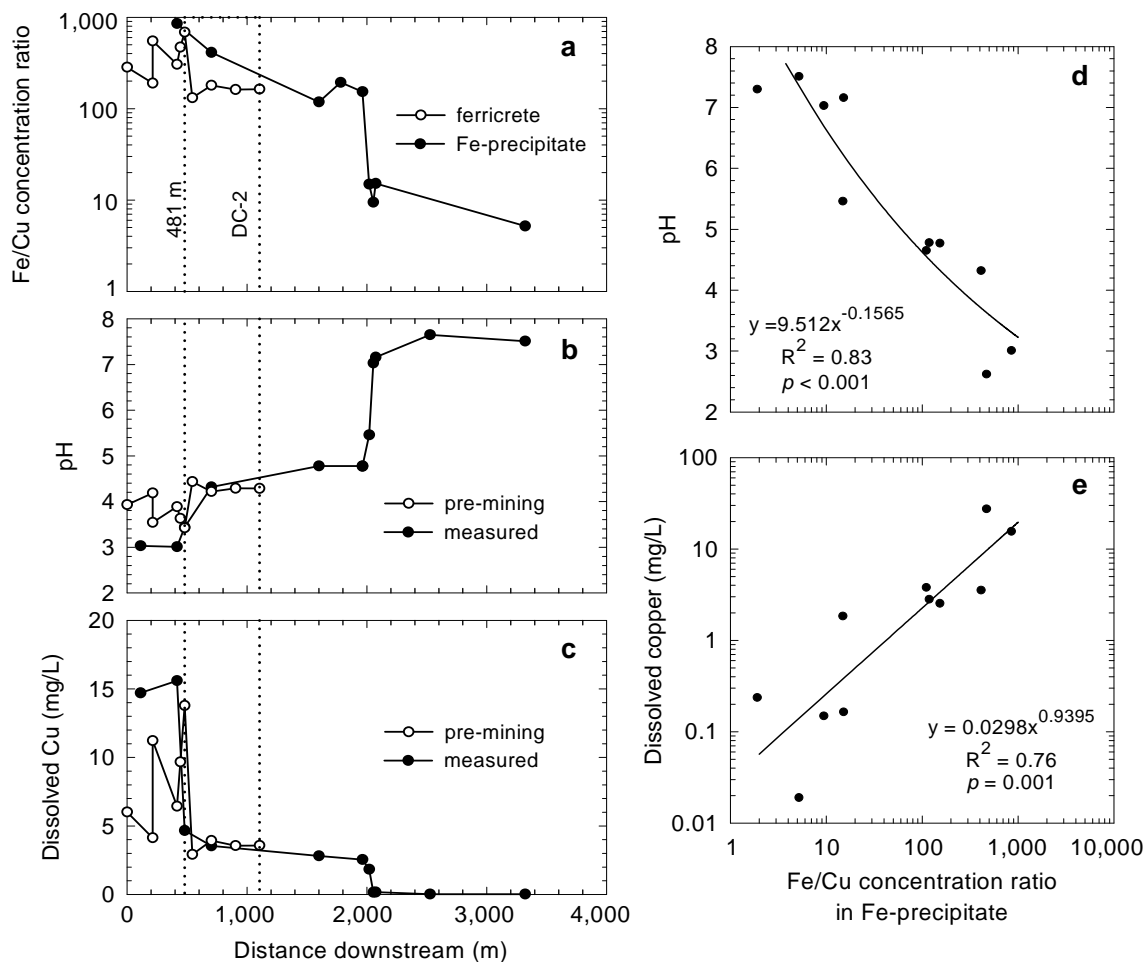


Figure 7. Downstream Profiles of pH and Copper Concentrations in Daisy Creek

- (a) Fe/Cu concentration ratio in ferricrete and Fe-precipitates
- (b) estimated pre-mining and measured pH
- (c) estimated pre-mining and measured dissolved copper concentration
- (d) Estimation models for pre-mining pH based on relation of measured pH and Fe/Cu ratio in Fe-precipitates
- (e) pre-mining dissolved copper concentration based on relation of measured dissolved copper concentration and Fe/Cu ratio in Fe-precipitates for Daisy Creek

In summary, mining appears to have adversely affected at least the upper 481 m of Daisy Creek. Dissolved copper concentrations were increased almost 40%, from a mean estimated pre-mining value of 8.5 mg/L to a mean measured value of 11.7 mg/L, and pH was decreased by about 0.6 pH units from a mean estimated pre-mining value of 3.8 (range = 3.4-4.2) to a mean measured value of 3.16 (range = 3.0-3.4) upstream from 481 m. Although conditions were not as acidic or metal-rich before mining, pH was low and copper concentrations were high prior to mining. It should be noted here that mean copper concentrations in the upper reaches (481 m) of Daisy Creek under pre-mining estimated and post-mining measured conditions, 8.8 mg/L and 11.7 mg/L respectively, are both essentially 1000 times that allowed by B-1 aquatic

life hardness adjusted standards for Daisy Creek at 0.0093 mg/L. Copper concentrations and pH values measured at 1,105 m (monitoring station DC-2) closely match pre-mining estimates at this location.

Estimated pre-mining conditions in Fisher Creek

The profile of estimated pre-mining pH for Fisher Creek (**Figure 8**) shows that in the headwaters upstream from the Glengarry adit, pre-mining pH (3.5-3.8 at 0 m) was similar to the pre-mining pH in Daisy Creek (mean = 3.8) and more acidic than the currently measured pH (4.16) in the headwaters of Fisher Creek. Downstream through the reach affected by inflow from the Glengarry adit, the pre-mining and currently measured pH values diverged, with the pre-mining pH increasing to 5.1 at 567 m and the measured pH decreasing to 3.54 at 666 m. Between 666 and the end of the ferricrete deposits at 2,042 m, pre-mining pH was fairly constant (mean = 4.8; range 4.4-5.0). Measured pH (in 2004) through the upper part of this reach (666-1,103 m) was approximately 3.5, about 1 to 1.5 pH units lower than the pre-mining values. In September 2008 (after closure and stemming of the flow from the Glengarry adit in August 2005), measured pH at SW-3 (995 m) was 4.0, somewhat lower than the estimated pre-mining value of 4.8 for this site. Between 1,103 and 2,042 m, measured pH gradually increased to 5.02, which is the same as the estimated pre-mining value at 2,042 m (**Figure 8**).

The profile of estimated pre-mining copper concentrations for Fisher Creek (**Figure 8**) shows conditions without the influence of the inflow from the Glengarry adit (263 m), which was the primary mining-related source of metals to the stream (Kimball et al., 1999). Upstream from the Glengarry adit (at 0 m), estimated pre-mining copper concentrations (0.51-0.64 mg/L) were similar to the currently measured concentration (0.558 mg/L), indicating that the measured copper concentration likely represents natural background conditions. Between 0 and 570 m, the pre-mining concentration decreased to 0.21 mg/L while the measured concentration increased to 0.690 mg/L (at 666 m) owing primarily to the inflow from the Glengarry Adit at 263 m. The pre-mining concentration decrease in this reach suggests that copper was either being diluted by inflows from known groundwater seeps and springs in this area or being precipitated, or both. Between 666 and 1,412 m (**Figure 8**), the estimated pre-mining copper concentrations (0.23 to 0.33 mg/L) were constant to slightly increasing. Stream flow presumably was increasing in this reach as it does today (Kimball et al., 1999) indicating that inflows were adding copper to the stream. The increase at 666 and 681 m (**Figure 8**) coincides with the location of a tributary (FC-2 in Figure 1 of Kimball et al., 1999) that contributed acid and copper. Similarly, the pre-mining increase at 1,267 and 1,412 m likely was caused by another acidic tributary (FCT-14 at 1,134 m) and diffuse ground-water inflows identified by the detailed synoptic sampling of Kimball et al. (1999) in this previously un-mined reach. These results indicate that locations of metal-rich ground-water discharge to the stream may be the same today as they were thousands of years ago.

Fisher Creek

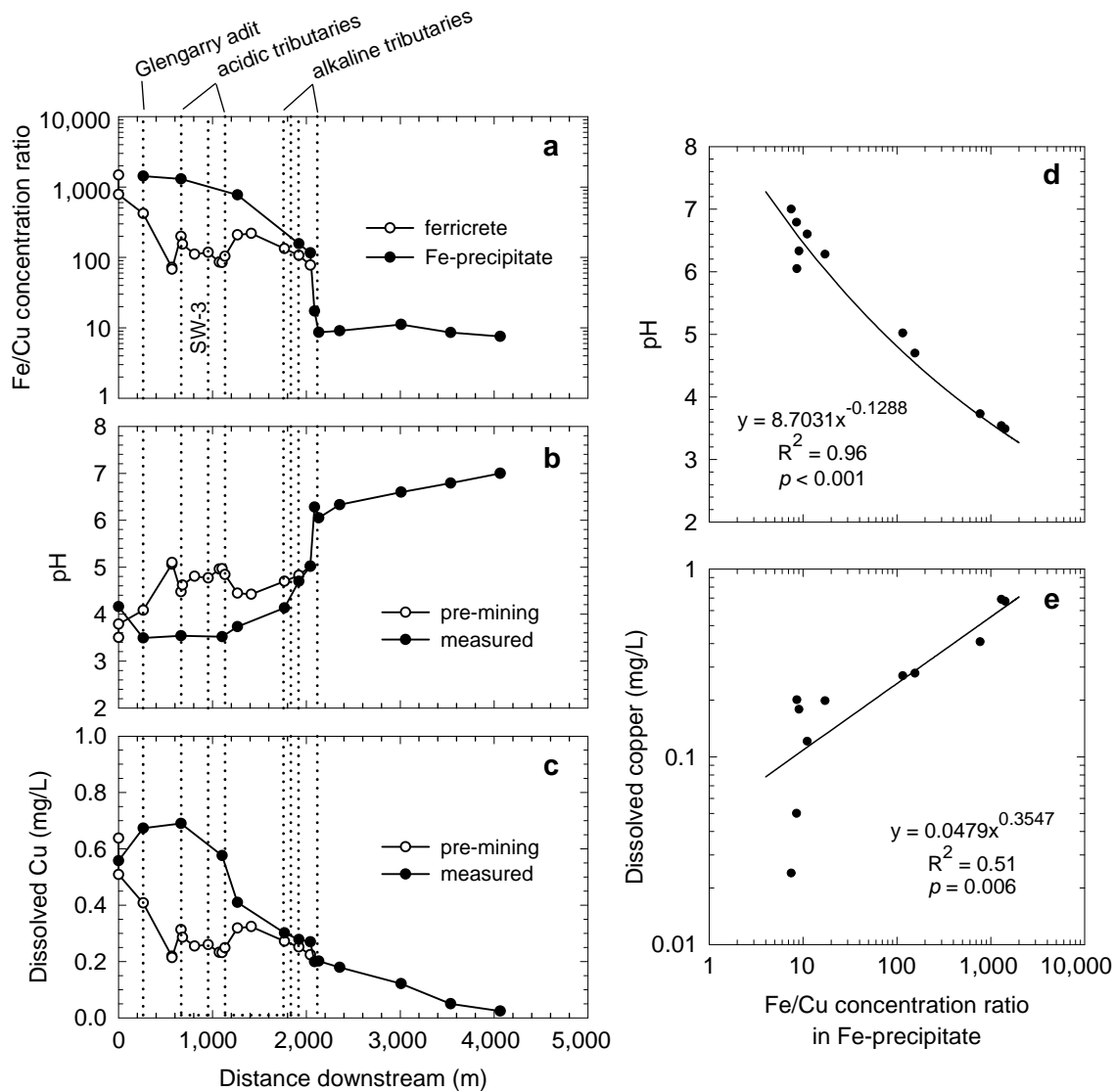


Figure 8. Downstream Profiles of pH and Copper Concentrations in Fisher Creek

- (a) Fe/Cu concentration ratio in ferricrete and Fe-precipitates,
- (b) estimated pre-mining and measured pH, and
- (c) estimated pre-mining and measured dissolved copper concentration.
- (d) Estimation models for pre-mining pH based on relation of measured pH and Fe/Cu ratio in Fe-precipitates
- (e) pre-mining dissolved copper concentration based on relation of measured dissolved copper concentration and Fe/Cu ratio in Fe-precipitates for Fisher Creek.

Inflows noted in panels a-c were identified by the detailed synoptic sampling of Kimball et al. (1999).

At SW-3 (995 m), the September 2008 total recoverable copper concentration was 0.67 mg/L, somewhat higher than the estimated pre-mining dissolved concentration of 0.26 mg/L. Near the downstream end of the ferricrete deposits (1,768-2,042 m), the estimated pre-mining concentrations (0.22-0.27 mg/L) were almost the same as the measured concentrations (0.270-0.301 mg/L).

Mining appears to have adversely affected about 1.8 km of Fisher Creek between the Glengarry adit at 263 m downstream to 2,042 m. Dissolved copper concentrations increased as much as 230%, from the estimated pre-mining value of 0.21 to 0.690 mg/L in the reach between 570 and 666 m, and pH decreased by a pH unit or more after mining between 570 and 1,103 m. Thus, mining appears to have decreased pH and increased copper concentration to a greater degree in Fisher Creek than in Daisy Creek.

In Fisher Creek upstream from the Glengarry adit, the estimated pre-mining pH (3.5-3.8) is slightly lower than the measured value (4.16), indicating that the pre-mining condition was worse than the measured condition. This unique situation could have two possible explanations. The first is that sulfide oxidation may have lessened after the sampled ferricrete was deposited and resulted in improved water quality in this reach of Fisher Creek. A second, more likely explanation is that mining activity caused the increase in pH. As described in other reports (Tetra Tech, 2009b), a raise extending vertically from the Glengarry adit to land surface daylighted into and drains the sulfidic rock outcropping in this headwater area. Prior to mining, drainage from the sulfidic rocks likely would have flowed into headwater tributaries of Fisher Creek. After construction of the raise, the acid and metal load in this drainage water no longer would have flowed to upper Fisher Creek, but instead was diverted and discharged from the Glengarry Adit portal.

5.4.3 Estimation of Pre-Mining Water Quality Based on Existing Water Quality in Non-Mined Areas

Surface water and groundwater inventory and sampling activities have been conducted in the District beginning in the late 1980s and early 1990s, resulting in a large database (Tetra Tech, 2009b). Tetra Tech reviewed the locations of each inventoried seep/spring/tributary and monitoring well to identify those that were topographically upgradient or upstream of mining disturbances, on opposite sides of surface water divides from mining disturbances, or otherwise located in the District in areas not impacted by historical mining. Field notes from the 1990 CBMI inventory were reviewed to confirm that the identified seeps/springs did not represent adit seepage and that they were not otherwise located in areas with visible mining-related disturbances. The locations of seeps/springs were cross referenced with a geological map for the District to determine the geologic unit from which each seep/spring originated. Well logs were reviewed to identify the geologic formation that each well was completed in. Finally, existing water quality data for these surface and groundwater monitoring stations were reviewed and used as an analogue for pre-mining water quality conditions (Tetra Tech, 2009b). More detailed description of these surface water and groundwater sources and the complete set of water quality data for each location is provided by Tetra Tech (2009b).

Surface water (i.e. discharges from seeps and springs, and flow in creeks) and groundwater resources in the New World District can be categorized into two groups; 1) those in mineralized areas and 2) those in non-mineralized areas. Mineralized areas are defined as areas associated with the four major Tertiary-age (Paleocene to Eocene) intrusive stocks of the district. Each of these areas is genetically, temporally, and spatially associated with widespread hydrothermal alteration and specific mineral deposits (veins, porphyries, replacements and breccia-hosted deposits). These intrusive stocks are, from north to south, the Scotch Bonnet diorite (dolerite), the Fisher Mountain rhyodacite porphyry, the Homestake quartz-dacite

porphyry, and the Henderson Mountain quartz monzonite. Non-mineralized areas are defined as areas outside of and more distal to the altered intrusive stocks located in the central portion of the district and encompass areas underlain by Precambrian granitic rock, Paleozoic sedimentary rock or unconsolidated surficial materials such as Pleistocene glacial deposits and Holocene surficial deposits.

Surface water quality from non-mineralized areas

Seeps and springs from non-mineralized areas flow into Miller and Daisy Creeks from the west and influence water quality in both creeks. These seeps and springs originate from both Pleistocene glacial deposits and Holocene surficial deposits and typically display neutral pH values and low sulfate and metal concentrations that were often below analytical detection limits (Tetra Tech, 2009b). One spring (F-17) had the maximum concentrations of both iron (0.67 mg/L) and manganese (0.12 mg/L) measured in any non-mineralized seep/spring sample.

It is worth noting that a line of springs (F-12, -13, 14, -15, and -16) located along an approximately 4,000-foot distance on the southwest facing flank of Sheep Mountain and originating in Precambrian granitic rock had pH values ranging between 5.5 and 6.5. The pH of this line of springs increased with increasing distance eastward along the previously un-mined flank of the mountain suggesting that more highly acidic water entered Fisher Creek from east-bank sources near the head of the drainage, compared to downstream locations prior to mining.

Surface water quality from mineralized areas

Seeps and springs in mineralized areas all originate in Eocene rhyodacite porphyry rock that can be further classified by geographic location as reported in the first column of **Table 5-12**.

Springs in the Lulu Pass Eocene rhyodacite porphyry are located on the west side of Lulu pass in the Daisy Creek drainage north of the historically mined McLaren Pit area. This mineralized geologic unit underlies about 27% of the area draining into Daisy Creek above its confluence with the Stillwater River. Springs originating in this unit have an average pH of 7.8 and elevated concentrations of some metals (**Table 5-12**). Average concentrations of copper (0.06 mg/L), iron (0.80 mg/L), lead (0.009 mg/L), and manganese (0.08 mg/L) all exceed DEQ-7 aquatic life or secondary standards for these constituents.

Seeps and springs originating in the rhyodacite porphyry of Henderson Mountain between Miller Creek and the lower portion of Fisher Creek had a lower average pH (6.8) compared to the Lulu Pass area (**Table 5-12**). Metal concentrations appear low and similar to those measured from non-mineralized areas, however the sample size is very small (i.e. one or two samples). The rhyodacite porphyry rock of Henderson Mountain underlies about 7% of the area draining into Fisher Creek above its confluence with the Clarks Fork of the Yellowstone River.

Seeps and springs originating from the Fisher Mountain Complex located at the headwaters of Fisher Creek have considerably lower pH values and elevated metal concentrations compared to all other inventoried seeps/springs (**Table 5-12**). Of the 13 individual seeps/springs inventoried in this area, only one (F-5) had near-neutral pH values (i.e. 6.7 and 7.2) while the remaining sample pH values ranged between 3.3 and 5.4 with an average of 4.5. Average metal concentrations were elevated relative to DEQ-7 aquatic life or secondary surface water quality standards for aluminum, cadmium, copper, iron, and manganese as reported in **Table 5-12**.

The Fisher Mountain Complex contains disseminated sulfide mineralization ranging from 1 to 4% throughout. The Complex underlies about 4% of the entire area draining into Fisher Creek and about 45% of the area draining into Fisher Creek above the Glengarry Adit. About 2% of the area draining into Daisy Creek is underlain by the Fisher Mountain Complex.

Groundwater quality upgradient of mined areas

Groundwater has been monitored from wells installed upgradient from mining disturbances at the heads of both Daisy and Fisher Creek drainages. These data (Appendix A in Tetra Tech 2009b) are summarized by drainage in **Table 5-13** and **Table 5-14**. In the Daisy Creek drainage, these wells consist of DCGW-100 completed in a mineralized section of the Meagher Limestone, and Tracer 2 completed in the Fisher Mountain Complex, both located topographically above (upgradient) the McLaren Pit. A third well MW-2 is located at the northwest corner of the pit and is completed in mineralized Wolsey Shale beneath the pit bottom. In the Fisher Creek drainage, four wells are located above mining disturbance in the Como Basin: EPA-11 completed in an intrusive dike within the Fisher Mountain Complex, Tracer 5 in the Fisher Mountain Complex, EPA-12 in the Scotch Bonnet Diorite, and MW-1 completed in mineralized Wolsey Shale.

Groundwater quality from each of these wells shows signs of degradation from naturally occurring mineralization. Wolsey Shale wells in both Daisy (i.e., MW-2) and Fisher (i.e., MW-1) Creek drainages have low pH ranging from 3.2 to 5.0 and dissolved metal concentrations that exceed DEQ-7 surface water quality standards despite those standards being based on total recoverable concentrations. The same is true for Fisher Mountain Complex wells Tracer 2 and Tracer 5 with pH ranging from 3.1 to 4.6 and elevated metals concentrations. Aluminum and iron concentrations are greater in the Daisy Creek wells compared to Fisher Creek wells while the opposite is true for manganese concentrations.

Groundwater from the intrusive dike monitored by EPA-11 had a greater average pH (5.1) compared to the other Fisher Mountain Complex wells. EPA-11 had considerably greater mean concentrations of sulfate (1211 mg/L), cadmium (0.0064 mg/L), iron (280 mg/L), lead (0.15 mg/L), manganese (13.7 mg/L), and zinc (1.07 mg/L) compared to all other wells discussed in this section.

Groundwater monitored in the upgradient mineralized section of the Meagher Limestone by DCGW-100 and in the Scotch Bonnet Diorite by EPA-12 has better water quality than the Wolsey Shale and Fisher Mountain Complex Wells. Mineralization in the Meagher Limestone well, which lies upgradient of the McLaren pit, is below the regional water table, presumably in reduced waters that have not significantly oxidized sulfide minerals in the mineralized interval. Groundwater in these wells has near-neutral pH, and metal concentrations that are low and often below detection limits. However, manganese concentrations in both wells are elevated, ranging from 0.41 to 19.1 mg/L, and iron concentrations measured from EPA-12 range between 27 and 37 mg/L.

Table 5-12.
Summary of Water Quality in Surface Water from Mineralized Areas.

Area Geology	Statistic	pH	Conductivity	Sulfate	Aluminum	Cadmium	Copper	Iron	Lead	Manganese	Zinc
		S.U. ¹	umhos/cm	Total Recoverable Concentrations in Milligrams per Liter							
Eocene rhyodacite porphyry of Lulu Pass	n ²	12	9	4	3	5	5	5	3	5	5
	Minimum	6.4	58	4	0.1	<0.001	<0.01	<0.02	<0.001	<0.02	<0.01
	Mean ³	7.8	87	12	0.1	<0.001	0.06	0.80	0.009	0.08	0.03
	Maximum	8.6	111	36	0.12	0.002	0.23	3.18	0.022	0.26	0.09
Eocene rhyodacite porphyry of Henderson Mountain	n	10	9	2	1	2	2	2	1	2	1
	Minimum	5.8	40	7	<0.1	Both Below Detection (<0.001)	<0.001	<0.03	<0.002	Both Below Detection (<0.02)	0.01
	Mean	6.8	74	17			0.02	0.04			
	Maximum	7.0	100	27			0.03	0.07			
Fisher Mountain Complex (breccia intruded by rhyodacite porphyry)	n	20	24	24	22	15	25	25	11	14	31
	Minimum	3.3	12	4	0.05	<0.0001	<0.001	<0.01	<0.003	0.01	<0.01
	Mean	4.5	101	35	1.52	0.0004	0.52	0.76	<0.003	0.18	0.05
	Maximum	7.2	311	114	6.00	0.001	2.31	11.10	0.003	0.53	0.24
DEQ-7 Standard	Human Health	6.5 to 8.5	No Standard	250	No Standard	0.005	1.3	0.3	0.015	0.05	2.0
	Acute ⁴				0.750 ⁵	0.0010	0.0073	No Standard	0.034	No Standard	0.067
	Chronic ⁴				0.087 ⁵	0.0002	0.0052	1.0	0.0013		0.067

¹ S.U. = Field pH reported in standard units

² n = number of samples

³ Half the reporting limit value was used to calculate means in instances where analytical data were below reporting limits.

⁴ Acute and chronic aquatic life standards calculated for waters having hardness of 50 mg/L and are provided for reference only.

⁵ Aluminum standards are based on dissolved concentrations and only applicable to waters with pH between 6.5 and 9. Values provided for reference only.

Table 5-13.
Summary of Groundwater Quality Wells Upgradient of Mining Disturbance in the Daisy Creek Drainage.

Well (Completion Formation)	Statistic	pH	Conductivity	Sulfate	Aluminum	Cadmium	Copper	Iron	Lead	Manganese	Zinc
		S.U. ¹	umhos/cm	Dissolved Concentrations in Milligrams per Liter							
DCGW-100 (Meagher Limestone)	n ²	11	11	5	4	5	5	5	4	4	4
	Minimum	6.2	533	148	< 0.05	< 0.0001	0.001	0.01	All below detection (< 0.001)	0.41	0.01
	Mean ³	6.9	689	177	< 0.05	0.0003	0.012	0.17		0.74	0.03
	Maximum	7.6	1410	218	0.06	0.0004	0.020	0.32		1.06	0.05
MW-2 (Wolsey Shale)	n	25	23	17	17	17	17	17	17	17	17
	Minimum	3.4	610	372	32.6	< 0.001	0.001	23	< 0.002	0.62	0.21
	Mean	3.9	785	469	41	0.002	0.27	97	0.01	0.99	0.37
	Maximum	4.7	1163	586	51	0.006	0.91	121	0.03	1.30	0.91
Tracer 2 (Fisher Mountain Complex)	n	14	14	10	10	10	10	10	10	10	10
	Minimum	3.1	445	365	41	0.0005	2.73	59.2	< 0.001	0.36	0.14
	Mean	3.7	675	467	54	0.0009	4.19	69.0	0.001	0.42	0.16
	Maximum	4.2	874	607	69	0.0012	8.62	88.2	0.002	0.52	0.21

¹ S.U. = Field pH reported in standard units

² n = number of samples

³ Half the reporting limit value was used to calculate means in instances where analytical data were below reporting limits.

Table 5-14.
Summary of Groundwater Quality Wells Upgradient of Mining Disturbance in the Fisher Creek Drainage.

Well (Completion Formation)	Statistic	pH	Conductivity	Sulfate	Aluminum	Cadmium	Copper	Iron	Lead	Manganese	Zinc
		S.U. ¹	umhos/cm	Dissolved Concentrations in Milligrams per Liter							
EPA-11 (Intrusive dike in Fisher Mountain Complex)	n ²	15	15	9	9	9	9	9	9	9	9
	Minimum	4.0	1.877	995	0.67	0.0018	< 0.001	197	0.02	8.59	0.65
	Mean ³	5.1	1522	1211	3.9	0.0064	0.33	280	0.15	13.7	1.07
	Maximum	5.6	2070	1470	6.9	0.012	0.75	347	0.34	19.1	1.61
EPA-12 (Scotch Bonnet Diorite)	n	17	17	10	10	10	10	10	10	10	10
	Minimum	5.6	285	134	< 0.05	All below detection (< 0.0001)	All below detection (< 0.005)	27.30	All below detection (< 0.001)	1.35	0.03
	Mean	6.3	387	154	< 0.1			31.72		1.61	0.05
	Maximum	7.2	671	180	< 0.1			37.10		2.04	0.08
MW-1 (Wolsey Shale)	n	22	21	17	17	17	17	17	16	17	17
	Minimum	3.2	20	117	< 0.1	< 0.001	< 0.01	11.5	< 0.002	0.99	0.05
	Mean	4.1	652	336	1.2	0.0013	0.35	45.0	0.017	3.41	0.20
	Maximum	5.0	1449	730	4.4	0.0025	1.48	108	0.018	6.76	0.25
Tracer 5 (Fisher Mountain Complex)	n	9	9	10	10	10	10	10	10	10	10
	Minimum	3.1	5.95	206	18.2	<0.0001	0.62	39.7	0.003	0.66	0.04
	Mean	3.8	489	279	24.4	0.0016	3.54	56.0	0.005	0.99	0.31
	Maximum	4.6	667	369	33.7	0.0026	9.33	76.6	0.006	1.37	0.43

¹ S.U. = Field pH reported in standard units

² n = number of samples

³ Half the reporting limit value was used to calculate means in instances where analytical data were below reporting limits.

5.4.4 Comparison of Ferricrete-Based Estimations and Current Water Quality

Close agreement between the semi-quantitative estimates of pre-mining water quality discussed in preceding sections provide an inference as to the extent that metal concentrations and pH conditions currently measured in these creeks are due to natural conditions that would exist in the absence of mine disturbance.

Daisy Creek

Pre-mining mean pH values and copper concentrations in the upper 481 meters of Daisy Creek were estimated to be, respectively, 3.8 and 8.5 mg/L (range 4.1 to 14 mg/L) based on calculations from the ferricrete study. These data are quite similar to those for well Tracer 2 [mean pH of 3.7 and mean dissolved copper concentration of 4.19 mg/L (range 2.73 to 8.62 mg/L) (**Table 5-13**). Tracer 2 is completed in the Fisher Mountain Complex up the hydrologic gradient from historically mined portions of the McLaren Pit and as such is considered representative of pre-mining or undisturbed conditions in the headwaters of Daisy Creek above monitoring station DC-2.

At locations below 481 meters from the head of Daisy Creek, downstream of the McLaren Pit, pre-mining estimates of water quality (pH range 4.2 to 4.4 and copper concentration range 2.9 to 3.9) were calculated and are similar to those currently measured at DC-2 suggesting that current water quality conditions at these locations are similar to those that existed prior to mining.

These data all support the hypothesis that natural mineralization in the Fisher Mountain Intrusive Complex and in the vicinity of the exposed McLaren massive sulfide deposit was a major source of acidity and metal release prior to mining. While inflows located north of the McLaren Pit improve Daisy Creek water quality through dilution, metal concentrations in these inflows are too high to meet DEQ-7 standards either on their own or upon mixing with surface water in Daisy Creek.

Fisher Creek

Pre-mining pH values for the reach of Fisher Creek upstream of the Glengarry Adit are estimated to be between 3.5 and 3.8 (similar to Daisy Creek) based on ferricrete / iron precipitate calculations. These data are similar to that for monitoring well Tracer 5 (pH range 3.1 to 4.6, mean 3.8) (**Table 5-14**) which is completed in the Fisher Mountain Complex in the Como Basin. Calculated estimates are less than the mean pH measured in seeps and springs originating from the Fisher Mountain Complex (4.5) or in monitoring well MW-1 completed in mineralized Wolsey Shale in the Como Basin (4.1) however this could be attributed to reasons explained in Section 5.4.2, in which case mean data for seeps and springs of the Fisher Mountain Complex may provide a reasonable representation of pre-mining pH conditions in the Fisher Creek headwaters.

Estimated pre-mining copper concentrations above the Glengarry Adit were calculated to range between 0.5 to 0.64 mg/L. These concentrations bracket the mean of 0.52 mg/L for seeps and springs originating in the Fisher Mountain Complex (**Table 5-12**) which underlies about 45% of the area draining into Fisher Creek above the Glengarry Adit. Estimated pre-mining copper concentrations were also similar to those measured during the study described in Section 5.4.2

which suggests current water quality reflects natural conditions in the Fisher Creek headwaters above the Glengarry Adit.

In September 2008 (after closure of the Glengarry adit), measured pH at SW-3 (995 m) was 4.0, somewhat lower than the pre-mining value of 4.8 estimated from the ferricrete study for this site. At SW-3, the September 2008 total recoverable copper concentration was 0.67 mg/L, somewhat higher than the estimated pre-mining value of 0.26 mg/L. The pre-mining estimates for pH and copper concentration are similar to those measured in July 2008 (pH of 5.4 and copper concentration of 0.21 mg/L) (**Table 5-5**) and are also similar to mean high flow data collected after closure of the Glengarry Adit (pH = 5.3, copper = 0.32 mg/L) (Table A-2 in **Appendix A**). These data indicate that current high flow data collected at SW-3 provide a reasonable estimate of pre-mining pH and metal concentrations at this location.

As was the case prior to mining, naturally occurring acidic and metal-rich inflows contribute metals to Fisher Creek below the Glengarry Adit. These natural sources of loading contribute a greater proportion of the total metal load in Fisher Creek compared to mine related sources and contribute to water quality in downstream reaches of Fisher Creek that are similar today to what they were prior to mining. Nimick et al. (2009) estimates that pre-mining and post-mining pH and copper concentrations converged to similar values around 2,000 m below the head of Fisher Creek (**Figure**).

5.4.5 Potential for Additional Water Quality Improvement Through Further Reclamation

A loading exercise was presented by Tetra Tech (2009b) whereby point source loads in Daisy and Fisher Creek drainages were subtracted from the total in-stream loads. The resulting total loads were then converted to concentrations based on stream flow rates to yield estimates of metal concentrations that could be expected in the creeks if additional reclamation activities were successful in completely eliminating adit discharges or removing 100% of the metals currently transported in the adit discharge. These calculations are based on the conservative assumption that current water quality in Daisy and Fisher Creeks is influenced by adit discharge with no consideration for the likelihood that attenuation mechanisms reduce metal loads in adit discharge prior to contact with water in the creeks. Calculations for Fisher Creek only include data for SW-3 and the The Sheep Mountain #1, Lower Tredennic Dump #1, and the Glengarry Mill Site Adits. This is because loads of some metals increased between the downstream monitoring stations SW-4 and CFY-2 by an amount greater than that in seepage from the Gold Dust Adit suggesting that cumulative loading occurs from natural sources below SW-3. More detail of the data and calculations used for this exercise are provided by Tetra Tech (2009b).

Results of these calculations (**Table 5-15** and **Table 5-16**) show that only minor improvements in water quality would be achieved if additional reclamation was conducted to stem or treat adit discharges. In Daisy Creek, the predicted decrease in metal concentrations would not result in compliance with DEQ-7 standards that are not currently met. The same is true for Fisher Creek near SW-3 where the calculations indicate that complete stemming of adit flow would conceptually result in an increase in some Fisher Creek metal concentrations because the adit discharge loads are sufficiently low to provide a degree of dilution upon mixing with stream water.

Table 5-15 Calculated Pre-mining Water quality at DC-2 without loading from McLaren Pit drains or adit.						
Scenario	Aluminum	Cadmium	Copper	Lead	Manganese	Zinc
	Total Recoverable Concentrations in Milligrams Per Liter					
Low Flow Conditions (Sept. 2006)						
Actual Measured Concentration at DC-2	12.4	0.0043	3.17	0.004	2.14	0.55
Pre-Mining Estimate (No Flow) ¹	11.7	0.0041	2.60	0.004	2.04	0.48
Alternate Pre-Mining Estimate (Diluting Flow) ²	10.0	0.0035	2.22	0.004	1.74	0.41
High Flow Conditions (June 2006)						
Actual Measured Concentration at DC-2	3.12	0.0005	0.69	0.002	0.34	0.1
Pre-Mining Estimate (No Flow) ¹	2.67	0.0003	0.43	0.002	0.28	0.1
Alternate Pre-Mining Estimate (Diluting Flow) ²	2.62	0.0003	0.43	0.002	0.28	0.1
DEQ-7 Standards						
Human Health	No Standard	0.005	1.3	0.015	0.05	2.0
Acute ³	0.750 ⁴	0.0021	0.014	0.082	No Standard	0.12
Chronic ³	0.087 ⁴	0.0003	0.0093	0.0032		0.12

- 1 Assumes that no flow from McLaren subsurface drains or McLaren adit reaches Daisy Creek at DC-2.
- 2 Assumes that McLaren subsurface drain and adit flow does reach Daisy Creek at DC-2 but that this flow delivers no metal load.
- 3 Acute and chronic aquatic life standards calculated for waters having hardness of 100 mg/L and are provided for reference only.
- 4 Aluminum standards are based on dissolved concentrations and only applicable to waters with pH between 6.5 and 9. Values provided for reference only.

Table 5-16 Calculated Pre-mining Water quality in Fisher Creek without loading from adits.							
Scenario	Aluminum	Cadmium	Copper	Iron	Lead	Manganese	Zinc
	Total Recoverable Concentrations in Milligrams Per Liter						
Actual Measured Concentration at SW-3	2.06	0.0007	0.73	1.17	0.002	0.48	0.13
Pre-Mining Estimate (No Flow) ¹	2.17	0.0007	0.78	1.17	0.002	0.50	0.14
Alternate Pre-Mining Estimate (Diluting Flow) ²	1.87	0.0006	0.67	1.01	0.002	0.43	0.12
DEQ-7 Standards							
Human Health	No Standard	0.005	1.3	0.30	0.015	0.05	2.0
Acute ³	0.750 ⁴	0.0021	0.014	No Standard	0.082	No Standard	0.12
Chronic ³	0.087 ⁴	0.0003	0.0093				1.0

- 1 Assumes that no flow from adits reaches Fisher Creek at confluence with Polar Star Creek.
- 2 Assumes that adit flow does reach Fisher Creek at confluence with Polar Star Creek but that this flow delivers no metal load.
- 3 Acute and chronic aquatic life standards calculated for waters having hardness of 100 mg/L and are provided for reference only.
- 4 Aluminum standards are based on dissolved concentrations and only applicable to waters with pH between 6.5 and 9. Values provided for reference only.

6.0 CONCLUSIONS

Surface water quality in the New World Mining District, particularly in Daisy and Fisher Creeks, does not meet DEQ-7 numeric water quality standards for a number of constituents including cadmium, copper, iron, lead, manganese, and zinc. However, compliance with Montana's water quality regulations can be further evaluated based on language included in section 75-5-306 MCA;

(1) *It is not necessary that wastes be treated to a purer condition than the natural condition of the receiving stream as long as the minimum treatment requirements established under this chapter are met.*

(2) *"Natural" refers to conditions or material present from runoff or percolation over which humans have no control or from developed land where all reasonable land, soil, and water conservation practices have been applied.*

The data presented in this report are evaluated below with respect to 75-5-306 MCA(1) and (2) to determine whether further treatment of District point sources is necessary for compliance with Montana water quality regulations.

6.1 COMPARISON OF POINT SOURCES IN DAISY CREEK WITH NATURAL WATER QUALITY

Data presented in Section 5.4 support the hypothesis that natural mineralization in the Fisher Mountain Intrusive Complex and in the vicinity of the exposed McLaren massive sulfide deposit was a major source of acidity and metal release prior to mining. While tributary inflows located north of the McLaren Pit improve Daisy Creek water quality through dilution, metal concentrations in these inflows, which were not impacted by mining, are too high to meet DEQ-7 standards either on their own or upon mixing with surface water in Daisy Creek. Pre-mining estimates of pH and copper concentrations closely match post-mining data for the reaches of Daisy Creek below 481 m, including monitoring station DC-2 located at 1,105 m suggesting that current water quality in these locations reflect naturally occurring conditions.

The 0 and 481 m segment of Daisy Creek is not routinely monitored and therefore data are not available to assess in detail the range of post-mining metal concentrations that occur. Water in this segment is generally known to be poor. Based on the observation of Nimick et. al (2009), both pre-mining and post-mining copper concentrations (8.8 mg/L and 11.7 mg/L respectively) are on the order of 1000 times greater than DEQ-7 aquatic standards for Daisy Creek and differ from one another by only 2.9 mg/L.

Discharge from the McLaren Adit and the three McLaren Pit subsurface drains report to the surface in the vicinity of the 0 to 481 m reach of Daisy Creek. The McLaren Adit discharge (**Table 5-3**) has lower concentrations of all monitored metals, except for iron (which is not conserved in surface water, i.e., it precipitates out as ferri-hydroxide deposits on clastic stream substrate), compared to concentrations at the nearest regularly monitored station on Daisy Creek (DC-2) (**Table 5-1** and Table A-2 in **Appendix A**), and has copper concentrations that are well below those estimated to have been present in the this stream segment prior to mining. Therefore, it is likely that the McLaren Adit discharge exists in "*a purer condition than the natural condition of the receiving stream*" and does not require treatment to comply with Montana water quality regulations.

While discharge from the three McLaren Pit subsurface drains is of poor quality, copper is the only metal with average concentrations more than 1000 times greater than DEQ-7 water quality standards. This provides some support for the hypothesis that these discharges exist in a condition that is the same as “*the natural condition of the receiving stream*”.

Average copper concentrations in discharge from subsurface drains DCSW-101 and DCSW-102, which have much greater flow than DCSW-103, are about 1000 time greater than the acute aquatic life standard, and therefore, may have overall quality that is similar to pre-mining water quality conditions in the 0 and 481 m segment of Daisy Creek as calculated by Nimick (2009). Perhaps more relevant is the origin of the subsurface drain discharge described in Section 3.1. Because this water originates from naturally occurring bedrock springs surfacing along the McLaren Pit high wall, and because copper concentrations in two of the discharges appear similar to those of estimated pre-mining concentrations in the 0 and 481 m segment of Daisy Creek, it is possible that these springs also surfaced historically in the same area on pre-mining topography and influenced pre-mining water quality in the same stream segment (i.e. it may be that water in the pre-mining channel originated from these very same springs). In addition, the quality of the water discharging from these naturally occurring bedrock springs is very similar to that of background monitor wells upgradient of the McLaren deposit (Tracer 2 and MW-2, section 5.3.4 above) completed in altered and pyritic portions of the Fisher Mountain Intrusive complex. These observations suggest that the statement “*is not necessary that wastes be treated to a purer condition than the natural condition of the receiving stream*” may also apply to the subsurface drains, which in turn would require no further treatment to comply with Montana water quality regulations.

6.2 COMPARISON OF POINT SOURCES IN FISHER CREEK WITH NATURAL WATER QUALITY

Data presented in Section 5.4 suggest mineralization in the Fisher Mountain Intrusive Complex in the Como Basin is responsible for acidity and metal release in the headwaters of Fisher Creek above the Glengarry Adit. As discussed above (section 5.4.2), current water quality in this stream segment is likely similar to that that existed prior to mining except that lower pH values may have been the norm prior to completion of the Como Raise in the early 1930s. Similarly, ferricrete-based estimation equations and the presence of acidic metal-rich natural inflows to Fisher Creek suggest that pre-mining water quality was similar to present water quality in downstream reaches of Fisher Creek, particularly below 2,000 m.

Pre-mining estimates for pH and copper concentration are most similar to mean high flow data measured after closure of the Glengarry Adit (pH = 5.3, copper = 0.32 mg/L) (Table A-2 in **Appendix A**). These data indicate that mean high flow data collected at SW-3 provide a reasonable estimate of pre-mining pH and metal concentrations at this location.

In addition, the quality of groundwater in monitoring wells (Tracer 2 and MW-2, section 5.3.4 above) completed in altered and pyritic portions of the Fisher Mountain Intrusive complex upgradient of the Glengarry adit, is very similar to that of existing and pre-mining surface water quality in the upper reaches of Fisher Creek.

There are four discharging adits in the Fisher Creek drainage that do not meet DEQ-7 numeric water quality standards (Section 5.2.2 and **Table 5-8**). The Sheep Mountain #1 (non District Property), Lower Tredennic Dump #1, and Henderson Mountain Dump 7 Adits typically have very low flow that infiltrates into the ground before reaching surface water. At the Lower

Tredennic Dump #1 and Henderson Mountain Dump 7 Adits infiltration galleries further enhances infiltration. No direct discharge to surface water occurs at any of these locations.

Drainage from Sheep Mountain #1 (non District Property) and Lower Tredennic Dump #1 infiltrates to groundwater that probably contributes base-flow to Polar Star Creek a tributary to Fisher Creek approximately 100 meters below monitoring station SW-3. Polar Star Creek is not monitored and therefore no comparison to water quality in this tributary can be made. Natural, pre-mining water quality at the confluence of Polar Star and Fisher Creeks appears to be best represented by mean high flow data after closure of the Glengarry Adit (Table A-2 in **Appendix A**). Comparison of these data to those for the Lower Tredennic Dump #1 Adit (**Table 5-8**) shows that only cadmium concentrations are greater than both DEQ-7 numeric standard (for chronic aquatic life) and estimated natural water quality in Fisher Creek. For the Sheep Mountain #1 Adit (non-District property), concentrations of cadmium and zinc exceed DEQ-7 aquatic life standards and the lead concentration exceeds aquatic life and human health standards. Aside from these three metals, concentrations of other monitored constituents in discharge from Sheep Mountain Dump #1 Adit are either in compliance with numerical standards or are less than or similar to estimated pre-mining water quality in Fisher Creek.

Drainage from the Henderson Mountain Dump 7 Adit infiltrates to groundwater that contributes base-flow to a small tributary and that ultimately flows into Fisher Creek at a location between SW-4 and CFY-2. Concentrations of most monitored metals in this adit discharge are considerably greater than both DEQ-7 numeric standards and average concentrations at SW-4 and CFY-2 (Table A-2 in **Appendix A**).

Unlike the other three adits in the Fisher Creek drainage, the Gold Dust Adit has a sustained discharge that is more than the combined flow of the other three adits. Flow from this adit typically infiltrates into the ground prior to reaching the main stem of Fisher Creek however the infiltrated groundwater likely contributes to base-flow in Fisher Creek at a location upstream of SW-4. Mean metal concentrations in discharge from the Gold Dust Adit (**Table 5-8**) are less than DEQ-7 standards as well as mean data from SW-4 for all but iron, lead, and manganese (Table A-2 in **Appendix A**). Iron and manganese concentrations exceed only aesthetic based secondary standards for these metals while the mean lead concentration (0.002 mg/L) exceeds the chronic aquatic life standard and is biased by one data from one sample collected on June 2006 (0.005 mg/L, Table A-4 in **Appendix A**). Excluding this sample from the mean calculation would result in a lead concentration that is similar to that for SW-4 and in compliance with all DEQ-7 standards. These data suggest that Gold Dust Adit discharge is of quality that is as pure as *“the natural condition of the receiving stream”* and therefore is in compliance with Montana water quality regulations.

6.3 COMPARISON OF POINT SOURCES IN MILLER CREEK WITH NATURAL WATER QUALITY

Because mineralized rock does not outcrop in the Miller Creek drainage other than in narrow vein structures, the relatively good water quality currently monitored in Miller Creek likely existed prior to mining.

The four adit discharges in the Miller Creek drainage from vein-type mineralization (Black Warrior, Henderson Mountain, Upper Miller Creek (on non-District property), and Little Daisy) all exceed water quality standards for a number of metals and have water quality that is worse than what occurs naturally in Miller Creek. These conditions mean that the adit discharges are not exempt from treatment based on 75-5-306 MCA(1). However adit discharges from each of

these adits infiltrates to groundwater that subsequently likely contributes to base-flow in Miller Creek and therefore, none of the four adits discharge directly to surface water.

6.4 SUMMARY OF CONCLUSIONS

Comparison of point source discharge water quality with estimates of pre-mining water quality suggest that discharges in the Daisy Creek drainage (i.e. the McLaren Adit and the three McLaren Pit subsurface drains) are actually in compliance with Montana water quality regulations despite having poor water quality. This is because these point sources have water quality that is the same as or better than that estimated for the pre-mining setting in the segments of Daisy Creek to which they discharge. For this reason, treatment of these discharges would result in their being “*treated to a purer condition than the natural condition of the receiving stream...*” which is not required under section 75-5-306 MCA(1).

In the Fisher Creek drainage, the Gold Dust Adit discharge infiltrates to groundwater and enters Fisher Creek as a contribution to base-flow at a point where current water quality is estimated to be the same as what existed prior to mining. This adit discharge has mean metal concentrations that are less than those of the receiving stream except for iron, lead, and manganese. The mean lead concentration is biased by a single data point collected in 2006 while most of the remaining data-points, including the mean value based on them, show lead concentrations that are similar to the receiving stream and in compliance with DEQ-7 standards. Iron and manganese are aesthetic based guidelines that are not enforceable. For these reasons treatment of the Gold Dust adit discharge would result in it being “*treated to a purer condition than the natural condition of the receiving stream...*” which is not required under section 75-5-306 MCA(1).

Whether remaining adits in Fisher and Miller Creek would be exempted from treatment under section 75-5-306 MCA(1) is not as clear because these adits have concentrations of at least one constituent, and often more, that exceeds DEQ-7 standards as well as estimated pre-mining water quality in the respective receiving stream. However, these adits typically produce low flows that infiltrate to groundwater and do not discharge directly to surface water. Furthermore, no impact to down-gradient receiving waters can be measured.

Local increases in copper concentrations as detected during an ionic tracers synoptic sampling study in Miller Creek surface water (Cleasby and Nimick 2002) occur well down-gradient (>1500 feet) of infiltrated discharge from the Henderson Mountain adit, and more likely result from discharges from copper-rich fens located uphill of the Miller Creek road and only a few hundred feet from Miller Creek.

In the case of Fisher Creek, load-based calculations assuming a direct discharge to surface water (which is not the case) indicate that additional treatment of adit discharge would not sufficiently improve water quality in Fisher Creek to an extent that would comply with DEQ-7 numeric standards for any constituent that is currently not in compliance (Section 5.4.5). The same is true for Daisy Creek and Miller Creek.

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APPENDIX A
Surface Water Monitoring Data

TABLE A-1
ADIT DISCHARGE SAMPLING SUMMARY
New World Mining District Adit Discharge Engineering Evaluation/Cost Analysis

Adit Station #	Site Name	Other Station Identifier	Location	Last pH (su)	Flow (gpm)		No. of Samples	Last Sampled
					Range	Last		
FISHER CREEK DRAINAGE								
F-28	Gold Dust Adit	FCSI-96-1 FCSI-96-1A	Middle Fisher Creek Valley; portal	6.9	1.3-247	4.4	43	9/22/2008
F-28-367	Gold Dust underground sample	F-28-367 FCSI-96-1A-367	367 feet from portal	7.9	1.5	1.5	1	8/14/2003
F-28-111	Gold Dust underground sample	GDPT 111	730 feet from portal	7.7	--	--	1	3/29/1992
F-28-112	Gold Dust underground sample	GDPT 112	730 feet from portal	7.7	--	--	1	3/29/1992
F-28-800	Gold Dust underground sample	RR-GD-800	800 feet from portal	6.9	38.6	38.6	1	9/16/2004
F-28-D1	Gold Dust underground sample	FCSI-96-1A-D1	Drill station D1; 1850 feet from portal	7.7	0.5	0.5	1	8/14/2003
F-28-D2	Gold Dust underground sample	GDDS 2	Drill station D2; about 2000 feet from portal	8.2	--	--	2	3/28/1992
F-28-D3	Gold Dust underground sample	FCSI-96-1A-D3	Drill station D3; about 2150 feet from portal	7.7	7	7	1	8/14/2003
F-8A	Glengarry Adit	FCSI-96-2A	Glengarry Mine at base of Lulu Pass switchbacks in Fisher Creek	6.9	0.45-219	0.45	80	6/12/2007
F-8B	Glengarry Millsite Adit	FCSI-96-4	Glengarry Millsite adit	3.4	0.8-26.9	3.1	9	8/15/2008
F-8	Glengarry Middle Adit	--	Middle adit between main adit and millsite	3.5	0-1.4	Dry	7	8/26/2004
FCSI-99-1	Sheep Mountain #1 (NDP) ³	--	Upper Tredennic basin, flank of Sheep Mountain	7.26	0.003-10	0.003	7	9/17/2007
FCSI-96-15-1	Upper Tredennic Dump 1	FCSI-96-15	Upper Tredennic basin	3.3	0-1.0	Dry	4	7/28/2004
FCSI-96-15-2	Upper Tredennic Dump 2	--	Upper Tredennic basin	2.9	0-0.5	Dry	3	7/16/2003
FCSI-96-6	Middle Tredennic Dump 1	--	Lower Tredennic basin	4.8	0-10	Dry	6	7/28/2004
FCSI-96-5	Lower Tredennic Dump 1	--	Lower Tredennic Basin	5.9	0.27-5	1.5	8	9/22/2008
F-2	Lower Spaulding Dump	FCSI-96-8 Lulu-1	South side of Lulu Pass	2.6	0-0.9	Dry	6	7/13/2001

**TABLE A-1
ADIT DISCHARGE SAMPLING SUMMARY
New World Mining District Adit Discharge Engineering Evaluation/Cost Analysis**

Adit Station #	Site Name	Other Station Identifier	Location	Last pH (su)	Flow (gpm)		No. of Samples	Last Sampled
					Range	Last		
FCSI-96-7	Middle Spaulding	--	South side of Lulu Pass	--	--	Dry	3	8/27/2004
FCSI-99-71	Henderson Mountain Dump 10	--	Above upper road to Homestake Mine	7.5	0-12	Dry	3	7/27/2004
FCSI-99-73	Henderson Mountain Dump 13	--	SE Henderson Mt, off Henderson Mt Rd	6.6	5-15	15	3	7/27/2004
AE-17	Henderson Mountain Dump 7	FCSI-99-68	SE Henderson Mt, off Henderson Mt Rd.	6.2	0-5	2.0	7	7/27/2004
DAISY CREEK DRAINAGE								
D-18	McLaren Adit	DCSI-96-1	W flank of Fisher Mountain; portal	5.9	1.8-29.6	6.0	31	9/23/2008
D-18-366	McLaren Mine underground	--	Borehole 366 feet in from portal	7.1	0-5.5	Dry	2	8/7/2003
D-18-423	McLaren Mine underground	--	Caved area 423 feet in from portal	7.1	1.5-4.7	4.7	2	8/7/2003
DCSI-99-102	Near McLaren Pit	--	Headwall below county road east of McLaren Pit	--	0	Dry	2	7/29/2004
DCSI-96-3-1	Daisy Pass Dump 1	--	Below Daisy Pass	6.8	<0.1-2	1.0	3	7/29/2004
DCSI-96-6	West of Como Dump 1	--	West side of Lulu pass, Goose Creek	--	0	Dry	2	7/29/2004
MILLER CREEK DRAINAGE								
M-8	Black Warrior Adit	MCSI-96-2; M-4; PA# 34-079	SE Bull of the Woods Pass	7.1	0.1-10	0.2	19	9/18/2007
MCSI-96-3	Upper Miller Creek Dump	--	Near Black Warrior, private land	5.9	0.04-2	0.27	7	9/18/2007
M-1	Little Daisy Adit	MCSI-96-6	SE Daisy Pass	6.8	0.5-220	8.9	24	9/23/2008
M-10	Upper Little Daisy Adit	--	Shaft above Little Daisy Adit	7.84	0-5.8	--	5	9/26/1991
M-25	Henderson Mt Adit	--	SW side Henderson Mountain; above Daisy Pass road	7.0	<0.04-25	<0.04	9	8/20/2007

TABLE A-1
ADIT DISCHARGE SAMPLING SUMMARY
New World Mining District Adit Discharge Engineering Evaluation/Cost Analysis

Adit Station #	Site Name	Other Station Identifier	Location	Last pH (su)	Flow (gpm)		No. of Samples	Last Sampled
					Range	Last		
SODA BUTTE CREEK DRAINAGE								
SBSI-99-74	Woody Ck. Mine Dump 1 (NDP)	--	Woody Creek, Mohawk claim	6.9	3.1-10	4.0	3	7/29/2004
AE-12	Reeb #1	--	SE flank of Henderson Mountain	3.3	0	Dry	2	7/7/2001
SBSI-99-85	Alice E. Millsite seep (NDP)	AE-6	S Henderson Mountain	5.4	0-10.0	4.0	4	7/29/2004
SBSI-99-87	Soda Butte Dump 8 (NDP)	--	Off Miller Mt Road, near Cooke City	6.9	3-100	3	4	7/29/2004
SBSI-99-95	Soda Butte Dump 1 (NDP)	--	Off Miller Mt Road, near Cooke City	7.4	0-0.1	Dry	3	7/29/2004

Notes: NDP = Non-District Property
(1) Monitored in July, August, and September 2003
(2) monitored in July and October 2003

TABLE A-2 - STATISTICAL SUMMARY OF WATER QUALITY DATA 1989-2008
New World Mining District Response and Restoration Project

Sample Station	Sample Date	Data Source	Flow (cfs)	Flow Flag	Field pH (su)	Aluminum Total Rec. (mg/l)	Al(calc)	Al Flag	Arsenic Total Rec. (mg/l)	As(calc)	As Flag	Cadmium Total Rec. (mg/l)	Cd(calc)	Cd Flag	Chromium Total Rec. (mg/l)	Cr(calc)	Cr Flag	Copper Total Rec. (mg/l)	Cu(calc)	Cu Flag	Iron Total Rec. (mg/l)	Fe(calc)	Fe Flag	Lead Total Rec. (mg/l)	Pb(calc)	Pb Flag	Manganese Total Rec. (mg/l)	Mn(calc)	Mn Flag	Zinc Total Rec. (mg/l)	Zn(calc)	Zn Flag	
Chronic Standard (for Hardness = 50 mg/l)						0.087			0.15			0.00142			0.117			0.0052			1			0.0005			NA			0.067			
Acute Standard (for Hardness = 50 mg/l)						0.75			0.34			0.00206			0.984			0.0073			NA			0.014			NA			0.067			
CFY-2	9-Aug-90	Hydrometrics	0.69		6.78	0.1	0.1	0.0050	0.0025	<	0.00100	0.0005	<	0.0200	0.01	<	0.05	0.05				0.12	0.12		0.01	0.005	<	0.04	0.04		0.02	0.01	<
CFY-2	5-Jun-91	Hydrometrics	91.6		7.05	0.5	0.5	0.0010	0.0005	<	0.00010	0.00005	<	0.0200	0.01	<	0.06	0.03	<			0.83	0.83		0.002	0.002		0.03	0.03		0.01	0.005	<
CFY-2	9-Jul-91	Hydrometrics	4.7		8.62	0.1	0.05	<	0.0050	0.0025	<	0.00020	0.0002		0.0200	0.01	<	0.06	0.06			0.25	0.25		J	0.0200	J	0.03	0.03		0.03	0.03	
CFY-2	13-Aug-91	Hydrometrics	2.4		8.6	0.1	0.1	0.0050	0.0025	<	0.00020	0.0002		0.0200	0.01	<	0.052	0.052				0.06	0.06		0.002	0.001	<	0.04	0.04		0.04	0.04	
CFY-2	24-Sep-91	Hydrometrics	1.4		9.22	0.1	0.05	<	0.0050	0.0025	<	0.00010	0.00005	<	0.0200	0.01	<	0.017	0.017			0.03	0.015	<	0.002	0.001	<	0.02	0.01	<	0.01	0.01	
CFY-2	23-Jul-93	Hydrometrics	17.03		7.44	0.3	0.3	0.0010	0.0005	<	0.00010	0.0001		0.0010	0.0005	<	0.11	0.11				0.42	0.42		0.002	0.001	<	0.05	0.05		0.03	0.015	<
CFY-2	21-Sep-93	Hydrometrics	2.46		7.3	0.1	0.1	0.0010	0.0005	<	0.00020	0.0002		0.0010	0.0005	<	0.06	0.06				0.17	0.17		0.002	0.001	<	0.04	0.04		0.028	0.028	
CFY-2	15-Jun-94	Hydrometrics	39.63		6.23	0.2	0.2	0.0010	0.0005	<	0.00010	0.00005	<	0.0010	0.0005	<	0.05	0.05	J			0.2	0.2		0.002	0.001	<	0.03	0.03		0.012	0.012	J
CFY-2	6-May-99	Maxim	0.091		7.35	0.1	0.05	<	0.0050	0.0025	<	0.00010	0.00005	<	0.004	0.004						0.01	0.005	<	0.001	0.0005	<	0.005	0.0025	<	0.01	0.005	<
CFY-2	9-Jul-99	Maxim	21.46		7.24	0.2	0.2				0.00010	0.0001		0.009	0.009							0.23	0.23		0.001	0.0005	<	0.019	0.019		0.04	0.04	
CFY-2	29-Sep-99	Maxim	2.071		7.33	0.1	0.05	<			0.00020	0.0002		0.022	0.022							0.04	0.04		0.001	0.0005	<	0.017	0.017		0.04	0.04	J
CFY-2	13-Apr-00	Maxim	0.658		8.02	0.05	0.025	<			0.00010	0.00005	<	0.008	0.008							0.05	0.025	<	0.001	0.0005	<	0.005	0.0025	<	0.02	0.01	<
CFY-2	8-Jul-00	Maxim	20.55		6.19	0.2	0.2	J			0.00010	0.00005	<	0.068	0.068	J						0.24	0.24	J	0.001	0.0005	<	0.035	0.035	J	0.02	0.02	J
CFY-2	22-Sep-00	Maxim			7.09	0.1	0.05	<			0.00010	0.00005	<	0.004	0.004							0.01	0.01		0.001	0.0005	<	0.003	0.0015	<	0.01	0.005	<
CFY-2	28-Sep-00	Maxim			7.1	0.1	0.05	<			0.00010	0.00005	<	0.01	0.01							0.03	0.03		0.001	0.0005	<	0.004	0.004		0.01	0.005	<
CFY-2	10-Oct-00	Maxim				0.1	0.05	<			0.00010	0.00005	<	0.01	0.01							0.05	0.025	<	0.003	0.0015	<	0.005	0.0025	<	0.02	0.01	<
CFY-2	19-Oct-00	Maxim			6.19	0.1	0.05	<			0.00010	0.00005	<	0.008	0.008							0.05	0.025	<	0.001	0.0005	<	0.004	0.004		0.01	0.01	
CFY-2	21-Apr-01	Maxim	0.48		7.47	0.1	0.05	<			0.00010	0.00005	<	0.005	0.005							0.01	0.005	<	0.001	0.0005	<	0.003	0.0015	<	0.01	0.01	
CFY-2	26-Jun-01	Maxim	30.66		6.95	0.1	0.05	<			0.00010	0.0001		0.054	0.054							0.24	0.24		0.002	0.002	J	0.024	0.024		0.01	0.005	<
CFY-2	11-Oct-01	Maxim	0.49		6.42	0.1	0.05	<	0.0030	0.0015	<	0.00010	0.00005	<	0.007	0.007						0.05	0.025	<	0.001	0.0005	<	0.003	0.0015	<	0.03	0.03	J
CFY-2	28-Apr-02	Maxim	0.28		6.5	0.1	0.05	<			0.00010	0.00005	<	0.007	0.007							0.02	0.02		0.001	0.0005	<	0.005	0.005		0.03	0.03	
CFY-2	14-Jul-02	Maxim	13		7.51	0.3	0.3	J			0.00010	0.00005	<	0.06	0.062							0.34	0.34		0.001	0.001		0.01	0.01		0.04	0.04	J
CFY-2	8-Oct-02	Maxim	0.027		7.92	0.1	0.05	<			0.0002	0.0002		0.008	0.008							0.03	0.03		0.001	0.0005	<	0.003	0.0015	<	0.03	0.03	J
CFY-2	22-Apr-03	Maxim	0.002		6.47	0.05	0.025	<			0.00010	0.00005	<	0.004	0.004							0.09	0.09		0.001	0.0005	<	0.003	0.0015	<	0.01	0.005	<
CFY-2	1-Jul-03	Maxim	4		6.35	0.17	0.17				0.0001	0.00005	<	0.04	0.04							0.19	0.19		0.001	0.0005	<	0.024	0.024		0.01	0.005	<
CFY-2	30-Sep-03	Maxim	0.014		5.67	0.05	0.025	<			0.0001	0.00005	<	0.008	0.008							0.01	0.01		0.001	0.0005	<	0.003	0.0015	<	0.01	0.01	
CFY-2	6-Apr-04	Maxim	0.045		7.38	0.05	0.025	<			0.0001	0.00005	<	0.004	0.004							0.01	0.005	<	0.001	0.0005	<	0.005	0.0025	<	0.02	0.02	JF%
CFY-2	28-Jun-04	Maxim	2.48		7.8	0.08	0.08				0.0001	0.00005	<	0.035	0.035							0.13	0.13		0.001	0.0005	<	0.013	0.013		0.01	0.005	<
CFY-2	5-Oct-04	Maxim	4.33		7.25	0.08	0.08				0.0001	0.0001		0.002	0.002							0.04	0.04		0.001	0.0005	<	0.01	0.01		0.03	0.03	
CFY-2	5-Apr-05	Maxim	0.54		7.57	0.05	0.025	<			0.0001	0.00005	<	0.004	0.004							0.01	0.01		0.001	0.0005	<	0.003	0.0015	<	0.01	0.005	<
CFY-2	6/28/2005	Maxim	58.17		6.3	0.2	0.2		--	--	0.0001	0.00005	<	0.045	0.045							0.2	0.2		0.001	0.001		0.021	0.021		0.02	0.02	
CFY-2	10/11/2005	Maxim	0.77		6.86	0.05	0.025	<			--	0.0001	0.00005	<	--	0.009	0.009					0.01	0.005	<	0.001	0.0005	<	0.003	0.0015	<	0.01	0.01	
CFY-2	26-Apr-06	Maxim	0.92		6.9	0.05	0.025	<			--	0.0001	0.00005	<	--	0.008	0.008					0.01	0.005	<	0.001	0.0005	<	0.003	0.0015	<	0.01	0.005	<
CFY-2	28-Jun-06	Maxim	34.94		7.3	0.16	0.16				0.0001	0.00005	<	0.045	0.045							0.17	0.17		0.001	0.0005	<	0.025	0.025		0.01	0.005	<
CFY-2	26-Sep-06	Maxim	0.87		7.2	0.05	0.025	<			0.0001	0.00005	<	0.007	0.007							0.01	0.005	<	0.001	0.0005	<	0.003	0.0015	<	0.09	0.09	
CFY-2	11-Apr-07	Tt	0.837		6.57	0.05	0.025	<			--	0.0001	0.00005	<	--	0.005	0.005					0.01	0.005	<	0.001	0.0005	<	0.003	0.0015	<	0.01	0.005	<
CFY-2	12-Jun-07	Tt	43.4		6.3	0.14	0.14				--	0.0001	0.00005	<	--	0.04	0.04					0.13	0.13		0.001	0.0005	<	0.01	0.01		0.01	0.005	<
CFY-2	17-Sep-07	Tt	0.915		6.87	0.05	0.025	<			--	0.0001	0.00005	<	--	0.008	0.008					0.01	0.01		0.001	0.0005	<	0.003	0.0015	<	0.01	0.005	<
CFY-2	17-Apr-08	Tt	0.74		5.16	0.05	0.025	<			0.0001	0.00005	<	0.007	0.007							0.01	0.005	<	0.001	0.0005	<	0.003	0.0015	<	0.01	0.01	
CFY-2	22-Sep-08	Tt	1.675		6.7	0.05	0.025	<			0.0001	0.00005	<	0.012	0.012							0.01	0.005	<	0.001	0.001	JF%	0.006	0.006		0.01	0.01	
CFY-2	14-Jul-08	Tt	60.47		7.19	0.06	0.06				0.0001	0.00005	<	0.033	0.033							0.14	0.14		0.001	0.0005	<	0.016	0.016		0.01	0.005	<
Station CFY-2: Pre-1999 Samples (n)			8		8		8				8				8						8			7			8				8		
Minimum			0.690		6.230	0.050		0.001			0.0001		0.001		0.001			0.017				0.015		0.001		0.010			0.005		0.005		
Maximum			91.600		9.220	0.500		0.003			0.0005		0.010		0.110			0.068				0.830		0.005		0.090			0.030		0.040		0.040
Mean			19.989																														

TABLE A-2 - STATISTICAL SUMMARY OF WATER QUALITY DATA 1989-2008
New World Mining District Response and Restoration Project

Sample Station	Sample Date	Data Source	Flow (cfs)	Flow Flag	Field pH (su)	Aluminum Total Rec. (mg/l)	Al (calc)	Al Flag	Arsenic Total Rec. (mg/l)	As (calc)	As Flag	Cadmium Total Rec. (mg/l)	Cd (calc)	Cd Flag	Chromium Total Rec. (mg/l)	Cr (calc)	Cr Flag	Copper Total Rec. (mg/l)	Cu (calc)	Cu Flag	Iron Total Rec. (mg/l)	Fe (calc)	Fe Flag	Lead Total Rec. (mg/l)	Pb (calc)	Pb Flag	Manganese Total Rec. (mg/l)	Mn (calc)	Mn Flag	Zinc Total Rec. (mg/l)	Zn (calc)	Zn Flag
Chronic Standard (for Hardness = 50 mg/l)						0.087			0.15			0.00142			0.117			0.0052			1			0.0005			NA			0.067		
Acute Standard (for Hardness = 50 mg/l)						0.75			0.34			0.00206			0.984			0.0073			NA			0.014			NA			0.067		
SW-3	2-Aug-89	Hydrometrics				0.1	0.05		0.0050	0.0025	<	0.00100	0.0005	<				0.03	0.03		0.03	0.015	<	0.01	0.005	<	0.11	0.11		0.01	0.01	
SW-3	15-Sep-89	Hydrometrics	0.36			3.7	3.7		0.0050	0.0025	<	0.00100	0.0005	<				1.04	1.04		5.58	5.58		0.01	0.005	<	1.24	1.24		0.18	0.18	
SW-3	20-Oct-89	Hydrometrics	0.26		3.43	3.7	3.7		0.0050	0.0025	<	0.00100	0.0005	<				0.85	0.85		5.59	5.59		0.01	0.005	<	1.23	1.23		0.17	0.17	
SW-3	17-Mar-90	Hydrometrics	0.25		3.44	2.2	2.2		0.0050	0.0025	<	0.00100	0.0005	<				0.61	0.61		3.27	3.27		0.01	0.005	<	1	1		0.15	0.15	
SW-3	28-May-90	Hydrometrics	0.9		3.35	3	3		0.0050	0.0025	<	0.00040	0.0004		0.0200	0.01		0.593	0.593		3.3	3.3		0.003	0.003		0.49	0.49		0.11	0.11	
SW-3	5-Jun-90	Hydrometrics	5.75		4.54	5.49	2.1	2.1										0.51	0.51		2.9	2.9								0.06	0.06	
SW-3	13-Jun-90	Hydrometrics	4.54		3.33	1.8	1.8											0.43	0.43		0.04	0.04								0.04	0.04	
SW-3	20-Jun-90	Hydrometrics	6.15		6.56	1.8	1.8					0.00200	0.002		0.0200	0.01		0.49	0.49		2.26	2.26		0.01	0.005	<	0.23	0.23		0.05	0.05	
SW-3	27-Jun-90	Hydrometrics	17.89		4.76	1.7	1.7		0.0050	0.0025	<	0.00010	0.0001		0.0200	0.01		0.419	0.419		5.89	5.89		0.004	0.004		0.16	0.16		0.04	0.04	
SW-3	3-Jul-90	Hydrometrics	14.9		4.66	1.6	1.6					0.00100	0.0005	<	0.0200	0.01		0.486	0.486		4.3	4.3		0.01	0.005	<	0.19	0.19		0.04	0.04	
SW-3	10-Jul-90	Hydrometrics	3.9		1.7	1.7						0.00100	0.0005	<	0.0200	0.01		0.59	0.59		3.18	3.18		0.01	0.005	<	0.27	0.27		0.08	0.08	
SW-3	17-Jul-90	Hydrometrics	2.3		3.67	2	2											0.8	0.8		3.79	3.79								0.07	0.07	
SW-3	26-Jul-90	Hydrometrics	1.6		3.6	2.6	2.6		0.0050	0.0025	<	0.00040	0.0004		0.0200	0.01		0.99	0.99		5.66	5.66		0.003	0.003		0.56	0.56		0.22	0.22	
SW-3	25-Sep-90	Hydrometrics	0.4		4.5	3.3	3.3		0.0050	0.0025	<	0.00090	0.0009		0.0200	0.01		0.96	0.96		6.98	6.98		0.007	0.007		1.29	1.29		0.16	0.16	
SW-3	15-Mar-91	Hydrometrics	0.2		2.79	2.7	2.7		0.0050	0.0025	<	0.00100	0.0005	<	0.0200	0.01		0.72	0.72		2.79	2.79		0.01	0.005	<	0.89	0.89		0.15	0.15	
SW-3	5-Jun-91	Hydrometrics	7		3.46	1.1	1.1		0.0010	0.0005	<	0.00010	0.0001		0.0200	0.01		0.59	0.59		3.78	3.78		0.002	0.002		0.16	0.16		0.03	0.03	
SW-3	9-Jul-91	Hydrometrics	3		2.91	1.46	1.46		0.0050	0.0025	<	0.00180	0.0018	J	0.0200	0.01		0.65	0.65		4.32	4.32		0.002	0.002	J	0.29	0.29		0.05	0.05	
SW-3	14-Aug-91	Hydrometrics	0.5		3.24	2.9	2.9		0.0050	0.0025	<	0.00070	0.0007		0.0200	0.02		0.95	0.95		5.93	5.93		0.004	0.004		0.93	0.93		0.14	0.14	
SW-3	24-Sep-91	Hydrometrics	0.2		3.29	4.3	4.3		0.0050	0.0025	<	0.00220	0.0022		0.0200	0.01		0.95	0.95		5.51	5.51		0.006	0.006		1.26	1.26		0.16	0.16	
SW-3	23-Jul-93	Hydrometrics	2.36		3.37	3.3	3.3		0.0010	0.001		0.00040	0.0004		0.0030	0.003		1.1	1.1		6.62	6.62		0.002	0.001	<	0.56	0.56		0.13	0.13	
SW-3	21-Sep-93	Hydrometrics	0.38		3.46	3.8	3.8		0.0010	0.0005	<	0.00030	0.0003		0.0010	0.0005	<	1.1	1.1		11.6	11.6		0.002	0.002		1.67	1.67		0.05	0.05	
SW-3	14-Jul-94	Hydrometrics	5.42		3.79	2.6	2.6		0.0010	0.0005	<	0.00030	0.0003		0.0010	0.0005	<	0.374	0.374		6.88	6.88		0.007	0.007		0.29	0.29		0.05	0.05	
SW-3	14-Jul-95	Hydrometrics	7.29		3.29	2.5	2.5		0.0020	0.002		0.00040	0.0004		0.0010	0.001		0.766	0.766	J	3.32	3.32	J	0.008	0.008		0.41	0.41		0.076	0.076	
SW-3	27-Sep-95	Hydrometrics	0.31		3.6	4.8	4.8		0.0010	0.0005	<	0.00090	0.0009		0.0010	0.001		1.53	1.53		11	11		0.008	0.008		1.66	1.66		0.231	0.231	
SW-3	21-May-96	Hydrometrics			3.22	4.3	4.3					0.00100	0.001					0.92	0.92		4.8	4.8		0.006	0.006		0.891	0.891		0.22	0.22	
SW-3	12-Jun-96	Hydrometrics	9.04		3.1													0.417	0.417		2.73	2.73	J							0.08	0.08	
SW-3	20-Jun-96	Hydrometrics	7.795		3.4	1.6	1.6					0.00020	0.0002					0.395	0.395		1.72	1.72		0.003	0.0015	<	0.167	0.167		0.03	0.03	
SW-3	26-Jun-96	Hydrometrics	12.65		4.16													0.391	0.391		3.25	3.25								0.04	0.04	
SW-3	2-Jul-96	Hydrometrics	15.9		3.67													0.374	0.374		6.88	6.88								0.08	0.08	
SW-3	11-Jul-96	Hydrometrics	9.18		4.09	1.3	1.3	J				0.00010	0.0001					0.448	0.448		1.93	1.93		0.003	0.0015	<	0.163	0.163		0.04	0.04	
SW-3	18-Jul-96	Hydrometrics	5.644		3.76													0.646	0.646		2.84	2.84								0.08	0.04	
SW-3	25-Jul-96	Hydrometrics	6.767		3.59													0.803	0.803		3.83	3.83								0.09	0.09	
SW-3	21-Aug-96	Hydrometrics	2.552		3.94													0.98	0.98		6.46	6.46								0.15	0.15	
SW-3	11-Sep-96	Hydrometrics	0.38		3.58	3.5	3.5					0.00090	0.0009	J				1.04	1.04		6.91	6.91		0.008	0.008		1.32	1.32		0.18	0.18	
SW-3	8-Jul-97	UOS Data	10.843			1.81	1.81		0.0100	0.005	<	0.00500	0.0025	<	0.0100	0.005	<	0.141	0.141		2.6	2.6					0.165	0.165		0.368	0.368	
SW-3	27-Apr-98	UOS Data			0.17	3.15	3.15											0.691	0.691		7.35	7.35					1.31	1.31		0.17	0.17	
SW-3	23-Apr-98	UOS Data	0.112			3.08	3.08											0.745	0.745		6.92	6.92					1.26	1.26		0.177	0.177	
SW-3	5-May-98	UOS Data	0.217			5.44	2.51	2.51										0.535	0.535		3.03	3.03					0.502	0.502		0.0968	0.0968	
SW-3	13-May-98	UOS Data	4.783			6.3	2.26	2.26										0.443	0.443		2.82	2.82					0.348	0.348		0.0689	0.0689	
SW-3	29-May-98	UOS Data	2.172			3.63	1.77	1.77										0.361	0.361		2.71	2.71					0.231	0.231		0.0547	0.0547	
SW-3	6-May-99	Maxim	0.2244			3.45	3.9	3.9				0.00110	0.0011					0.9	0.9		7.49	7.49		0.007	0.007		1.35	1.35		0.29	0.29	
SW-3	9-Jul-99	Maxim	7.53			4.12	1.5	1.5				0.00020	0.0002					0.41	0.41		1.85	1.85		0.002	0.002		0.162	0.162		0.06	0.06	
SW-3	30-Sep-99	Maxim	0.3068			3.43	3.1	3.1				0.00050	0.0005					0.709	0.709		1.3	1.3								0.0		

TABLE A-2 - STATISTICAL SUMMARY OF WATER QUALITY DATA 1989-2008
 New World Mining District Response and Restoration Project

Sample Station	Sample Date	Data Source	Flow (cfs)	Flow Flag	Field pH (su)	Aluminum Total Rec. (mg/l)	Al(calc)	Al Flag	Arsenic Total Rec. (mg/l)	As(calc)	As Flag	Cadmium Total Rec. (mg/l)	Cd(calc)	Cd Flag	Chromium Total Rec. (mg/l)	Cr(calc)	Cr Flag	Copper Total Rec. (mg/l)	Cu(calc)	Cu Flag	Iron Total Rec. (mg/l)	Fe(calc)	Fe Flag	Lead Total Rec. (mg/l)	Pb(calc)	Pb Flag	Manganese Total Rec. (mg/l)	Mn(calc)	Mn Flag	Zinc Total Rec. (mg/l)	Zn(calc)	Zn Flag
Chronic Standard (for Hardness = 50 mg/l)						0.087			0.15			0.00142			0.117			0.0052			1			0.0005			NA			0.067		
Acute Standard (for Hardness = 50 mg/l)						0.75			0.34			0.00206			0.984			0.0073			NA			0.014			NA			0.067		
SW-3	28-Jun-06	Maxim	5.46		5	1.74	1.74					0.0001	0.0001		1.52	1.52		0.002	0.002		1.52	1.52		0.002	0.002		0.18	0.18		0.02	0.02	
SW-3	26-Sep-06	Maxim	0.16		3.62	2.81	2.81					0.0008	0.0008		0.79	0.79		0.002	0.002		1.89	1.89		0.002	0.002		0.59	0.59		0.14	0.14	
SW-3	11-Apr-07	Tt	0.065		5	2.14	2.14				--	0.001	0.001		0.75	0.75		0.001	0.001		0.87	0.87		0.001	0.001		0.45	0.45		0.14	0.14	
SW-3	12-Jun-07	Tt	6.94		7	1.72	1.72				--	0.0002	0.0002		0.32	0.32		0.002	0.002		2.46	2.46		0.002	0.002		0.13	0.13		0.01	0.01	
SW-3	17-Sep-07	Tt	0.142		3.85	2.51	2.51				--	0.0008	0.0008		0.84	0.84		0.002	0.002		1.26	1.26		0.002	0.002		0.57	0.57		0.12	0.12	
SW-3	17-Apr-08	Tt	0.0852		3.64	2.13	2.13				--	0.0011	0.0011		0.97	0.97		0.001	0.001		1.01	1.01		0.001	0.001		0.54	0.54		0.14	0.14	
SW-3	14-Jul-08	Tt	8.17		5.38	0.74	0.74					0.0001	0.0001		0.21	0.21		0.001	0.001		0.72	0.72		0.001	0.001		0.1	0.1		0.02	0.02	
SW-3	22-Sep-08	Tt	0.37		3.78	2.95	2.95					0.0007	0.0007		0.67	0.67		0.002	0.002		1.69	1.69		0.002	0.002	JF%	0.58	0.58		0.11	0.11	
Station SW-3: Pre-1999 Samples (n)						38	36	34	19			26			18			40			40			25			31			40		
Minimum			0.112		2.500	0.950		0.0005			0.00010		0.0005		0.030			0.015			0.001			0.001			0.110			0.010		
Maximum			17.890		6.560	4.800		0.0050			0.00250		0.0200		1.530			11.800			0.009			0.009			1.670			0.231		
Mean			4.581		3.830	2.528		0.0021			0.00078		0.0078		0.677			4.485			0.005			0.005			0.685			0.103		
Standard Deviation (SD)			4.867		0.903	1.041		0.0011			0.00065		0.0050		0.291			2.446			0.002			0.002			0.507			0.063		
Mean + (2 x SD); for pH: Mean - (2 x SD)			14.314		2.024	4.611		0.0043			0.00207		0.0179		1.258			9.377			0.009			0.009			1.700			0.229		
Station SW-3: 1989-2008 Samples (n)						83	86	77	23			68			18			92			83			68			74			92		
Minimum			0.050		2.500	0.950		0.001			0.000		0.001		0.030			0.015			0.001			0.001			0.100			0.010		
Maximum			17.890		7.000	4.800		0.005			0.006		0.020		1.530			22.000			0.013			0.013			1.740			0.710		
Mean			3.432		3.815	2.470		0.002			0.001		0.008		0.686			4.662			0.005			0.005			0.736			0.118		
Standard Deviation (SD)			4.094		0.782	0.851		0.001			0.001		0.005		0.247			3.398			0.003			0.003			0.501			0.093		
Mean + (2 x SD); for pH: Mean - (2 x SD)			11.621		2.250	4.171		0.004			0.002		0.018		1.181			11.457			0.010			0.010			1.737			0.304		
Station SW-3: 1989-10/04 Low Flow (n)						35	38	38	13			32			7			42			39			33			38			42		
Minimum			0.050		2.500	0.950		0.001			0.000		0.001		0.030			0.015			0.002			0.002			0.110			0.010		
Maximum			4.783		6.300	4.800		0.003			0.006		0.020		1.530			22.000			0.013			0.013			1.740			0.710		
Mean			0.605		3.577	2.967		0.002			0.001		0.009		0.799			6.680			0.007			0.007			1.119			0.170		
Standard Deviation (SD)			0.902		0.688	0.796		0.001			0.001		0.007		0.244			3.676			0.003			0.003			0.394			0.108		
Mean + (2 x SD); for pH: Mean - (2 x SD)			2.408		2.202	4.579		0.004			0.003		0.022		1.287			14.031			0.012			0.012			1.906			0.386		
Station SW-3: 10/04-10/08 all samples (n)						14	14	14	0			14			0			14			14			14			14			14		
Minimum			0.065		3.620	0.740						0.001			0.210			0.720			0.001			0.001			0.100			0.010		
Maximum			8.170		7.000	2.950						0.011			0.970			2.460			0.002			0.002			0.590			0.180		
Mean			2.194		4.364	1.984						0.006			0.635			1.264			0.002			0.002			0.396			0.100		
Standard Deviation (SD)			3.328		0.953	0.621						0.004			0.233			0.485			0.000			0.000			0.187			0.056		
Mean + (2 x SD); for pH: Mean - (2 x SD)			8.850		6.270	3.227						0.013			1.100			2.233			0.003			0.003			0.769			0.211		
Station SW-3: 10/04-10/08 High Flow (n)						4	4	4	0			4			0			4			4			4			4			4		
Minimum			5.460		4.000	0.740						0.001			0.210			0.720			0.001			0.001			0.100			0.010		
Maximum			8.170		7.000	1.740						0.002			0.390			2.460			0.002			0.002			0.180			0.040		
Mean			7.175		5.345	1.423						0.001			0.320			1.460			0.002			0.002			0.138			0.023		
Standard Deviation (SD)			1.278		1.247	0.469						0.001			0.079			0.742			0.001			0.001			0.033			0.013		
Mean + (2 x SD); for pH: Mean - (2 x SD)			9.731		7.840	2.360						0.002			0.477			2.945			0.003			0.003			0.204			0.048		
Station SW-3: 10/04-10/08 Low Flow (n)						10	10	10	0			10			0			10			10			10			10			10		
Minimum			0.065		3.620	1.360						0.001			0.590			0.870			0.001			0.001			0.290			0.080		
Maximum			0.380		5.000	2.950						0.001			0.970			1.890			0.002			0.002			0.590			0.180		
Mean			0.201		3.971	2.209						0.001			0.761			1.185			0.002			0.002			0.499			0.131		
Standard Deviation (SD)			0.135		0.440	0.536						0.000			0.120			0.363			0.000			0.000			0.092			0.028		
Mean + (2 x SD); for pH: Mean - (2 x SD)			0.471		3.090	3.282						0.001			1.000			1.911			0.003			0.003			0.683			0.184		
Narrative Standard: SW-3						21	21	21	NA			0.002			NA			2.25			0.001			0.001			1.713			0.223		

Notes: mg/l = milligrams/liter; su = standard units
 n = number of samples

< = less than detection
 J = estimated value

NA = not applicable

TABLE A-2 - STATISTICAL SUMMARY OF WATER QUALITY DATA 1989-2008
New World Mining District Response and Restoration Project

Sample Station	Sample Date	Data Source	Flow (cfs)	Flow Flag	Field pH (su)	Aluminum Total Rec. (mg/l)	Al(calc)	Al Flag	Arsenic Total Rec. (mg/l)	As(calc)	As Flag	Cadmium Total Rec. (mg/l)	Cd(calc)	Cd Flag	Chromium Total Rec. (mg/l)	Cr(calc)	Cr Flag	Copper Total Rec. (mg/l)	Cu(calc)	Cu Flag	Iron Total Rec. (mg/l)	Fe(calc)	Fe Flag	Lead Total Rec. (mg/l)	Pb(calc)	Pb Flag	Manganese Total Rec. (mg/l)	Mn(calc)	Mn Flag	Zinc Total Rec. (mg/l)	Zn(calc)	Zn Flag		
Chronic Standard (for Hardness = 50 mg/l)						0.087			0.15			0.00142			0.117			0.0052				1			0.0005									
Acute Standard (for Hardness = 50 mg/l)						0.75			0.34			0.00206			0.984			0.0073						NA			0.014							
SW-4	2-Aug-89	Hydrometrics				0.1	0.05		0.005	0.0025	<	0.001	0.0005	<				0.03	0.03		0.03	0.015	<	0.01	0.005	<	0.11	0.11			0.01	0.01		
SW-4	15-Sep-89	Hydrometrics	1.35			0.2	0.2		0.005	0.0025	<	0.001	0.0005	<				0.09	0.09		0.09	0.09		0.01	0.005	<	0.07	0.07			0.07	0.07		
SW-4	20-Oct-89	Hydrometrics	1.19		5.75	0.1	0.1		0.005	0.0025	<	0.001	0.0005	<				0.07	0.07		0.04	0.04		0.01	0.005	<	0.06	0.06			0.06	0.06		
SW-4	17-Mar-90	Hydrometrics	1		5.55	0.1	0.05	<	0.005	0.0025	<	0.001	0.0005	<				0.04	0.04		0.03	0.015	<	0.01	0.005	<	0.02	0.01	<		0.02	0.07		
SW-4	29-May-90	Hydrometrics	15.4		7.22	0.8	0.8		0.005	0.0025	<	0.0001	0.00005	<	0.02	0.01	<	0.116	0.116		0.71	0.71		0.002	0.001	<	0.05	0.05			0.05	0.03		
SW-4	5-Jun-90	Hydrometrics	27.84		6.7	0.3	0.3											0.08	0.08		0.42	0.42									0.02	0.02		
SW-4	13-Jun-90	Hydrometrics	30.73		5.52	0.2	0.2											0.06	0.06		0.21	0.21									0.02	0.02		
SW-4	15-Jun-90	Hydrometrics	21.9																															
SW-4	20-Jun-90	Hydrometrics	47.46		6.45	0.3	0.3					0.001	0.0005	<	0.02	0.01	<	0.08	0.08		0.39	0.39		0.01	0.005	<	0.04	0.04			0.41	0.41		
SW-4	22-Jun-90	Hydrometrics	88.8																															
SW-4	26-Jun-90	Hydrometrics	112.4		7.11	0.5	0.5		0.005	0.0025	<	0.0002	0.0002		0.02	0.01	<	0.087	0.087		1.02	1.02		0.002	0.001	<	0.05	0.05			0.02	0.02		
SW-4	28-Jun-90	Hydrometrics	100.37																															
SW-4	3-Jul-90	Hydrometrics	83.9		9.07	0.4	0.4					0.002	0.002		0.02	0.01	<	0.08	0.08		0.65	0.65		0.01	0.01		0.04	0.04			0.02	0.02		
SW-4	5-Jul-90	Hydrometrics	49.4																															
SW-4	6-Jul-90	Hydrometrics																																
SW-4	7-Jul-90	Hydrometrics																																
SW-4	8-Jul-90	Hydrometrics																																
SW-4	10-Jul-90	Hydrometrics	30.6			0.3	0.3					0.001	0.0005	<	0.02	0.01	<	0.09	0.09		0.43	0.43		0.01	0.005	<	0.05	0.05			0.03	0.03		
SW-4	11-Jul-90	Hydrometrics																																
SW-4	12-Jul-90	Hydrometrics	25																															
SW-4	13-Jul-90	Hydrometrics																																
SW-4	14-Jul-90	Hydrometrics																																
SW-4	15-Jul-90	Hydrometrics																																
SW-4	16-Jul-90	Hydrometrics																																
SW-4	17-Jul-90	Hydrometrics	14.4		6.6	0.4	0.4														0.14	0.14		0.49	0.49							0.03	0.03	
SW-4	18-Jul-90	Hydrometrics																																
SW-4	19-Jul-90	Hydrometrics	11.7																															
SW-4	20-Jul-90	Hydrometrics																																
SW-4	21-Jul-90	Hydrometrics																																
SW-4	22-Jul-90	Hydrometrics																																
SW-4	23-Jul-90	Hydrometrics																																
SW-4	24-Jul-90	Hydrometrics																																
SW-4	25-Jul-90	Hydrometrics																																
SW-4	26-Jul-90	Hydrometrics																																
SW-4	27-Jul-90	Hydrometrics	7.1		6.87	0.3	0.3		0.005	0.0025	<	0.0004	0.0004		0.02	0.01	<	0.16	0.16		0.44	0.44		0.002	0.001	<	0.1	0.1			1.95	1.95		
SW-4	27-Jul-90	Hydrometrics	3.2		7.05																													
SW-4	25-Sep-90	Hydrometrics	1.5		5	0.3	0.3		0.005	0.0025	<	0.0003	0.0003		0.02	0.01	<	0.11	0.11		0.21	0.21		0.002	0.001	<	0.13	0.13			0.05	0.05		
SW-4	15-Mar-91	Hydrometrics	0.8		6.79	0.1	0.05	<	0.005	0.0025	<	0.001	0.001		0.02	0.01	<	0.06	0.06		0.03	0.015	<	0.01	0.005	<	0.02	0.01	<		0.07	0.07		
SW-4	5-Jun-91	Hydrometrics	55.3		7.07	0.2	0.1	<	0.001	0.0005	<	0.0001	0.00005	<	0.02	0.01	<	0.05	0.025	<	0.67	0.335	<	0.002	0.001	<	0.03	0.015	<		0.01	0.005	<	
SW-4	9-Jul-91	Hydrometrics	21		6.72	0.1	0.05	<	0.005	0.0025	<	0.0002	0.0002		0.02	0.02		0.1	0.1		0.38	0.38		0	J		0.05	0.05			0.03	0.03		
SW-4	14-Aug-91	Hydrometrics	1.7		6.25	0.4	0.4		0.005	0.0025	<	0.0002	0.0002		0.02	0.01	<	0.15	0.15		0.21	0.21		0.002	0.001	<	0.12	0.12			0.07	0.07		
SW-4	24-Sep-91	Hydrometrics	1.1		6.66	0.3	0.3		0.005	0.0025	<	0.0008	0.0008		0.02	0.01	<	0.11	0.11		0.24	0.24		0.002	0.001	<	0.08	0.08			0.04	0.04		
SW-4	27-May-92	Hydrometrics	77.78		7.72	0.2	0.2		0.005	0.0025	<	0.0001	0.00005	<	0.01	0.005	<	0.05	0.051		0.31	0.31		0.002	0.001	<	0.03	0.03			0.03	0.02		
SW-4	19-Jul-92	Hydrometrics	15		6.87	3.4	1.7	<	0.005	0.0025	<	0.0002	0.0002		0.01	0.005	<	0.29	0.29		7.1	3.55	<	0.002	0.001	<	0.16	0.16			0.15	0.075	<	
SW-4	23-Sep-92	Hydrometrics	1.95		7.04	0.3	0.3		0.005	0.0025	<	0.0004	0.0004		0.01	0.005	<	0.117	0.117		0.17	0.17		0.002	0.001	<	0.13	0.13			0.05	0.05		
SW-4	21-Jul-93	Hydrometrics	19.92		7.47	0.3	0.3		0.001	0.0005	<	0.0001	0.0001		0.001	0.0005	<	0.146	0.146		0.65	0.65		0.002	0.001	<	0.09	0.09			0.04	0.04		
SW-4	21-Sep-93	Hydrometrics	1.98		6.95	0.2	0.2		0.001	0.0005	<	0.0002	0.0002		0.001	0.0005	<	0.1	0.1		0.32	0.32		0.002	0.001	<	0.16	0.16			0.038	0.038		
SW-4	2-Mar-94	Hydrometrics	0.4		7.7	0.1	0.05	<																										

TABLE A-2 - STATISTICAL SUMMARY OF WATER QUALITY DATA 1989-2008
 New World Mining District Response and Restoration Project

Sample Station	Sample Date	Data Source	Flow (cfs)	Flow Flag	Field pH (su)	Aluminum Total Rec. (mg/l)	Al(calc)	Al Flag	Arsenic Total Rec. (mg/l)	As(calc)	As Flag	Cadmium Total Rec. (mg/l)	Cd(calc)	Cd Flag	Chromium Total Rec. (mg/l)	Cr(calc)	Cr Flag	Copper Total Rec. (mg/l)	Cu(calc)	Cu Flag	Iron Total Rec. (mg/l)	Fe(calc)	Fe Flag	Lead Total Rec. (mg/l)	Pb(calc)	Pb Flag	Manganese Total Rec. (mg/l)	Mn(calc)	Mn Flag	Zinc Total Rec. (mg/l)	Zn(calc)	Zn Flag
Chronic Standard (for Hardness = 50 mg/l)						0.087			0.15			0.00142			0.117			0.0052			1			0.0005			NA			0.067		
Acute Standard (for Hardness = 50 mg/l)						0.75			0.34			0.00206			0.984			0.0073			NA			0.014			NA			0.067		
SW-4	28-Jun-04	Maxim	70.91		7.9	0.8	0.8					0.0001	0.00005	<				0.11	0.11		1.48	1.48		0.003	0.003		0.045	0.045		0.05	0.05	
SW-4	5-Oct-04	Maxim	3.21		6.2	0.12	0.12					0.0002	0.0002					0.05	0.05		0.06	0.06		0.001	0.0005	<	0.029	0.029		0.02	0.02	
SW-4	4/5/2005	Maxim	0.7		7.19	0.05	0.025	<			--	0.0002	0.0002				--	0.033	0.033		0.01	0.01		0.001	0.0005	<	0.008	0.008		0.08	0.08	
SW-4	6/28/2005	Maxim	50.84		6.6	0.25	0.25				--	0.0001	0.00005	<			--	0.063	0.063		0.2	0.2		0.001	0.0005	<	0.028	0.028		0.02	0.02	
SW-4	10/11/2005	Maxim	1.62		6.3	0.05	0.025	<			--	0.0002	0.0002				--	0.05	0.05		0.16	0.16		0.001	0.0005	<	0.005	0.005		0.03	0.03	
SW-4	26-Apr-06	Maxim	0.62		7.18	0.05	0.025	<			--	0.0002	0.0002				--	0.043	0.043		0.02	0.02		0.001	0.0005	<	0.005	0.005		0.04	0.04	
SW-4	28-Jun-06	Maxim	33.1		6.26	0.19	0.19				--	0.0001	0.00005	<			--	0.064	0.064		0.21	0.21		0.001	0.0005	<	0.034	0.034		0.01	0.005	
SW-4	26-Sep-06	Maxim	0.66		5.56	0.08	0.08				--	0.0002	0.0002				--	0.034	0.034		0.01	0.01		0.001	0.0005	<	0.026	0.026		0.18	0.18	
SW-4	11-Apr-07	Tt	0.582		6.58	0.05	0.025	<			--	0.0002	0.0002				--	0.038	0.038		0.02	0.02		0.001	0.0005	<	0.014	0.014		0.04	0.04	
SW-4	12-Jun-07	Tt	46.7		6.9	0.3	0.3				--	0.0001	0.00005	<			--	0.069	0.069		0.27	0.27		0.001	0.0005	<	0.02	0.02		0.01	0.005	
SW-4	17-Sep-07	Tt	0.88		6.91	0.07	0.07				--	0.0002	0.0002				--	0.044	0.044		0.05	0.05		0.001	0.0005	<	0.033	0.033		0.02	0.02	
SW-4	17-Apr-08	Tt	0.448		5.88	0.05	0.025	<			--	0.0002	0.0002				--	0.044	0.044		0.02	0.02		0.001	0.0005	<	0.011	0.011		0.04	0.04	
SW-4	14-Jul-08	Tt	46.54		6.89	0.13	0.13				--	0.0001	0.00005	<			--	0.049	0.049		0.18	0.18		0.001	0.0005	<	0.022	0.022		0.01	0.005	
SW-4	22-Sep-08	Tt	1.462		6.01	0.11	0.11				--	0.0002	0.0002				--	0.065	0.065		0.02	0.02		0.001	0.001	JF%	0.046	0.046		0.03	0.03	
Station SW-4: Pre-1999 Samples (n)			45		43	35		23				32		22				41			41			32			32			41		
Minimum			0.400		5.000	0.050		0.001				0.000		0.001				0.025			0.015			0.000			0.005			0.005		
Maximum			112.400		9.070	1.700		0.003				0.002		0.020				0.290			3.550			0.010			1.950			1.950		
Mean			27.670		6.778	0.353		0.002				0.000		0.007				0.101			0.599			0.002			0.069			0.092		
Standard Deviation (SD)			30.774		0.750	0.327		0.001				0.000		0.005				0.049			0.794			0.002			0.045			0.304		
Mean + (2 x SD); for pH: Mean - (2 x SD)			89.218		5.277	1.008		0.0037				0.00109		0.0171				0.198			2.186			0.007			0.159			0.700		
Station SW-4: 1989-2008 Samples (n)			73		73	65		24				62		22				71			71			62			62			71		
Minimum			0.400		5.000	0.025		0.001				0.000		0.001				0.025			0.005			0.000			0.005			0.005		
Maximum			112.400		9.070	1.700		0.003				0.002		0.020				0.290			3.550			0.010			1.950			1.950		
Mean			23.084		6.701	0.256		0.002				0.000		0.007				0.084			0.419			0.002			0.050			0.073		
Standard Deviation (SD)			28.155		0.757	0.283		0.001				0.000		0.005				0.044			0.662			0.002			0.041			0.232		
Mean + (2 x SD); for pH: Mean - (2 x SD)			79.395		5.188	0.822		0.004				0.001		0.017				0.172			1.742			0.005			0.132			0.538		
Station SW-4: 10/04-10/08 Samples (n)			13		13	13		0				13		0				13			13			13			13			13		
Minimum			0.448		5.560	0.025		0.000				0.000		0.000				0.033			0.010			0.001			0.005			0.005		
Maximum			50.840		7.190	0.300		0.000				0.000		0.000				0.068			0.270			0.001			0.046			0.180		
Mean			14.412		6.496	0.106		0.000				0.000		0.000				0.050			0.095			0.001			0.022			0.040		
Standard Deviation (SD)			21.104		0.510	0.092		0.000				0.000		0.000				0.012			0.094			0.000			0.013			0.047		
Mean + (2 x SD); for pH: Mean - (2 x SD)			56.620		7.516	0.289		0.000				0.000		0.000				0.074			0.283			0.001			0.047			0.133		
Station SW-4: 10/04-10/08 Low Flow (n)			9		9	9		0				9		0				9			9			9			9			9		
Minimum			0.448		5.560	0.025		0.000				0.000		0.000				0.033			0.010			0.001			0.005			0.020		
Maximum			3.210		7.190	0.120		0.000				0.000		0.000				0.065			0.160			0.001			0.046			0.180		
Mean			1.131		6.423	0.056		0.000				0.000		0.000				0.045			0.041			0.001			0.020			0.053		
Standard Deviation (SD)			0.878		0.581	0.040		0.000				0.000		0.000				0.010			0.048			0.000			0.014			0.051		
Mean + (2 x SD); for pH: Mean - (2 x SD)			2.888		5.262	0.135		0.000				0.000		0.000				0.064			0.137			0.001			0.049			0.155		
NA (not applicable) Standard (SW-4)					0.24	0.74			NA			0.001			NA			0.172			0.74			0.000			0.74			1.0		

Notes: mg/l = milligrams/liter; su = standard units
 n = number of samples

< = less than detection
 J = estimated value

NA = not applicable

TABLE A-2 - STATISTICAL SUMMARY OF WATER QUALITY DATA 1989-2008
New World Mining District Response and Restoration Project

Sample Station	Sample Date	Data Source	Flow (cfs)	Flow Flag	Field pH (su)	Aluminum Total Rec. (mg/l)	Al (calc)	Al Flag	Arsenic Total Rec. (mg/l)	As (calc)	As Flag	Cadmium Total Rec. (mg/l)	Cd (calc)	Cd Flag	Chromium Total Rec. (mg/l)	Cr (calc)	Cr Flag	Copper Total Rec. (mg/l)	Cu (calc)	Cu Flag	Iron Total Rec. (mg/l)	Fe (calc)	Fe Flag	Lead Total Rec. (mg/l)	Pb (calc)	Pb Flag	Manganese Total Rec. (mg/l)	Mn (calc)	Mn Flag	Zinc Total Rec. (mg/l)	Zn (calc)	Zn Flag	
Chronic Standard (for Hardness = 50 mg/l)						0.087			0.15			0.00142			0.117			0.0052			1			0.0005									
Acute Standard (for Hardness = 50 mg/l)						0.75			0.34			0.00206			0.984			0.0073			NA			0.014			NA						
SW-6	2-Oct-89	Hydrometrics	4		4.82				0.0050	0.0025	<	0.00100	0.0005	<				0.01	0.005	<	0.03	0.015	<	0.01	0.005	<	0.02	0.01	<	0.01	0.01		
SW-6	20-Oct-89	Hydrometrics	4.52		6.02	0.1	0.05	<	0.0050	0.0025	<	0.00100	0.0005	<				0.01	0.005	<	0.03	0.015	<	0.01	0.005	<	0.02	0.01	<	0.01	0.01		
SW-6	29-May-90	Hydrometrics	102.1		7.34	0.2	0.2		0.0050	0.0025	<	0.00010	0.00005	<	0.0200	0.01	<	0.035	0.035		0.23	0.23		0.002	0.001	<	0.02	0.02		0.02	0.02		
SW-6	6-Jun-90	Hydrometrics	123.2		7.25	0.1	0.1					0.00200	0.002		0.0200	0.01	<	0.02	0.02		0.13	0.13		0.01	0.01		0.02	0.01	<	0.01	0.01		
SW-6	7-Jun-90	Hydrometrics	138.6																														
SW-6	13-Jun-90	Hydrometrics	116.97		7.25	0.1	0.05	<				0.00800	0.08		0.0200	0.01	<	0.01	0.005	<	0.06	0.06		0.01	0.005	<	0.02	0.01	<	0.01	0.01		
SW-6	14-Jun-90	Hydrometrics	186																														
SW-6	20-Jun-90	Hydrometrics	167.97		8.75	0.2	0.2					0.00100	0.001		0.0200	0.01	<	0.03	0.03		0.26	0.26		0.01	0.005	<	0.02	0.02		0.02	0.02		
SW-6	22-Jun-90	Hydrometrics	273.3																														
SW-6	26-Jun-90	Hydrometrics	251.5		8.52	0.2	0.2		0.0050	0.0025	<	0.00010	0.00005	<	0.0200	0.01	<	0.037	0.037		0.4	0.4		0.0002	0.001	<	0.02	0.02		0.02	0.02		
SW-6	29-Jun-90	Hydrometrics	218.48																														
SW-6	2-Jul-90	Hydrometrics	210.6		9.39	0.2	0.2					0.00100	0.0005	<	0.0200	0.01	<	0.039	0.039		0.35	0.35		0.01	0.005	<	0.02	0.02		0.04	0.04		
SW-6	4-Jul-90	Hydrometrics	165.4																														
SW-6	9-Jul-90	Hydrometrics	89.9		9.2	0.1	0.1					0.00100	0.0005	<	0.0200	0.01	<	0.03	0.03		0.14	0.14		0.01	0.005	<	0.02	0.01	<	0.02	0.02		
SW-6	11-Jul-90	Hydrometrics	72																														
SW-6	17-Jul-90	Hydrometrics	35.4		8.86	0.2	0.2											0.07	0.07		0.3	0.3									0.03	0.015	<
SW-6	19-Jul-90	Hydrometrics	26.4																														
SW-6	27-Jul-90	Hydrometrics	18.9		6.81	0.1	0.05	<	0.0050	0.0025	<	0.00010	0.00005	<	0.0200	0.01	<	0.03	0.03		0.1	0.1		0.002	0.001	<	0.02	0.01	<	0.03	0.015	<	
SW-6	23-Aug-90	Hydrometrics	10.1		6.7																												
SW-6	25-Sep-90	Hydrometrics	3.3		5.5	0.1	0.05	<	0.0050	0.0025	<	0.00010	0.00005	<	0.0200	0.01	<	0.007	0.007		0.03	0.015	<	0.002	0.001	<	0.02	0.01	<	0.04	0.04		
SW-6	15-Mar-91	Hydrometrics	7		8.01	0.1	0.05	<	0.0050	0.0025	<	0.00010	0.00005	<	0.0200	0.01	<	0.017	0.005	<	0.03	0.015	<	0.001	0.005	<	0.02	0.01	<	0.02	0.01	<	
SW-6	5-Jun-91	Hydrometrics	201.7		6.67	0.2	0.2		0.0010	0.0005	<	0.00010	0.00005	<	0.0200	0.01	<	0.017	0.0085	<	0.18	0.18		0.002	0.001	<	0.02	0.01	<	0.01	0.005	<	
SW-6	9-Jul-91	Hydrometrics	51.2		6.72	0.1	0.1		0.0050	0.0025	<	0.00010	0.0001		0.0200	0.01	<	0.033	0.033		0.14	0.14		0	0	J	0.02	0.01	<	0.03	0.03		
SW-6	14-Aug-91	Hydrometrics	3.9		7.31	0.1	0.05	<	0.0050	0.0025	<	0.00010	0.00005	<	0.0200	0.01	<	0.011	0.011		0.06	0.06		0.0002	0.001	<	0.02	0.01	<	0.02	0.02		
SW-6	24-Sep-91	Hydrometrics	2.5		6.71	0.1	0.05	<	0.0050	0.0025	<	0.00010	0.00005	<	0.0200	0.01	<	0.013	0.0065	<	0.03	0.015	<	0.002	0.001	<	0.02	0.01	<	0.01	0.005	<	
SW-6	19-Jul-92	Hydrometrics	30.67		7.52	1.6	1.6		0.0050	0.0025	<	0.00010	0.00005	<	0.0100	0.005	<	0.11	0.11		2.88	2.88		0.002	0.001	<	0.05	0.05		0.13	0.13		
SW-6	23-Sep-92	Hydrometrics	3.54		6.43	0.1	0.05	<	0.0050	0.0025	<	0.00010	0.0001		0.0100	0.005	<	0.016	0.016		0.2	0.2		0.002	0.001	<	0.02	0.02		0.05	0.05		
SW-6	21-Jul-93	Hydrometrics	38.11		7.46	0.2	0.2		0.0010	0.0005	<	0.00010	0.0001		0.0010	0.0005	<	0.062	0.062		0.24	0.24		0.002	0.001	<	0.03	0.03		0.01	0.01	J	
SW-6	22-Sep-93	Hydrometrics	4.2		7.25	0.1	0.05	<	0.0010	0.0005	<	0.00010	0.0001		0.0010	0.0005	<	0.019	0.019		0.03	0.03		0.002	0.001	<	0.03	0.03		0.018	0.009	<	
SW-6	14-Apr-94	Hydrometrics	19.2						0.0010	0.0005	<	0.00010	0.00005	<				0.001	0.0005	<													
SW-6	15-Jun-94	Hydrometrics	87.64		8.3	0.1	0.1		0.0010	0.0005	<	0.00010	0.00005	<	0.0010	0.0005	<	0.016	0.016	J	0.11	0.11		0.002	0.001	<	0.001	0.01		0.005	0.005	J	
SW-6	21-May-96	Hydrometrics	45.62		4.86	0.1	0.1					0.00010	0.00005	<				0.021	0.021		0.15	0.15		0.003	0.0015	<	0.012	0.012		0.04	0.02	<	
SW-6	10-Jul-96	Hydrometrics	149.2		5.41	0.1	0.05	<				0.00010	0.0001					0.024	0.024		0.01	0.01		0.003	0.0015	<	0.013	0.013		0.01	0.005	<	
SW-6	11-Sep-96	Hydrometrics	2.91		6.63	0.1	0.05	<				0.00010	0.00005	<				0.011	0.011		0.02	0.02		0.003	0.0015	<	0.007	0.007		0.01	0.005	<	
SW-6	6-May-99	Maxim	13.65		7.57	0.1	0.1					0.00010	0.00005	<				0.01	0.01		0.13	0.13		0.001	0.005	<	0.008	0.008		0.01	0.005	<	
SW-6	7-Jul-99	Maxim	148.38		7.64	0.2	0.2		0.0010	0.0005	<	0.00010	0.00005	<				0.034	0.034		0.27	0.27		0.001	0.005	<	0.014	0.014		0.03	0.02		
SW-6	29-Sep-99	Maxim	3.727		7.43	0.1	0.05	<				0.00010	0.00005	<				0.016	0.016		0.06	0.06		0.001	0.005	<	0.007	0.007		0.02	0.02	J	
SW-6	13-Apr-00	Maxim	2.55		6.86	0.05	0.025	<				0.00010	0.00005	<				0.004	0.004		0.05	0.025	<	0.001	0.005	<	0.005	0.0025	<	0.02	0.01	<	
SW-6	8-Jul-00	Maxim	36.08		6.05	0.1	0.1	J				0.00010	0.00005	<				0.032	0.032	J	0.14	0.14	J	0.001	0.005	<	0.018	0.018	J	0.01	0.01	J	
SW-6	19-Oct-00	Maxim	3.34		6.5	0.1	0.05	<				0.00010	0.00005	<				0.006	0.006		0.05	0.025	<	0.001	0.005	<	0.003	0.0015	<	0.01	0.005	<	
SW-6	21-Apr-01	Maxim	2.67		8.02	0.1	0.05	<				0.00010	0.00005	<				0.004	0.004		0.02	0.02		0.001	0.005	<	0.003	0.0015	<	0.01	0.005	<	
SW-6	26-Jun-01	Maxim	60.42		6.95	0.1	0.05	<				0.00010	0.00005	<				0.027	0.027		0.12	0.12		0.001	0.005	<	0.008	0.008		0.01	0.005	<	
SW-6	11-Oct-01	Maxim	1.17		6.62	0.1	0.05	<	0.0030	0.0015	<				0.00010	0.00005	<	0.004	0.004		0.04	0.04		0.001	0.005	<	0.006	0.006		0.008	0.008		
SW-6	23-Apr-02	Maxim	0.64		6.56	0.1	0.05	<				0.0001	0.00005	<				0.004	0.004		0.06	0.06		0.001	0.005	<	0.003	0.003		0.01	0.005	<	
SW-6	1-Jul-02	Maxim	110		7.06	0.1	0.1	J				0.0002	0.0002					0.032	0.032		0.14	0.14		0.001	0.001		0.008	0.008		0.01	0.01	J	
SW-6	8-Oct-02	Maxim	3.36		7.87	0.1	0.05	<				0.0001	0.0001					0.014	0.014		0.01	0.01		0.001	0.005	<	0.006	0.006		0.05	0.05	J	
SW-6	22-Apr-03	Maxim	4.13		6.49	0.05	0.025	<				0.0001	0.00005	<				0.005	0.005		0.12	0.12		0.001	0.005	<	0.007	0.007</					

TABLE A-2 - STATISTICAL SUMMARY OF WATER QUALITY DATA 1989-2008
New World Mining District Response and Restoration Project

Sample Station	Sample Date	Data Source	Flow (cfs)	Flow Flag	Field pH (su)	Aluminum Total Rec. (mg/l)	Al(calc)	Al Flag	Arsenic Total Rec. (mg/l)	As(calc)	As Flag	Cadmium Total Rec. (mg/l)	Cd(calc)	Cd Flag	Chromium Total Rec. (mg/l)	Cr(calc)	Cr Flag	Copper Total Rec. (mg/l)	Cu(calc)	Cu Flag	Iron Total Rec. (mg/l)	Fe(calc)	Fe Flag	Lead Total Rec. (mg/l)	Pb(calc)	Pb Flag	Manganese Total Rec. (mg/l)	Mn(calc)	Mn Flag	Zinc Total Rec. (mg/l)	Zn(calc)	Zn Flag		
Chronic Standard (for Hardness = 50 mg/l)						0.087			0.15			0.00142			0.117			0.0052			1			0.0005										
Acute Standard (for Hardness = 50 mg/l)						0.75			0.34			0.00206			0.984			0.0073			NA					0.014			NA					
DC-2	3-Oct-89	Hydrometrics	0.2		3.48				0.0050	0.0025	<	0.00100	0.0005	<				7.89	7.89		28.26	28.26					3.37	3.37		1.03	1.03			
DC-2	12-Jul-90	Hydrometrics	4.39		3.97	7.2	7.2		0.0050	0.0025	<	0.00500	0.005					2.74	2.74		17.9	17.9					0.71	0.71		0.31	0.31			
DC-2	15-Jun-94	Hydrometrics	2.86		3.18	9	9		0.0010	0.0005	<	0.00210	0.0021		0.0040	0.004		2.64	2.64	J	10.4	10.4		0.003	0.003		1.08	1.08		0.332	0.332			
DC-2	26-Jul-94	Hydrometrics			3.96	16.4	16.4		0.0010	0.0005	<	0.00540	0.0054		0.0050	0.005		5.32	5.32		15.8	15.8		0.009	0.009		2.57	2.57		0.667	0.667			
DC-2	22-Aug-94	Hydrometrics			3.5	28.6	28.6		0.0020	0.002		0.00760	0.0076		0.0100	0.01		8.26	8.26		41.8	41.8		0.024	0.024		3.65	3.65		0.904	0.904			
DC-2	23-Aug-94	Hydrometrics			3.46	23.9	23.9		0.0010	0.0005	<	0.00740	0.0074		0.0060	0.006		7.27	7.27		20.4	20.4		0.006	0.006		3.43	3.43		0.886	0.886			
DC-2	20-Sep-94	Hydrometrics			4.21	25	25		0.0010	0.0005	<	0.00760	0.0076		0.0070	0.007		7.44	7.44		23.6	23.6		0.004	0.004		3.59	3.59		1.2	1.2	J		
DC-2	13-Oct-94	Hydrometrics			5.29																													
DC-2	26-Sep-95	Hydrometrics	0.194		3.5	22	22		0.0010	0.0005	<	0.00520	0.0052		0.0060	0.006		6.33	6.33		16.2	16.2		0.005	0.005		2.99	2.99		0.894	0.894			
DC-2	21-May-96	Hydrometrics	0.467		4.69	8.3	8.3					0.00270	0.0027					1.91	1.91		5.55	5.55		0.004	0.004		1.12	1.12		0.43	0.43			
DC-2	30-May-96	Hydrometrics	1.116		4.45	6.9	6.9					0.00190	0.0019					1.62	1.62		5.52	5.52		0.004	0.004		0.785	0.785		0.31	0.31			
DC-2	5-Jun-96	Hydrometrics	2.79		3.38	7	7					0.00140	0.0014					1.83	1.83		19.3	19.3		0.008	0.008		0.629	0.629		0.24	0.24			
DC-2	12-Jun-96	Hydrometrics	10.8		3.35							0.00120	0.0012					1.25	1.25		10.7	10.7	J							0.21	0.21	J		
DC-2	18-Jun-96	Hydrometrics	14.33		5.06	5	5					0.00120	0.0012					1.44	1.44		9.69	9.69		0.003	0.003		0.481	0.481		0.19	0.19			
DC-2	26-Jun-96	Hydrometrics	11.3		5.03							1.52	1.52					1.52	1.52		8.54	8.54								0.19	0.19			
DC-2	2-Jul-96	Hydrometrics	13.79		4.5							1.38	1.38					1.38	1.38		6.76	6.76								0.24	0.24	J		
DC-2	9-Jul-96	Hydrometrics	15.48		4	4.2	4.2					0.00080	0.0008					1.11	1.11		8.05	8.05		0.01	0.01		0.379	0.379		0.15	0.15			
DC-2	18-Jul-96	Hydrometrics	4.937		4.64													2.23	2.23		8	8								0.33	0.33			
DC-2	25-Jul-96	Hydrometrics	1.175		6.83													2.7	2.7		9.84	9.84								0.39	0.39			
DC-2	21-Aug-96	Hydrometrics	0.138		3.89													4.74	4.74		15.4	15.4								0.64	0.64			
DC-2	10-Sep-96	Hydrometrics	0.18		3.32							0.00580	0.0058					6.22	6.22		15.6	15.6		0.006	0.006		2.72	2.72		0.89	0.89			
DC-2	9-Jul-97	UOS Data				3.27	3.27		0.0100	0.005	<	0.00500	0.0025	<	0.0100	0.005	<	0.876	0.876		5.32	5.32					0.304	0.304		0.129	0.129			
DC-2	30-Mar-98	UOS Data			0.13	12.3	12.3											2.69	2.69		12.8	12.8					2.14	2.14		0.688	0.688			
DC-2	22-Apr-98	UOS Data			0.072	4.54	12.1	12.1				2.66	2.66					2.66	2.66		11.2	11.2					1.95	1.95		0.589	0.589			
DC-2	4-May-98	UOS Data			0.699	4.3	5.4	5.4										1.23	1.23		6.43	6.43					0.574	0.574		0.162	0.162			
DC-2	29-May-98	UOS Data			2.67	3.88	5.4	5.4										1.47	1.47		10	10					0.592	0.592		0.22	0.22			
DC-2	6-May-99	Maxim			0.028	4.49	9.2	9.2				0.00380	0.0038					1.94	1.94		16	16		0.006	0.006		1.61	1.61		0.51	0.51			
DC-2	6-Jul-99	Maxim			9.46	4.78	3.7	3.7				0.00120	0.0012					1.07	1.07		4.83	4.83		0.002	0.002		0.37	0.37		0.15	0.15			
DC-2	29-Jun-00	Maxim			0.464	4.48	12.4	12.4				0.00440	0.0044					3.98	3.98		13.6	13.6		0.002	0.002		1.93	1.93		0.6	0.6			
DC-2	12-Apr-00	Maxim			0.012	4.88	10.7	10.7				0.00560	0.0056					2.51	2.51		13.5	13.5		0.004	0.004		2.02	2.02		0.02	0.01	<		
DC-2	20-May-00	Maxim			1.57	4.26												1.42	1.42											0.19	0.19			
DC-2	20-May-00	Maxim			1.57	4.22												1.44	1.44											0.19	0.19			
DC-2	20-May-00	Maxim			1.61	4.24												1.89	1.89											0.26	0.26			
DC-2	20-May-00	Maxim			2.61	4.12	5.5	5.5				0.00110	0.0011					1.34	1.34		14.4	14.4		0.007	0.007		0.6	0.6		0.17	0.17			
DC-2	14-Jun-00	Maxim			5.16	5.5												1.59	1.59											0.24	0.24			
DC-2	14-Jun-00	Maxim			6.07	4.58												1.64	1.64											0.23	0.23			
DC-2	14-Jun-00	Maxim			6.44	4.42												1.61	1.61											0.22	0.22			
DC-2	14-Jun-00	Maxim			7.66							0.00140	0.0014					1.43	1.43		8.26	8.26		0.002	0.002		0.5	0.5		0.2	0.2			
DC-2	9-Jul-00	Maxim			3.5	4.61												1.59	1.59	J										0.23	0.23	J		
DC-2	9-Jul-00	Maxim			2.4	4.5	6.1	6.1	J			0.00190	0.0019					2.01	2.01	J	8.55	8.55	J	0.003	0.003		0.72	0.72	J	0.26	0.26	J		
DC-2	9-Jul-00	Maxim			2.83	4.47												2.04	2.04	J										0.28	0.28	J		
DC-2	9-Jul-00	Maxim			3.35	4.69												1.75	1.75	J										0.26	0.26	J		
DC-2	9-Oct-00	Maxim			0.2	3.28	14	14				0.00450	0.0045					3.77	3.77		6.54	6.54	J	0.007	0.007		2.23	2.23		0.54	0.54			
DC-2	20-Apr-01	Maxim			0.15	5.05	11.1	11.1				0.00370	0.0037					2.2	2.2		10.8	10.8		0.004	0.004		1.66	1.66		0.37	0.37			
DC-2	29-Jun-01	Maxim			3.217	4.95	5.5	5.5				0.00170	0.0017					1.34	1.34		10.3	10.3		0.022	0.022	J	0.63	0.63		0.29	0.29			
DC-2	10-Oct-01	Maxim																																

TABLE A-2 - STATISTICAL SUMMARY OF WATER QUALITY DATA 1989-2008
 New World Mining District Response and Restoration Project

Sample Station	Sample Date	Data Source	Flow (cfs)	Flow Flag	Field pH (su)	Aluminum Total Rec. (mg/l)	Al(calc)	Al Flag	Arsenic Total Rec. (mg/l)	As(calc)	As Flag	Cadmium Total Rec. (mg/l)	Cd(calc)	Cd Flag	Chromium Total Rec. (mg/l)	Cr(calc)	Cr Flag	Copper Total Rec. (mg/l)	Cu(calc)	Cu Flag	Iron Total Rec. (mg/l)	Fe(calc)	Fe Flag	Lead Total Rec. (mg/l)	Pb(calc)	Pb Flag	Manganese Total Rec. (mg/l)	Mn(calc)	Mn Flag	Zinc Total Rec. (mg/l)	Zn(calc)	Zn Flag
Chronic Standard (for Hardness = 50 mg/l)						0.087			0.15			0.00142			0.117			0.0052			1			0.0005			NA			0.067		
Acute Standard (for Hardness = 50 mg/l)						0.75			0.34			0.00206			0.984			0.0073			NA			0.014			NA			0.067		
Station DC-2: Pre-1999 Samples (n)			20		24	18			9			15			7			25			25			12			19			25		
Minimum			0.072		3.180	3.270			0.001			0.001			0.004			0.876			5.320			0.002			0.304			0.129		
Maximum			15.480		6.830	28.600			0.005			0.008			0.010			8.260			41.800			0.024			3.650			1.200		
Mean			4.386		4.184	12.339			0.002			0.004			0.006			3.391			13.722			0.007			1.740			0.489		
Standard Deviation (SD)			5.453		0.830	8.194			0.002			0.003			0.002			2.458			8.361			0.006			1.252			0.322		
Mean + (2 x SD); for pH: Mean - (2 x SD)			15.292		2.524	28.728			0.005			0.009			0.010			8.307			30.445			0.019			4.244			1.133		
Station DC-2: 1989-2008 Samples (n)			63		70	58			12			56			7			75			66			53			60			75		
Minimum			0.012		3.180	2.300			0.001			0.000			0.004			0.310			4.800			0.002			0.230			0.010		
Maximum			15.480		7.100	28.600			0.005			0.008			0.010			8.260			41.800			0.024			3.650			1.200		
Mean			3.145		4.522	10.734			0.001			0.003			0.006			2.695			11.702			0.005			1.619			0.434		
Standard Deviation (SD)			4.071		0.889	5.997			0.001			0.002			0.002			1.786			6.316			0.004			0.955			0.263		
Mean + (2 x SD); for pH: Mean - (2 x SD)			11.287		2.743	22.729			0.004			0.007			0.010			6.267			24.333			0.014			3.529			0.959		
Station DC-2: 1998-4/02 Low Flow (n)			21		24	19			6			16			4			24			21			15			20			24		
Minimum			0.012		3.280	5.340			0.001			0.001			0.006			1.230			5.520			0.002			0.574			0.010		
Maximum			2.670		5.290	28.600			0.003			0.008			0.010			8.260			41.800			0.024			3.650			1.200		
Mean			0.693		4.145	13.729			0.001			0.004			0.007			3.607			14.962			0.006			2.075			0.545		
Standard Deviation (SD)			0.833		0.547	7.105			0.001			0.002			0.002			2.363			8.365			0.005			1.014			0.320		
Mean + (2 x SD); for pH: Mean - (2 x SD)			2.359		3.052	27.938			0.003			0.009			0.011			8.332			31.692			0.017			4.102			1.185		
Station DC-2: 1998 -4/02 High Flow (n)			20		20	11			4			11			3			22			16			9			11			22		
Minimum			1.175		3.180	3.270			0.001			0.001			0.004			0.876			4.830			0.002			0.304			0.129		
Maximum			15.480		6.830	16.400			0.005			0.005			0.005			5.320			19.300			0.010			2.570			0.667		
Mean			6.686		4.467	6.615			0.002			0.005			0.005			1.880			10.003			0.005			0.756			0.259		
Standard Deviation (SD)			4.363		0.776	3.663			0.002			0.002			0.001			0.921			4.172			0.003			0.639			0.111		
Mean + (2 x SD); for pH: Mean - (2 x SD)			15.413		2.914	13.941			0.006			0.005			0.006			3.722			18.347			0.011			2.034			0.481		
Station DC-2: 10/03-10/08 Low Flow (n)			11		11	11			0			11			0			11			11			11			11			11		
Minimum			0.022		3.700	6.580						0.002						1.440			5.940			0.002			1.250			0.350		
Maximum			0.530		6.930	14.100						0.005						3.580			15.500			0.006			2.370			0.840		
Mean			0.196		4.721	10.613						0.004						2.451			10.771			0.004			1.882			0.530		
Standard Deviation (SD)			0.154		1.002	2.463						0.001						0.761			2.849			0.001			0.341			0.123		
Mean + (2 x SD); for pH: Mean - (2 x SD)			0.524		2.718	15.539						0.005						3.973			16.468			0.006			2.564			0.775		
Station DC-2: 10/03-10/08 High Flow (n)			6		6	6			0			6			0			6			6			6			6			6		
Minimum			0.507		4.720	2.300						0.000						0.310			2.320			0.002			0.230			0.070		
Maximum			10.200		7.100	8.900						0.002						2.200			10.200			0.009			1.120			0.340		
Mean			6.914		6.170	3.893						0.001						0.785			4.807			0.003			0.433			0.138		
Standard Deviation (SD)			3.666		0.841	2.507						0.001						0.706			2.827			0.003			0.338			0.102		
Mean + (2 x SD); for pH: Mean - (2 x SD)			14.246		4.487	8.906						0.002						2.196			10.460			0.009			1.110			0.342		
Narrative Standard - DC-2					27	28.4			NA			0.005			NA			8.064			29.646			0.016			4.688			1.104		

Notes: mg/l = milligrams/liter; su = standard units
 n = number of samples

< = less than detection
 J = estimated value

NA = not applicable

TABLE A-2 - STATISTICAL SUMMARY OF WATER QUALITY DATA 1989-2008
New World Mining District Response and Restoration Project

Sample Station	Sample Date	Data Source	Flow (cfs)	Flow Flag	Field pH (su)	Aluminum Total Rec. (mg/l)	Al (calc)	Al Flag	Arsenic Total Rec. (mg/l)	As (calc)	As Flag	Cadmium Total Rec. (mg/l)	Cd (calc)	Cd Flag	Chromium Total Rec. (mg/l)	Cr (calc)	Cr Flag	Copper Total Rec. (mg/l)	Cu (calc)	Cu Flag	Iron Total Rec. (mg/l)	Fe (calc)	Fe Flag	Lead Total Rec. (mg/l)	Pb (calc)	Pb Flag	Manganese Total Rec. (mg/l)	Mn (calc)	Mn Flag	Zinc Total Rec. (mg/l)	Zn (calc)	Zn Flag
Chronic Standard (for Hardness = 50 mg/l)						0.087			0.15			0.00142			0.117			0.0052			1			0.0005			NA			0.067		
Acute Standard (for Hardness = 50 mg/l)						0.75			0.34			0.00206			0.984			0.0073			NA			0.014			NA			0.067		
DC-5	3-Oct-89	Hydrometrics	0.370		5.69				0.0050	0.0025	<	0.00300	0.003					2.54	2.54		6.88	6.88					1.16	1.16		0.4	0.4	
DC-5	12-Jul-90	Hydrometrics	8.910		7.43	2.7	2.7		0.0050	0.0025	<	0.00100	0.0005	<				0.97	0.97		4.3	4.3					0.28	0.28		0.12	0.12	
DC-5	28-Jul-93	Hydrometrics			7.2	3.2	3.2		0.0020	0.001	<	0.00100	0.0005	<	0.0020	0.002		1.09	1.09		4.19	4.19	0.002	0.002	0.0020	0.002	0.35	0.35		0.12	0.12	
DC-5	23-Sep-93	Hydrometrics	0.540		6.61	5.3	5.3		0.0010	0.0005	<	0.00230	0.0023		0.0020	0.002		2.17	2.17		4.68	4.68	0.002	0.002		1.2	1.2		0.36	0.36		
DC-5	25-Aug-94	Hydrometrics	0.240		6.4	8.1	8.1J		0.0010	0.0005	<	0.00270	0.0027		0.0020	0.002		2.85	2.85J		5.7	5.7J	0.002	0.002	0.002	0.002	1.23	1.23		0.42	0.42	
DC-5	13-Jul-95	Hydrometrics	30.430		7.1	2	2		0.0010	0.0005	<	0.00050	0.0005		0.0020	0.002		4.85	4.85J		3.8	3.8J	0.003	0.003	0.003	0.003	0.18	0.18		0.062	0.062	
DC-5	27-Sep-95	Hydrometrics	0.420		5.3	7.7	7.7		0.0010	0.0005	<	0.00230	0.0023		0.0020	0.002		2.45	2.45		2.38	2.38	0.003	0.003		1.18	1.18		0.391	0.391		
DC-5	18-Jun-96	Hydrometrics	30.740		7.63	1.4	1.4		0.0010	0.0005	<	0.00040	0.0004					0.346	0.346		3.12	3.12	0.003	0.0015	<	0.143	0.143		0.06	0.06		
DC-5	9-Jul-96	Hydrometrics	28.140		6.34	1.7	1.7J					0.00040	0.0004					0.46	0.46		2.48	2.48	0.003	0.0015	<	0.166	0.166		0.07	0.07		
DC-5	10-Sep-96	Hydrometrics	0.312		6.13	7.2	7.2					0.00230	0.0023					2.62	2.62		4.42	4.42	0.003	0.0015	<	1.08	1.08		0.37	0.37		
DC-5	6-May-99	Maxim	1.180		6.29	1.4	1.4					0.00060	0.0006					0.33	0.33		0.65	0.65	0.001	0.001		0.25	0.25		0.08	0.08		
DC-5	8-Jul-99	Maxim	23.830		7.46	1.2	1.2					0.00040	0.0004					0.31	0.31		1.54	1.54	0.001	0.001		0.124	0.124		0.07	0.07		
DC-5	29-Sep-99	Maxim	1.484		2.64	4	4					0.00120	0.0012					1.26	1.26		2.67	2.67	0.002	0.002		0.5	0.5		0.17	0.17J		
DC-5	12-Apr-00	Maxim	0.429		6.59	2.9	2.9					0.00140	0.0014					1.04	1.04		1.38	1.38	0.004	0.004		0.041	0.041		0.02	0.01		
DC-5	9-Jul-00	Maxim	8.900		7.65	1.6	1.6J					0.00050	0.0005	<				0.54	0.54J		2.11	2.11J	0.001	0.0005	<	0.19	0.19J		0.07	0.07J		
DC-5	9-Oct-00	Maxim	1.200		7.17	2.7	2.7					0.00460	0.0046					0.61	0.61		1.3	1.3J	0.003	0.0015	<	0.23	0.23		0.08	0.08		
DC-5	29-Jun-01	Maxim	5.107		6.95	1.8	1.8					0.00060	0.0006					0.55	0.55		3.02	3.02	0.002	0.002J		0.21	0.21		0.09	0.09		
DC-5	10-Oct-01	Maxim	0.340		7.73	3.5	3.5		0.0030	0.0015	<	0.00100	0.001					0.71	0.71		1.19	1.19	0.003	0.003		0.41	0.41		0.15	0.15		
DC-5	25-Apr-02	Maxim		ice	5.6	0.1	0.05	<				0.0004	0.0004					0.024	0.024		0.01	0.0005	<				0.16	0.16		0.04	0.04	
DC-5	2-Jul-02	Maxim	12.600		6.5	1.6	1.6J					0.0005	0.0005					0.54	0.54		2.48	2.48	0.002	0.002		0.19	0.19		0.08	0.08J		
DC-5	18-Sep-02	Maxim			5.86	5.9	5.9					0.0021	0.0021					1.61	1.61		3.66	3.66	0.003	0.003		0.93	0.93		0.21	0.21		
DC-5	28-Sep-02	Maxim			0.3	0.3	0.3					0.0004	0.0004					0.079	0.079		0.25	0.25	0.001	0.0005	<	0.086	0.086		0.03	0.02J		
DC-5	9-Oct-02	Maxim	0.740		7.1	3.7	3.7					0.001	0.001					0.76	0.76		2.07	2.07	0.003	0.003		0.45	0.45		0.15	0.15J		
DC-5	21-Apr-03	Maxim	0.570		6.26	2.07	2.07					0.0009	0.0009					0.56	0.56		1.3	1.3	0.002	0.002		0.35	0.35		0.13	0.13		
DC-5	11-Jul-03	Maxim	5.460		6.37	2.1	2.1					0.0006	0.0006					0.48	0.48		1.55	1.55	0.001	0.001		0.29	0.29		0.07	0.07		
DC-5	8-Sep-03	Maxim			5.7	7.84	7.84					0.0017	0.0017					2.01	2.01		15.7	15.7	0.018	0.018		1.05	1.05		0.38	0.38		
DC-5	29-Sep-03	Maxim	0.185		7.01	5.34	5.34					0.0012	0.0012					1.44	1.44		3	3	0.003	0.003		0.62	0.62		0.3	0.3		
DC-5	7-Apr-04	Maxim	0.197		6.44	2.16	2.16					0.0007	0.0007					0.52	0.52		1.1	1.1	0.001	0.001		0.34	0.34		0.13	0.13JF%		
DC-5	29-Jun-04	Maxim	19.210		7.7	0.73	0.73					0.0002	0.0002					0.16	0.16		1.23	1.23	0.001	0.001		0.1	0.1		0.002	0.02J		
DC-5	11-Aug-04	Maxim	0.820		7.35	3.03	3.03					0.0011	0.0011					0.87	0.87		3.69	3.69	0.001	0.001		0.46	0.46		0.15	0.15		
DC-5	6-Oct-04	Maxim	1.800		6.62	1.93	1.93					0.0007	0.0007					0.51	0.51		2.13	2.13	0.001	0.0005	<	0.33	0.33		0.11	0.11		
DC-5	4/6/2005	Maxim	0.24		7.23	2.43	2.43				--	0.001	0.001		--			0.54	0.54		1.74	1.74	0.001	0.001		0.51	0.51		0.35	0.35JF%		
DC-5	6/29/2005	Maxim	19.26		6.9	0.7	0.7		--		--	0.0002	0.0002		--			0.17	0.17		0.98	0.98	0.001	0.001		0.095	0.095		0.1	0.1		
DC-5	9/27/2005	Maxim	0.43		6.3	3.88	3.88		--		--	0.0015	0.0015		--			0.97	0.97		2.61	2.61	0.004	0.004		0.73	0.73		0.22	0.22		
DC-5	25-Apr-06	Maxim	0.46		6.94	0.96	0.96					0.0005	0.0005					0.23	0.23		0.64	0.64	0.001	0.0005	<	0.29	0.29		0.06	0.06		
DC-5	27-Jun-06	Maxim	15.79		6.62	1.13	1.13					0.0001	0.00005	<				0.21	0.21		1.13	1.13	0.001	0.0005	<	0.11	0.11		0.04	0.04		
DC-5	27-Sep-06	Maxim	0.28		6.73	2.83	2.83					0.0014	0.0014					0.79	0.79		0.91	0.91	0.001	0.001		0.66	0.66		0.17	0.17		
DC-5	11-Apr-07	Tt	0.432		6.93	1.23	1.23					0.0007	0.0007		--			0.25	0.25		1.03	1.03	0.001	0.0005	<	0.32	0.32		0.09	0.09		
DC-5	13-Jun-07	Tt	30.7		5.7	1.39	1.39		--		--	0.0002	0.0002		--			0.019	0.019		1.73	1.73	0.003	0.003		0.099	0.099		0.02	0.02		
DC-5	18-Sep-07	Tt	0.418		6.92	4.23	4.23					0.0014	0.0014		--			1.16	1.16		5.04	5.04	0.002	0.002		0.74	0.74		0.22	0.22		
DC-5	17-Apr-08	Tt	0.25		7.33	1.19	1.19					0.0007	0.0007					0.31	0.31		1.3	1.3	0.001	0.0005	<	0.37	0.37		0.09	0.09		
DC-5	15-Jul-08	Tt	17.66		7.04	0.89	0.89					0.0002	0.0002					0.18	0.18		0.98	0.98	0.002	0.002		0.11	0.11		0.03	0.03		
DC-5	24-Sep-08	Tt	0.641		7.64	6.53	6.53					0.0013	0.0013					1.48	1.48		5.34	5.34	0.005	0.005	JF%	0.71	0.71		0.21	0.21		
Station DC-5: Pre-1999 Samples (n)			9		10			7				10			5			10			10			8			10			10		
Minimum			0.240		5.300	1.400		0.0005				0.00040			0.0020			0.346			2.380			0.002			0.143			0.060		
Maximum			30.740		7.630	8.100		0.0025				0.00300			0.0020			2.850			6.880			0.003			1.230			0.420		
Mean			11.122		6.583	4.367		0.0011				0.00149			0.0020			1.598			4.195			0.002			0.697			0.237		
Standard Deviation (SD)			14.272		0.760	2.729		0.0009				0.00111			0.0000			1.017			1.387			0.001			0.504			0.161		
Mean + (2 x SD); for pH: Mean - (2 x SD)			39.667		5.062	9.826		0.0030				0.00370			0.0020			3.632			6.969			0.003			1.704			0.560		
Station DC-5: 1989-2008 Samples (n)			38		42			42				8			43			43			43			41			43			43		

TABLE A-2 - STATISTICAL SUMMARY OF WATER QUALITY DATA 1989-2008
New World Mining District Response and Restoration Project

Sample Station	Sample Date	Data Source	Flow (cfs)	Flow Flag	Field pH (su)	Aluminum Total Rec. (mg/l)	Al(calc)	Al Flag	Arsenic Total Rec. (mg/l)	As(calc)	As Flag	Cadmium Total Rec. (mg/l)	Cd(calc)	Cd Flag	Chromium Total Rec. (mg/l)	Cr(calc)	Cr Flag	Copper Total Rec. (mg/l)	Cu(calc)	Cu Flag	Iron Total Rec. (mg/l)	Fe(calc)	Fe Flag	Lead Total Rec. (mg/l)	Pb(calc)	Pb Flag	Manganese Total Rec. (mg/l)	Mn(calc)	Mn Flag	Zinc Total Rec. (mg/l)	Zn(calc)	Zn Flag	
Chronic Standard (for Hardness = 50 mg/l)						0.087			0.15			0.00142			0.117			0.0052					1	0.0005									
Acute Standard (for Hardness = 50 mg/l)						0.75			0.34			0.00206			0.984			0.0073						NA									
SW-7	28-May-90	Hydrometrics	40.30		7.02	0.1	0.1		0.0050	0.0025	<	0.00010	0.00005	<	0.0200	0.01	<	0.03	0.03		0.2	0.2		0.002	0.001	<	0.02	0.01	<	0.02	0.02		
SW-7	5-Jun-90	Hydrometrics	81.11		7.23	0.4	0.4											0.11	0.11		0.99	0.99									0.02	0.02	
SW-7	6-Jun-90	Hydrometrics	115.10																														
SW-7	13-Jun-90	Hydrometrics	69.81		7.15	0.26	0.26												0.07	0.07		0.61	0.61								0.02	0.02	
SW-7	15-Jun-90	Hydrometrics	56.30																														
SW-7	20-Jun-90	Hydrometrics	97.51		7.28	0.5	0.5												0.14	0.14		0.99	0.99								0.02	0.02	
SW-7	22-Jun-90	Hydrometrics	129.15																														
SW-7	27-Jun-90	Hydrometrics	138.80		8.76	0.6	0.6		0.0050	0.0025	<	0.00020	0.0002		0.0200	0.01	<	0.147	0.147		1.02	1.02		0.002	0.001	<	0.05	0.05			0.03	0.03	
SW-7	28-Jun-90	Hydrometrics	140.13																														
SW-7	3-Jul-90	Hydrometrics	122.90		9.58	0.4	0.4												0.11	0.11		0.78	0.78						0.05	0.05		0.03	0.03
SW-7	10-Jul-90	Hydrometrics	50.20		0.3	0.3						0.00100	0.0005	<	0.0200	0.01	<	0.11	0.11		0.67	0.67		0.01	0.005	<	0.04	0.04		0.04	0.04		
SW-7	12-Jul-90	Hydrometrics	41.70																														
SW-7	17-Jul-90	Hydrometrics	24.70		9.09	0.5	0.5												0.17	0.17		0.93	0.93								0.03	0.015	
SW-7	19-Jul-90	Hydrometrics	20.90																														
SW-7	26-Jul-90	Hydrometrics	10.40		6.65	0.5	0.5		0.0050	0.0025	<	0.00020	0.0002		0.0200	0.01	<	0.21	0.21		1.05	1.05		0.003	0.003		0.07	0.07		0.04	0.04		
SW-7	22-Aug-90	Hydrometrics	5.60		7.41																												
SW-7	25-Sep-90	Hydrometrics	2.20		6.63	0.1	0.05	<	0.0050	0.0025	<	0.00010	0.00005	<	0.0200	0.01	<	0.02	0.02		0.14	0.14		0.002	0.001	<	0.05	0.05		0.02	0.02		
SW-7	15-Mar-91	Hydrometrics	1.50		6.54	0.1	0.05	<	0.0050	0.0025	<	0.00100	0.0005	<	0.0200	0.01	<	0.01	0.005	<	0.24	0.24		0.01	0.005	<	0.04	0.04		0.01	0.01		
SW-7	6-Jun-91	Hydrometrics	157.60		7.75	0.3	0.3		0.0050	0.0025	<	0.00010	0.00005	<	0.0200	0.01	<	0.06	0.03	<	0.74	0.74		0.002	0.002	J	0.03	0.03		0.04	0.04		
SW-7	10-Jul-91	Hydrometrics	37.70		7.84	0.4	0.4		0.0050	0.0025	<	0.00010	0.0001		0.0200	0.01		0.18	0.18		1.2	1.2		0.024	0.024	J	0.05	0.05		0.04	0.04		
SW-7	13-Aug-91	Hydrometrics	4.10		7.81	0.1	0.1		0.0050	0.0025	<	0.00010	0.0001		0.0200	0.01		0.04	0.04		0.15	0.15		0.002	0.001		0.07	0.07		0.03	0.03		
SW-7	24-Sep-91	Hydrometrics	5.50		8.23	0.1	0.05	<	0.0050	0.0025	<	0.00010	0.0001		0.0200	0.01	<	0.017	0.017		0.21	0.21		0.002	0.001	<	0.06	0.06		0.01	0.01		
SW-7	19-Jul-92	Hydrometrics	20.00		8.02	0.5	0.5		0.0050	0.0025	<	0.00010	0.00005	<	0.0100	0.005	<	0.17	0.17		0.07	0.07		0.002	0.001	<	0.07	0.07		0.03	0.03		
SW-7	22-Sep-92	Hydrometrics	3.23		7.58	0.1	0.1		0.0050	0.0025	<	0.00020	0.0002		0.0100	0.005	<	0.087	0.0435	<	0.2	0.1	<	0.002	0.001	<	0.08	0.08		0.04	0.04		
SW-7	23-Sep-93	Hydrometrics	3.71		8.11	0.2	0.2		0.0010	0.0005	<	0.00010	0.0001		0.0010	0.0005	<	0.06	0.06		0.29	0.29		0.002	0.001	<	0.07	0.07		0.016	0.016		
SW-7	25-Aug-94	Hydrometrics	1.69		8.18	0.02	0.02	J	0.0010	0.0005	<	0.00010	0.00005	<	0.0010	0.0005	<	0.007	0.007	J	0.16	0.16	J	0.002	0.001	<	0.027	0.027		0.008	0.004		
SW-7	13-Jul-95	Hydrometrics	113.48		6.93	0.6	0.6		0.0010	0.0005	<	0.00010	0.0001		0.0030	0.003		0.098	0.098	J	0.97	0.97	J	0.002	0.001	<	0.05	0.05		0.02	0.02		
SW-7	27-Sep-95	Hydrometrics	4.80		5.4	0.1	0.05	<	0.0010	0.0005	<	0.00010	0.00005	<	0.0010	0.0005	<	0.021	0.021		0.17	0.17		0.002	0.001	<	0.03	0.03		0.027	0.0135		
SW-7	18-Jun-96	Hydrometrics	223.08		8.04	0.5	0.5		0.0050	0.0025	<	0.00020	0.0002		0.0010	0.0005	<	0.08	0.087		1.05	1.05		0.003	0.0015	<	0.046	0.046		0.03	0.02		
SW-7	9-Jul-96	Hydrometrics	97.63		6.84	0.3	0.3	J				0.00010	0.0001					0.096	0.096		0.53	0.53		0.003	0.0015	<	0.038	0.038		0.02	0.02		
SW-7	10-Sep-96	Hydrometrics	2.12		7.36	0.1	0.05	<				0.00010	0.00005	<				0.019	0.019		0.13	0.13		0.003	0.0015	<	0.025	0.025		0.01	0.01		
SW-7	6-May-99	Maxim	6.48		6.32	0.4	0.4		0.0010	0.0005	<				0.008	0.008		0.62	0.62		0.001	0.0005	<	0.036	0.036		0.01	0.005	<	0.01	0.005		
SW-7	8-Jul-99	Maxim	111.83		7.58	0.4	0.4					0.00010	0.0001		0.064	0.064		0.53	0.53		0.001	0.0005	<	0.027	0.027		0.02	0.02		0.01	0.005		
SW-7	29-Sep-99	Maxim	2.49		6.47	0.1	0.05	<				0.00010	0.00005	<				0.001	0.0005	<	0.42	0.42		0.001	0.0005	<	0.023	0.023		0.03	0.03		
SW-7	12-Apr-00	Maxim	0.41		7.01	0.05	0.025	<				0.00010	0.00005	<				0.004	0.004		0.43	0.43		0.001	0.0005	<	0.066	0.066		0.05	0.05		
SW-7	9-Jul-00	Maxim	32.25		7.67	0.3	0.3	J				0.00010	0.00005	<				0.072	0.072	J	0.36	0.36	J	0.001	0.0005	<	0.029	0.029	J	0.02	0.02		
SW-7	9-Oct-00	Maxim	1.81		8.1	0.01	0.005	<				0.00010	0.00005	<				0.001	0.0005	<	0.22	0.22	J	0.003	0.0015	<	0.02	0.01	<	0.01	0.005		
SW-7	29-Jun-01	Maxim	36.63		7.29	0.2	0.2					0.00080	0.0008		0.12	0.12		0.53	0.53		0.004	0.004	J	0.035	0.035		0.01	0.005	<	0.01	0.005		
SW-7	10-Oct-01	Maxim	1.53		7.63	0.1	0.05	<	0.0030	0.0015	<	0.00010	0.00005	<				0.005	0.005		0.12	0.12		0.001	0.001		0.015	0.015		0.02	0.02		
SW-7	25-Apr-02	Maxim			6.14	0.1	0.05	<				0.0001	0.00005	<				0.003	0.003		0.26	0.26		0.001	0.0005	<	0.028	0.028		0.01	0.005		
SW-7	2-Jul-02	Maxim	74.60		7.06	0.3	0.3	J				0.0001	0.00005	<				0.089	0.089		0.49	0.49		0.001	0.0005	<	0.024	0.024		0.02	0.02		
SW-7	9-Oct-02	Maxim	2.42		7.1	0.1	0.1					0.0001	0.0001		0.019	0.019		0.019	0.019		0.23	0.23		0.001	0.0005	<	0.036	0.036		0.06	0.06		
SW-7	21-Apr-03	Maxim	6.43		6.43	0.05	0.025	<				0.0001	0.0001																				

TABLE A-2 - STATISTICAL SUMMARY OF WATER QUALITY DATA 1989-2008
 New World Mining District Response and Restoration Project

Sample Station	Sample Date	Data Source	Flow (cfs)	Flow Flag	Field pH (su)	Aluminum Total Rec. (mg/l)	Al (calc)	Al Flag	Arsenic Total Rec. (mg/l)	As (calc)	As Flag	Cadmium Total Rec. (mg/l)	Cd (calc)	Cd Flag	Chromium Total Rec. (mg/l)	Cr (calc)	Cr Flag	Copper Total Rec. (mg/l)	Cu (calc)	Cu Flag	Iron Total Rec. (mg/l)	Fe (calc)	Fe Flag	Lead Total Rec. (mg/l)	Pb (calc)	Pb Flag	Manganese Total Rec. (mg/l)	Mn (calc)	Mn Flag	Zinc Total Rec. (mg/l)	Zn (calc)	Zn Flag		
Chronic Standard (for Hardness = 50 mg/l)						0.087			0.15			0.00142			0.117			0.0052						0.0005										
Acute Standard (for Hardness = 50 mg/l)						0.75			0.34			0.00206			0.984			0.0073							0.014									
SW-2	2-Aug-89	Hydrometrics				0.1		0.05<				0.001		0.0005<					0.01	0.005<		0.03	0.015<		0.01	0.005<		0.02	0.01<		0.01	0.005<		
SW-2	16-Sep-89	Hydrometrics	0.53			0.1		0.05<				0.001		0.0005<					0.01	0.01		0.08	0.08		0.01	0.005<		0.02	0.01<		0.04	0.04		
SW-2	19-Oct-89	Hydrometrics	0.71		6.98	0.1		0.05<				0.001		0.0005<					0.01	0.005<		0.03	0.015<		0.01	0.005<		0.02	0.01<		0.01	0.005<		
SW-2	6-Jun-90	Hydrometrics	10.9		7.32	0.1		0.05<				0.0001		0.00005<					0.026	0.026<		0.18	0.18		0.002	0.001<		0.02	0.01<		0.02	0.02		
SW-2	7-Jun-90	Hydrometrics	14.7																															
SW-2	13-Jun-90	Hydrometrics	19.52		7.38	0.1		0.05<											0.02	0.02		0.13	0.13								0.01	0.005<		
SW-2	14-Jun-90	Hydrometrics	13.5																															
SW-2	20-Jun-90	Hydrometrics	30.65		8.52	1.6	1.6												0.25	0.25		4.5	4.5								0.04	0.04		
SW-2	22-Jun-90	Hydrometrics	33.3																															
SW-2	26-Jun-90	Hydrometrics	48.7		9.13	0.9	0.9					0.0004	0.0004						0.132	0.132		1.9	1.9		0.014	0.014		0.09	0.09		0.03	0.03		
SW-2	28-Jun-90	Hydrometrics	43.3																															
SW-2	3-Jul-90	Hydrometrics	44		8.55	0.2	0.2												0.02	0.02		0.49	0.49								0.01	0.005<		
SW-2	5-Jul-90	Hydrometrics	27.3																															
SW-2	10-Jul-90	Hydrometrics	17.7			0.1		0.05<											0.02	0.01<		0.05	0.05								0.01	0.005<		
SW-2	11-Jul-90	Hydrometrics	12																															
SW-2	17-Jul-90	Hydrometrics	7.4		8.51	0.1		0.05<											0.01	0.01		0.06	0.06									0.01	0.005<	
SW-2	19-Jul-90	Hydrometrics	4.4																															
SW-2	27-Jul-90	Hydrometrics	2.5		6.39	0.1		0.05<				0.0001	0.00005<						0.007	0.007		0.03	0.015<		0.002	0.001<		0.02	0.01<		0.02	0.01<		
SW-2	23-Aug-90	Hydrometrics	1.6		7.48																													
SW-2	25-Sep-90	Hydrometrics	0.6		6	0.1		0.05<				0.0001	0.00005<						0.006	0.006		0.15	0.15		0.002	0.001<		0.02	0.01<		0.02	0.02		
SW-2	5-Jun-91	Hydrometrics	38.7		7.3	1.9	1.9					0.007	0.005<						0.027	0.025<		3.3	3.35		0.042	0.042		0.15	0.15		0.05	0.05		
SW-2	9-Jun-91	Hydrometrics	8.1		8.55	0.1		0.05<				0.0001	0.00005<						0.027	0.027		0.06	0.06					0.02	0.01<		0.02	0.02		
SW-2	13-Aug-91	Hydrometrics	0.7		7.96	0.1		0.05<				0.0001	0.0001						0.009	0.009		0.05	0.05		0.001	0.0005<		0.02	0.01<		0.02	0.02		
SW-2	24-Sep-91	Hydrometrics	0.7		8.26	0.1		0.05<				0.0002	0.0002						0.007	0.0035<		0.04	0.04		0.002	0.001<		0.02	0.01<		0.01	0.005<		
SW-2	27-May-92	Hydrometrics	30.81		8.02	0.1	0.1					0.0001	0.00005<						0.029	0.029		0.42	0.42		0.002	0.001<		0.02	0.02		0.03	0.03		
SW-2	18-Jul-92	Hydrometrics	3.5		8.02	0.1		0.05<				0.0001	0.00005<						0.012	0.012		0.05	0.05		0.002	0.001<		0.02	0.01<		0.19	0.19		
SW-2	22-Sep-92	Hydrometrics	0.77		7.73	0.1		0.05<				0.0001	0.00005<						0.009	0.009		0.04	0.04		0.002	0.001<		0.02	0.01<		0.01	0.01		
SW-2	21-Jul-93	Hydrometrics	7.24		8.23	0.1		0.05<				0.0001	0.0001						0.029	0.029		0.04	0.04		0.002	0.001<		0.01	0.005<		0.01	0.01	J4	
SW-2	23-Jul-93	Hydrometrics	0.43		7.65	0.1		0.05<				0.0001	0.00005<						0.006	0.006		0.04	0.04		0.002	0.001<		0.01	0.005<		0.008	0.008		
SW-2	16-Jun-94	Hydrometrics	10.03		7.84	0.1		0.05<				0.0001	0.00005<						0.017	0.017	J4	0.05	0.05		0.002	0.001<		0.01	0.005<		0.01	0.01	J4	
SW-2	15-Sep-95	Hydrometrics	0.863		7.5																													
SW-2	26-Sep-95	Hydrometrics	0.71		7.9																													
SW-2	30-Sep-99	Maxim	0.841		7.4	0.1		0.05<				0.0001	0.00005<						0.003	0.003		0.05	0.05		0.001	0.0005<		0.005	0.0025<		0.03	0.03	JF%	
SW-2	14-Apr-00	Maxim	0.288		10.14	0.05	0.025<					0.0001	0.00005<						0.01	0.01		0.05	0.025<		0.001	0.0005<		0.005	0.0025<		0.02	0.01<		
SW-2	7-Jul-00	Maxim	5.2		7.95	0.1		0.05<				0.0001	0.00005<						0.014	0.014	JF%	0.09	0.09	JF%	0.001	0.0005<		0.005	0.0025<		0.01	0.005<		
SW-2	10-Oct-00	Maxim	0.62		8.04	0.1		0.05<				0.0001	0.00005<						0.001	0.001		0.13	0.13	JF%	0.003	0.0015<		0.02	0.01<		0.01	0.01		
SW-2	19-Apr-01	Maxim	0.62		6.14	0.1		0.05<				0.0001	0.00005<						0.008	0.008		0.04	0.04		0.001	0.0005<		0.003	0.0015<		0.01	0.005<		
SW-2	26-Jun-01	Maxim	10.04		7.1	0.1		0.05<				0.0001	0.00005<						0.015	0.015		0.07	0.07		0.001	0.0005<		0.003	0.0015<		0.01	0.005<		
SW-2	12-Oct-01	Maxim	0.29		8.18	0.1		0.05<		0.003	0.0015<	0.001	0.0005<						0.004	0.004		0.05	0.025<		0.001	0.0005<		0.003	0.003		0.08	0.08		
SW-2	24-Apr-02	Maxim	0.27		6.78	0.1		0.05<				0.0001	0.00005<						0.006	0.006		0.02	0.02		0.001	0.0005<		0.003	0.0015<		0.01	0.005<		
SW-2	2-Jul-02	Maxim	14.8		6.95	0.1		0.05<				0.0001	0.00005<						0.017	0.017		0.15	0.15		0.001	0.001		0.003	0.0015<		0.05	0.05	JF%	
SW-2	24-Jul-02	Maxim	2.237		5.53	0.1	0.1					0.0001	0.00005<						0.011	0.011		0.08	0.08		0.002	0.002		0.003	0.0015<		0.03	0.03		
SW-2	7-Oct-02	Maxim	0.63		7.5	0.1		0.05<				0.0001	0.0001						0.006	0.006		0.04	0.04		0.001	0.001		0.004	0.004		0.04	0.04	JF%	
SW-2	22-Apr-03	Maxim	0.32		6.26	0.05	0.025<					0.0001	0.00005<						0.012	0.012		0.2	0.2		0.001	0.0005<		0.008	0.008		0.02	0.02		
SW-2	30-Jun-03	Maxim	31.4		7.28																													

TABLE A-2 - STATISTICAL SUMMARY OF WATER QUALITY DATA 1989-2008
 New World Mining District Response and Restoration Project

Sample Station	Sample Date	Data Source	Flow (cfs)	Flow Flag	Field pH (su)	Aluminum Total Rec. (mg/l)	Al(calc)	Al Flag	Arsenic Total Rec. (mg/l)	As(calc)	As Flag	Cadmium Total Rec. (mg/l)	Cd(calc)	Cd Flag	Chromium Total Rec. (mg/l)	Cr(calc)	Cr Flag	Copper Total Rec. (mg/l)	Cu(calc)	Cu Flag	Iron Total Rec. (mg/l)	Fe(calc)	Fe Flag	Lead Total Rec. (mg/l)	Pb(calc)	Pb Flag	Manganese Total Rec. (mg/l)	Mn(calc)	Mn Flag	Zinc Total Rec. (mg/l)	Zn(calc)	Zn Flag		
Chronic Standard (for Hardness = 50 mg/l)						0.087			0.15			0.00142			0.117			0.0052				1			0.0005			NA			0.067			
Acute Standard (for Hardness = 50 mg/l)						0.75			0.34			0.00206			0.984			0.0073								0.014			NA			0.067		
SW-5	15-Sep-89	Hydrometrics	0.44			0.1	0.05	<				0.001	0.0005	<				0.01	0.005	<	0.03	0.015	<	0.01	0.005	<	0.02	0.01	<	0.03	0.03			
SW-5	20-Oct-89	Hydrometrics	0.47		6.29	0.1	0.05	<				0.001	0.0005	<				0.01	0.005	<	0.03	0.015	<	0.01	0.005	<	0.02	0.01	<	0.01	0.005	<		
SW-5	29-May-90	Hydrometrics	14.34		7.04	0.2	0.2					0.0001	0.00005	<				0.019	0.019		0.34	0.34		0.003	0.003		0.02	0.01	<	0.02	0.02			
SW-5	6-Jun-90	Hydrometrics	19.93		7.16	0.1	0.05	<										0.01	0.01		0.16	0.16								0.01	0.01			
SW-5	12-Jun-90	Hydrometrics	29.84		7.65	0.1	0.1											0.01	0.01		0.3	0.3								0.09	0.09			
SW-5	14-Jun-90	Hydrometrics	23.6																															
SW-5	20-Jun-90	Hydrometrics	41.26		8.33	1.3	1.3											0.2	0.2		3	3								0.03	0.03			
SW-5	26-Jun-90	Hydrometrics	90		8.75	1.4	1.4					0.0004	0.0004					0.153	0.153		3.22	3.22		0.022	0.022		0.13	0.13		0.04	0.04			
SW-5	29-Jun-90	Hydrometrics	80																															
SW-5	2-Jul-90	Hydrometrics	55.5		9.24	0.1	0.05	<										0.01	0.005	<	0.07	0.07								0.01	0.005	<		
SW-5	4-Jul-90	Hydrometrics	34.4																															
SW-5	9-Jul-90	Hydrometrics	18.2			0.1	0.05	<										0.01	0.005	<	0.09	0.09								0.02	0.02			
SW-5	11-Jul-90	Hydrometrics	14																															
SW-5	17-Jul-90	Hydrometrics	6.7		7.97	0.1	0.05	<										0.01	0.005	<	0.05	0.05								0.02	0.02			
SW-5	19-Jul-90	Hydrometrics	5.1																															
SW-5	27-Jul-90	Hydrometrics	2.9		6.36	0.1	0.05	<				0.0001	0.00005	<				0.004	0.004		0.08	0.08		0.002	0.001	<	0.02	0.01	<	0.04	0.02	<		
SW-5	23-Aug-90	Hydrometrics	2.2		7.81																													
SW-5	25-Sep-90	Hydrometrics	0.7		6	0.1	0.05	<				0.0001	0.00005	<				0.003	0.003		0.03	0.015	<	0.002	0.001	<	0.02	0.01	<	0.46	0.46			
SW-5	5-Jun-91	Hydrometrics	50.6		7.64	1.8	1.8					0.0004	0.0004					0.09	0.045	<	3.12	3.12		0.003	0.003		0.11	0.11		0.01	0.01			
SW-5	9-Jul-91	Hydrometrics	11.1		8.37	0.1	0.05	<				0.0001	0.00005	<				0.021	0.021		0.06	0.06		0	J2		0.02	0.01	<	0.02	0.02			
SW-5	13-Aug-91	Hydrometrics	0.7		8.27	0.1	0.05	<				0.0001	0.00005	<				0.002	0.001	J4	0.05	0.05		0.002	0.001	<	0.02	0.01	<	0.06	0.06			
SW-5	24-Sep-91	Hydrometrics	0.5		8.41	0.1	0.1					0.0001	0.00005	<				0.006	0.003	<	0.05	0.05		0.002	0.002		0.02	0.01	<	0.01	0.01			
SW-5	27-May-92	Hydrometrics	38.13		8.1	0.2	0.2					0.0001	0.00005	<				0.029	0.029		0.54	0.54		0.002	0.001	<	0.02	0.02		0.02	0.02			
SW-5	18-Jul-92	Hydrometrics	5.5		7.55	0.1	0.05	<				0.0001	0.00005	<				0.006	0.006		0.07	0.07		0.002	0.001	<	0.02	0.01	<	0.13	0.13			
SW-5	23-Sep-92	Hydrometrics	0.63		8.14	0.1	0.05	<				0.0001	0.00005	<				0.004	0.004		0.06	0.06		0.002	0.001	<	0.02	0.01	<	0.01	0.005	<		
SW-5	21-Jul-93	Hydrometrics	7.62		7.43	0.1	0.05	<				0.0001	0.00005	<				0.009	0.009		0.03	0.015	<	0.002	0.001	<	0.01	0.005	<	0.006	0.006	J4		
SW-5	23-Sep-93	Hydrometrics	0.53		8.24	0.1	0.05	<				0.0001	0.00005	<				0.005	0.005		0.03	0.015	<	0.002	0.001	<	0.01	0.005	<	0.008	0.008			
SW-5	16-Jun-94	Hydrometrics	9.4		7.37	0.1	0.05	<				0.0001	0.00005	<				0.002	0.002	J4	0.04	0.04		0.002	0.001	<	0.01	0.005	<	0.008	0.008	J4		
SW-5	15-Sep-95	Hydrometrics	0.546		7.3																													
SW-5	26-Sep-95	Hydrometrics	0.34		8.1																													
SW-5	7-Jul-99	Maxim	22.33		7.95	0.1	0.1					0.0001	0.00005	<				0.014	0.014		0.13	0.13		0.001	0.001		0.005	0.0025	<	0.01	0.01			
SW-5	24-Jul-02	Maxim	1.403		5.45	0.1	0.05	<				0.0009	0.0009					0.006	0.006		0.06	0.06		0.001	0.001		0.003	0.0015	<	0.04	0.04			
SW-5	22-Apr-03	Maxim	0.14		6.44	0.05	0.025	<				0.0001	0.00005	<				0.004	0.004		0.16	0.16		0.001	0.0005	<	0.008	0.008		0.01	0.005	<		
SW-5	30-Jun-03	Maxim	21		7.27	0.21	0.21					0.0001	0.00005	<				0.014	0.014		0.32	0.32		0.003	0.003		0.01	0.01		0.01	0.005	<		
SW-5	6-Apr-04	Maxim	0.327		7.32	0.05	0.025	<				0.0001	0.00005	<				0.006	0.006		0.02	0.02		0.001	0.0005	<	0.005	0.0025	<	0.07	0.07	JF%		
SW-5	29-Jun-04	Maxim	20.68		8.1	0.18	0.18					0.0001	0.00005	<				0.013	0.013		0.21	0.21		0.001	0.001		0.004	0.004		0.02	0.02			
SW-5	5-Oct-04	Maxim	0.37		7.2	0.05	0.025	<				0.0001	0.00005	<				0.001	0.0005	<	0.01	0.005	<	0.001	0.0005	<	0.003	0.0015	<	0.01	0.005	<		
SW-5	27-Jun-05	Maxim	17.83		6.9	0.12	0.12					0.0001	0.00005	<				0.016	0.016		0.21	0.21		0.001	0.001		0.006	0.006		0.01	0.005	<		
SW-5	28-Sep-05	Maxim	0.08		7.6	0.05	0.025	<				0.0001	0.00005	<				0.004	0.004		0.01	0.005	<	0.001	0.0005	<	0.004	0.004		0.01	0.01			
SW-5	26-Jun-06	Maxim	8.56		6.81	0.05	0.025	<				0.0001	0.00005	<				0.01	0.01		0.1	0.1	B	0.001	0.0005	<	0.005	0.005		0.01	0.005	<		
SW-5	11-Apr-07	Tt	0.002		7.04	0.05	0.025	<				0.0001	0.00005	<				0.004	0.004		0.05	0.05	J	0.001	0.0005	<	0.003	0.0015	<	0.01	0.005	<		
SW-5	14-Jun-07	Tt	--		8	0.07	0.07					0.0001	0.00005	<				--	0.013	0.013		0.08	0.08		0.001	0.0005	<	0.003	0.0015	<	0.01	0.005	<	
SW-5	19-Sep-07	Tt	0.0695		8.11	0.05	0.025	<				0.0001	0.00005	<				--	0.002	0.002		0.01	0.005	<	0.001	0.0005	<	0.003	0.0015	<	0.01	0.005	<	
SW-5	15-Apr-08	Tt	0.0022		7.05	0.05	0.025	<				0.0001	0.00005	<				0.003	0.003		0.01	0.005	<	0.001	0.0005	<	0.01							

**Table A-3
Water Quality and Flow at Daisy Creek Adit Discharge Monitoring Stations
New World Mining District Response and Restoration Project
Adit Discharge EECA**

Station Name	Sample Date	Flow (gpm)	Field pH (su)	Hardness (mg/L CaCO ₃)	Sulfate (mg/l)	Concentration (Total Recoverable in Milligrams Per Liter)								
						Aluminum	Cadmium	Copper	Iron	Lead	Manganese	Zinc		
D-18	9/13/1989	1.8	3.41		268									
D-18	7/13/1990	25.1	6.82		246	0.2	0.001	0.01	13.8			0.91	0.09	
D-18	7/25/1990	20.2		353	280									
D-18	8/1/1990	22.4	6.49	370	311	0.1	0.001	0.01	17.5	0.01		0.86	0.03	
D-18	8/22/1990	18.0		393	324	0.1	0.001	0.01	17.3	0.01		0.88	0.03	
D-18	9/6/1990	9.0		386	324	0.4	0.001	0.01	22.3	0.01		0.9	0.05	
D-18	9/25/1990	6.7	5.5	423	350	0.1	0.0001	0.002	19.2	0.002		0.93	0.06	
D-18	7/10/1991	18.0	7.1	276	214	0.9	0.0049	0.08	14.7			0.86	0.05	
D-18	9/25/1991	6.7	7.02	414	336	0.2	0.0017	0.018	14.6	0.002		0.94	0.03	
D-18	7/20/1995	20.2	5.9	230	180	1.3	0.0005	0.078	14.4	0.006		0.62	0.028	
D-18	9/26/1995	5.6	5.4		349	0.2	0.0008	0.011	24	0.002		1.07	0.028	
D-18	7/10/1996	18.0	5.43	252	158	0.3	0.0004	0.045	9.8	0.003		0.534	0.02	
D-18	8/15/1996	15.0												
D-18	9/10/1996	6.7	6.36	358	333	0.2	0.0009	0.005	38	0.003		1.14	0.04	
D-18	10/5/1996				333	0.234	0.002	0.007	27.6	0.002		1.06	0.0313	
D-18	10/5/1996	3.1	5.7		339	0.1	0.0006	0.003	27	0.003		1.1	0.02	
D-18	7/6/2001	8.1	6.59	314	264	0.2	0.0017	0.026	20.8	0.001		1.04	0.01	
D-18	7/2/2002	29.6	6.48	249	149	0.1	0.0001	0.017	6.69	0.001		0.49	0.02	
D-18	9/26/2002	6.9	6.6	385	299	0.1	0.0003	0.001	7.39	0.001		1	0.02	
D-18	10/7/2002	5.4	7.08	354	288	0.2	0.0004	0.033	14.7	0.002		0.096	0.08	
D-18	7/28/2003	10.0	5.4	338	332	4.95	0.0005	0.14	8.35	0.001		0.92	0.09	
D-18	8/7/2003	7.0	6.8	348	302	0.2	0.0001	0.03	3.64	0.002		0.6	0.01	
D-18	10/1/2003	3.6	6.77	449	379	0.1	0.0001	0.025	19.1	0.001		0.96	0.05	
D-18	7/29/2004	7.3	6.7											
D-18	8/10/2004	7.6	6.65											
D-18	9/23/2004	4.7	6.5	404	363	0.08	0.0001	0.018	20	0.001		0.97	0.01	
D-18	9/23/2005	4.9	6.2											
D-18	8/28/2006	6.3	5.8											
D-18	8/20/2007	4.488	6.73	424	389	0.7	0.0001	0.044	34	0.004		1.24	0.09	
D-18	9/18/2007	4.80216	6.28	436	395	0.17	0.0001	0.02	29.3	0.001		1.13	0.08	
D-18	9/23/2008	5.96904	5.9	430	421	0.32	0.0001	0.027	30.3	0.001		1.18	0.09	
Total number of samples		31	30	26	21	26	24	24	24	22	24	24	24	
Number of high flow samples		10	10	9	8	8	8	8	8	6	8	8	8	
Total number of samples after plugging inflow to McLaren Adit (September, 2003)		9	9	9	5	5	5	5	5	5	5	5	5	

gpm = gallons per minute

s.u. = standard units

mg/l CaCO₃ = milligrams per liter as calcium carbonate

mg/l = milligrams per liter

Italics indicate analyte was below detection limit or flow rates that were estimated as equal to or less than the displayed value.

Table A-4 (continued)
Water Quality and Flow at Fisher Creek Adit Discharge Monitoring Stations
New World Mining District Response and Restoration Project
Adit Discharge EECA

Station Name	Sample Date	Flow (gpm)	Field pH (su)	Hardness (mg/L CaCO ₃)	Sulfate (mg/l)	Concentration (Total Recoverable in Milligrams Per Liter)							
						Aluminum	Cadmium	Copper	Iron	Lead	Manganese	Zinc	
F-28	9/20/1989	1.3	7.17		258	0.1							
F-28	8/8/1990	4.0	7.31	284	214		0.001	0.01	0.52	0.01	0.02	0.02	
F-28	8/23/1990	1.3		283	219	0.1							
F-28	9/6/1990	4.5	7.08	341	240	0.1	0.001	0.01	0.28	0.01	0.07	0.03	
F-28	9/25/1990	1.8	5	381	259	0.1	0.0001	0.002	0.31	0.002	0.07	0.06	
F-28	7/10/1991	11.2	7.79	236	181	0.1	0.0001	0.009	0.34		0.05	0.04	
F-28	8/14/1991			414	301	1.6	0.0002	0.008	1.2	0.002	0.2	0.04	
F-28	9/26/1991	1.8	7.76	431	304	0.1	0.0018	0.108	33.4	0.014	5.76	0.3	
F-28	3/2/1992			557	396	0.4	0.0001	0.006	1.99	0.004	0.78	0.02	
F-28	3/16/1992			577	424	0.4	0.0004	0.03	16.7	0.02	1.19	0.1	
F-28	3/27/1992			592	466	1	0.0001	0.02	4.11	0.008	0.72	0.03	
F-28	3/29/1992			558	412	0.1	0.0002	0.03	7.99	0.015	0.91	0.06	
F-28	4/21/1992	5.8		545	441		0.0001	0.009	1.06	0.003	0.56	0.04	
F-28	5/20/1992	13.5		481	304								
F-28	7/22/1992			438	348								
F-28	7/23/1992	13.5											
F-28	8/9/1993	42.6	7.35	381	282		0.00257	0.00653	144	0.00217	0.0557	0.0111	
F-28	6/16/1994	26.9	7.24										
F-28	7/14/1995	18.0	6.88		163	0.1	0.0001	0.003	0.78	0.015	0.04	0.021	
F-28	9/26/1995	13.5	6.7		376	0.1	0.0001	0.003	0.78	0.002	0.07	0.007	
F-28	8/17/1996	15.0											
F-28	9/12/1996	9.4	6.23	477	351	0.1	0.0001	0.001	0.09	0.003	0.04	0.02	
F-28	7/8/1997	29.2			270	0.206	0.005	0.01	2.23	0.003	0.152	0.02	
F-28	8/10/1999	15.0											
F-28	7/11/2001	31.4	7.54	595	451	0.1	0.0001	0.004	0.35	0.001	0.073	0.01	
F-28	6/30/2002	26.0	7.12	378	233	0.1	0.0001	0.002	0.18	0.001	0.029	0.01	
F-28	7/23/2002	9.0	6.3	683	405	0.1	0.0009	0.002	0.21	0.001	0.054	0.01	
F-28	10/8/2002	4.9	7.38	759	591	0.1	0.0003	0.001	0.19	0.001	0.004	0.03	
F-28	7/1/2003	246.9	6.75	376	275	0.06	0.0001	0.002	0.26	0.001	0.047	0.01	
F-28	8/14/2003	12.0	7.5	640	469	0.05	0.0001	0.002	0.38	0.001	0.08	0.01	
F-28	9/30/2003	14.8	7.49	660	484	0.05	0.0001	0.012	0.23	0.001	0.085	0.01	
F-28	7/29/2004	20.5	7.62	507	371	0.05	0.0001	0.005	0.2	0.001	0.065	0.05	
F-28	9/16/2004	19.7	7.47	668	497	0.05	0.0001	0.003	0.13	0.001	0.082	0.05	
F-28	8/15/2005	32.8	7.5	634	460	0.06	0.0001	0.002	0.64	0.002	0.18	0.05	
F-28	9/22/2005	3.4	7.7	334	282	0.06	0.0001	0.001	0.01	0.001		0.01	
F-28	10/11/2005	4.0											
F-28	10/27/2005	4.1											
F-28	6/28/2006	18.9	6.12	181	142	0.35	0.0001	0.01	2.64	0.005	0.25	0.03	
F-28	9/26/2006	3.6	6.77	416	323	0.06	0.0001	0.001	0.62	0.001	0.13	0.04	
F-28	6/12/2007	24.2	6.6	64	145	0.05	0.0001	0.002	0.45	0.001	0.03	0.01	
F-28	8/20/2007	4.5	7.59	388	266	0.08	0.0001	0.003	0.42	0.002	0.093	0.02	
F-28	9/17/2007	3.9	7.14	411	289	0.05	0.0001	0.002	0.22	0.001	0.079	0.01	
F-28	9/22/2008	4.4	6.87	423	313	0.05	0.0001	0.002	0.37	0.001	0.092	0.02	
Total number of samples	43	37	28	33	37	32	33	33	33	32	32	33	
Number of high flow samples	12	11	9	8	10	9	9	9	9	8	9	9	

gpm = gallons per minute

s.u. = standard units

mg/l CaCO₃ = milligrams per liter as calcium carbonate

mg/l = milligrams per liter

Italics indicate analyte was below detection limit or flow rates that were estimated as equal to or less than the displayed value.

Table A-5 (continued)
Water Quality and Flow at Miller Creek Adit Discharge Monitoring Stations
New World Mining District Response and Restoration Project
Adit Discharge EECA

Station Name	Sample Date	Flow (gpm)	Field pH (su)	Hardness (mg/L CaCO ₃)	Sulfate (mg/l)	Concentration (Total Recoverable in Milligrams Per Liter)						
						Aluminum	Cadmium	Copper	Iron	Lead	Manganese	Zinc
M-8	8/9/1993	2.0	7.22	127	25		0.00257	0.0234	1.32	0.0898	0.065	0.43
M-8	7/31/1996	2.5	7.67									
M-8	8/14/1996	10.0										
M-8	8/20/1996	0.5	8.22									
M-8	9/14/1996	0.1	8.01									
M-8	10/12/1996	0.7	7.81									
M-8	11/9/1996	0.5										
M-8	7/17/1997	2.1										
M-8	7/31/1997	5.9										
M-8	8/20/1997	2.9										
M-8	9/14/1997	2.9										
M-8	10/7/1997	0.4										
M-8	8/4/1999	10.0										
M-8	7/11/2001	0.1	7.49	142	43	0.1	0.002	0.015	0.55	0.066	0.023	0.42
M-8	7/16/2003	7.9	7.42	106	23	0.05	0.001	0.002	0.04	0.006	0.02	0.24
M-8	7/21/2004	10.0	7.2									
M-8	9/23/2004	8.1	7.0	147	27	0.05	0.0005	0.001	0.02	0.001	0.003	0.1
M-8	8/20/2007	0.08976	7.54	170	50	16.3	0.0047	0.041	19.8	0.2	0.54	1.21
M-8	9/18/2007	0.26928	7.14	201	66	57.9	0.011	0.16	83.5	1.36	2.06	2.96
Total number of samples	19	19	11	6	6	5	6	6	6	6	6	6
Number of high flow samples	6	6	4	2	2	2	2	2	2	2	2	2
MCSI-96-3	8/9/1993	1.0										
MCSI-96-3	8/14/1996	0.5										
MCSI-96-3	8/4/1999	1.0										
MCSI-96-3	7/16/2003	2.0	7.57	61	12	0.05	0.0004	0.001	0.02	0.003	0.02	0.11
MCSI-96-3	7/21/2004	2.0	6.5									
MCSI-96-3	8/20/2007	0.04488	6.46	90	30	10.4	0.0046	0.03	19.1	0.61	0.88	0.96
MCSI-96-3	9/18/2007	0.26928	5.93	99	33	9.5	0.0093	0.03	16.4	0.36	3.64	1.48
Total number of samples	7	7	4	3	3	3	3	3	3	3	3	3
Number of high flow samples	2	2	2	1	1	1	1	1	1	1	1	1

gpm = gallons per minute

s.u. = standard units

mg/l CaCO₃ = milligrams per liter as calcium carbonate

mg/l = milligrams per liter

Italics indicate analyte was below detection limit or flow rates that were estimated as equal to or less than the displayed value.

Table A-6
Water Quality and Flow From McLaren Pit Cap Sub-Grade Drains
New World Mining District Response and Restoration Project
Adit Discharge EECA

Station Name	Sample Date	Flow (gpm)	Field pH (su)	Hardness (mg/L CaCO ₃)	Sulfate (mg/l)	Concentration (Total Recoverable in Milligrams Per Liter)						
						Aluminum	Cadmium	Copper	Iron	Lead	Manganese	Zinc
DCSW-101	7/13/2004	19.5	2.6	125	628	29.3	0.01	15.8	117	0.012	3.08	1.7
DCSW-101	8/10/2004	15.8	2.28	125	560	26	0.0094	13.5	106	0.009	2.91	1.59
DCSW-101	10/6/2004	5.6	2.92	176	686	34.3	0.016	20.7	173	0.007	5.1	2.82
DCSW-101	6/29/2005	24.6	2.7	142	736	33.7	0.011	15.8	147	0.014	2.81	1.85
DCSW-101	9/27/2005	3.3	2.73	185	748	31.5	0.012	14.2	199	0.01	3.64	2.09
DCSW-101	6/27/2006	20.6	4.36	114	515	26.1	0.0082	13.5	105	0.012	2.74	1.50
DCSW-101	9/27/2006	2.2	2.93	175	797	29	0.01	13.2	178	0.005	3.41	1.87
DCSW-101	7/18/2007	16.6	2.8	104	450	23.3	0.0069	9.91	92	0.007	2.38	1.29
DCSW-101	9/18/2007	3.9	3.04	155	607	25.4	0.01	12.6	133	0.006	3.34	1.77
DCSW-101	7/15/2008	26.0	2.64	122	555	25.5	0.0074	10.5	94	0.016	2.28	1.32
DCSW-101	9/24/2008	6.5	2.74	144	612	27	0.0084	11.3	142	0.008	2.86	1.44
DCSW-102	7/13/2004	10.5	2.4	186	862	33.5	0.017	19	142	0.002	4.62	2.69
DCSW-102	8/10/2004	5.8	2.39	155	641	23.2	0.011	13.8	90	0.001	3.47	1.95
DCSW-102	10/6/2004	0.3	2.54	275	1160	39.1	0.017	27.7	265	0.002	6.31	3.18
DCSW-102	6/29/2005	18.8	2.5	240	1030	42.2	0.029	19.6	187	0.005	6.22	4.29
DCSW-102	9/27/2005	0.0	2.55	234	791	24.8	0.016	15.9	146	0.009	4.69	2.33
DCSW-102	6/27/2006	14.8	4.17	192	771	32.500	0.015	19	135	0.002	4.76	2.66
DCSW-102	9/27/2006	0.04	2.69	220	876	24.2	0.012	14.2	116	0.002	4.04	1.97
DCSW-102	6/13/2007	23.3	2.8	244	875	31.4	0.019	16.4	163	0.004	4.88	3.49
DCSW-102	7/15/2008	15.3	2.36	218	852	34.4	0.02	15.2	115	0.003	5.22	3.32
DCSW-102	9/24/2008	0.0	2.5	172	651	22.2	0.01	13	101	0.001	3.51	1.74
DCSW-103	7/13/2004	2.4	2.3	723	2920	108	0.026	44.6	632	0.002	13.3	4.24
DCSW-103	8/10/2004	1.7	2.53	591	2220	88.1	0.026	34.8	363	0.002	12.5	4.29
DCSW-103	10/6/2004	0.8	2.52	745	2550	110	0.023	46.1	505	0.002	16.7	4.84
DCSW-103	6/29/2005	1.8	2.4	750	3050	122	0.032	47.3	678	0.004	14.2	5.25
DCSW-103	9/27/2005	0.3	2.42	642	1910	76.6	0.028	31	352	0.003	11.8	4.33
DCSW-103	6/27/2006	1.8	4.13	619	2210	81.100	0.024	36	434	0.002	13.10	4.44
DCSW-103	9/27/2006	0.9	2.62	688	1980	77.300	0.022	29	315	0.002	12.50	4.07
DCSW-103	7/18/2007	1.3	2.44	570	1760	76.100	0.022	30	316	0.003	10.70	4.07
DCSW-103	9/18/2007	0.7	2.59	686	2220	87.900	0.023	30	374	0.004	12.70	4.09
DCSW-103	7/15/2008	1.3	2.19	553	2080	89.900	0.023	29	347	0.002	9.95	3.92
DCSW-103	9/24/2008	0.9	2.31	523	1740	66.100	0.02	25	270	0.003	10.70	3.73

gpm = gallons per minute

s.u. = standard units

mg/l CaCO₃ = milligrams per liter as calcium carbonate

mg/l = milligrams per liter

APPENDIX B
Comparison of Pre- and Post Reclamation Surface
Water Quality in Daisy and Fisher Creeks

**TABLE B-1
SUMMARY OF SURFACE WATER FLOW AND QUALITY IN DAISY CREEK AFTER CAPPING MCLAREN PIT**

Station	Summary Statistic ¹	Flow (gpm) or % ²	Concentration (total recoverable in milligrams per liter) or Percent						
			Aluminum	Cadmium	Copper	Iron	Lead	Manganese	Zinc
Daisy Creek									
DC-2	Average of all data before capping	1507	11.74	0.0037	2.94	12.75	0.006	1.72	0.45
	Average of all data after capping	1152	8.24	0.0026	1.86	8.66	0.004	1.37	0.39
	% Change	-24	-30	-30	-37	-32	-33	-20	-13
	Average of high flow data before capping	2842	6.97	0.0022	1.93	9.86	0.006	0.83	0.27
	Average of high flow data after capping	3103	3.89	0.001	0.78	4.81	0.003	0.43	0.14
	% Change	9	-44	-61	-59	-51	-44	-48	-49
	Average low flow data before capping	244	11.78	0.0038	3.08	12.38	0.005	1.91	0.50
Avg low flow data after capping	87	10.61	0.0036	2.45	10.77	0.004	1.88	0.53	
% Change	-64	-10	-5	-20	-13	-25	-1	6	
DC-5	Average of all data before capping	3308	3.36	0.0013	1.07	3.18	0.0026	0.48	0.17
	Average of all data after capping	3074	2.20	0.0007	0.52	1.97	0.0017	0.37	0.13
	% Change	-7	-34	-43	-51	-38	-35	-22	-25
	Average of high flow data before capping	7686	1.93	0.0005	0.58	2.86	0.0016	0.21	0.08
	Average of high flow data after capping	9210	0.97	0.0002	0.15	1.21	0.0016	0.10	0.05
	% Change	20	-50	-64	-75	-58	0	-51	-43
	Average low flow data before capping	277	4	0.0018	1.38	2.69	0.0022	0.63	0.22
Avg low flow data after capping	284	2.76	0.0010	0.69	2.32	0.0017	0.50	0.16	
% Change	3	-31	-44	-50	-14	-21	-21	-26	
SW-7	Average of all data before capping	22237	0.24	<0.0001	0.064	0.49	0.0020	0.039	0.022
	Average of all data after capping	13332	0.11	<0.0001	0.016	0.27	0.0010	0.026	0.013
	% Change	-40	-56	0	-76	-45	-47	-33	-42
	Average of high flow data before capping	35965	0.38	0.0002	0.109	0.70	0.0031	0.039	0.024
	Average of high flow data after capping	35191	0.19	<0.0001	0.034	0.28	0.0010	0.019	0.010
	% Change	-2	-51	-50	-69	-60	-68	-52	-58
	Average low flow data before capping	1241	0.08	<0.0001	0.015	0.25	0.0011	0.039	0.021
Avg low flow data after capping	1188	0.06	<0.0001	0.007	0.26	0.0011	0.030	0.014	
% Change	-4	-19	0	-56	4	0	-23	-33	
Chronic Aquatic Life Standard (Hardness = 50 mg/l)			0.087³	0.00016	0.005	1	0.001	0.05³	0.07
Chronic Aquatic Life Standard (Hardness = 100 mg/l)			0.087	0.00027	0.009	1	0.003	0.05	0.12

- Notes: 1 Data collected between 1989 and 2008; high flow calculated using June and July sampling events; low flow calculated using all other data
2 gpm = gallons per minute; % change indicates increase (positive) or decrease (negative) in flow and concentration for applicable stations.
3 Aluminum standard applies to dissolved concentrations in water with pH 6.6-9.0 s.u.; manganese standard is secondary MCL based on aesthetic qualities.

**TABLE B-2
SUMMARY OF SURFACE WATER FLOW AND QUALITY IN FISHER CREEK AFTER GLENGARRY ADIT CLOSURE**

Station	Summary Statistic ¹	Flow (gpm) or % ²	Concentration (total recoverable in milligrams per liter) or Percent						
			Aluminum	Cadmium	Copper	Iron	Lead	Manganese	Zinc
Fisher Creek									
SW-3	Average of all data before adit closure	1794	2.58	0.0008	0.69	5.35	0.005	0.82	0.12
	Average of all data after adit closure	842	2.02	0.0006	0.64	1.29	0.002	0.40	0.10
	% Change	-53	-22	-23	-8	-76	-66	-51	-15
	Average of high flow data before closure	3130	1.96	0.0005	0.57	3.63	0.004	0.29	0.06
	Average of high flow data after closure	3220	1.42	0.0001	0.32	1.46	0.002	0.14	0.02
	% Change	3	-27	-75	-44	-60	-56	-53	-63
	Average low flow data before closure	271	2.99	0.0010	0.80	6.68	0.007	1.12	0.17
	Avg low flow data after closure	111	2.29	0.0008	0.78	1.22	0.002	0.52	0.14
% Change	-59	-24	-17	-3	-82	-76	-53	-20	
SW-4	Average of all data before closure	10884	0.29	0.0003	0.092	0.49	0.0018	0.058	0.08
	Average of all data after closure	6887	0.12	0.0002	0.050	0.10	0.0010	0.021	0.04
	% Change	-37	-60	-44	-46	-80	-44	-64	-47
	Average of high flow data before closure	18793	0.45	0.0002	0.102	0.82	0.0020	0.056	0.10
	Average of high flow data after closure	19880	0.22	0.0001	0.061	0.22	0.001	0.026	0.01
	% Change	6	-52	-50	-40	-74	-50	-54	-88
	Average low flow data before closure	705	0.14	0.0004	0.082	0.10	0.0016	0.061	0.06
	Avg low flow data after closure	391	0.06	0.0002	0.044	0.04	0.001	0.019	0.06
% Change	-45	-54	-50	-46	-61	-38	-70	-4	
CFY-2	Average of all data before closure	4792	0.11	0.00010	0.032	0.135	0.0009	0.018	0.017
	Average of all data after closure	7639	0.08	0.00010	0.019	0.06	0.001	0.008	0.02
	% Change	59	-27	0	-42	-56	11	-54	3
	Average of high flow data before closure	11001	0.21	0.00008	0.060	0.307	0.0010	0.0285	0.018
	Average of high flow data after closure	22101	0.14	0.0001	0.041	0.16	0.001	0.018	0.01
	% Change	101	-33	25	-32	-48	0	-37	-31
	Average low flow data before closure	356	0.05	0.00011	0.016	0.039	0.0009	0.0127	0.017
	Avg low flow data after closure	408	0.05	0.0001	0.008	0.01	0.001	0.003	0.02
% Change	15	0	-9	-53	-74	11	-73	18	
Chronic Aquatic Life Standard (Hardness = 50 mg/l)			0.087³	0.00016	0.005	1	0.001	0.05³	0.07
Chronic Aquatic Life Standard (Hardness = 100 mg/l)			0.087	0.00027	0.009	1	0.003	0.05	0.12

- Notes: 1 Data collected between 1989 and 2008; high flow calculated using June and July sampling events; low flow calculated using all other data
2 gpm = gallons per minute; % change indicates increase (positive) or decrease (negative) in flow and concentration for applicable stations.
3 Aluminum standard applies to dissolved concentrations in water with pH 6.6-9.0 s.u.; manganese standard is secondary MCL based on aesthetic qualities.