FINAL

Data Summary Report
Upper Blackfoot Mining Complex

Prepared for:

Montana Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

Prepared by:
TerraGraphics Environmental Engineering, Inc.
15 W 6th Avenue, Power Block 3rd Floor W
Helena, MT 59601
Phone: 406.441.5441
Fax: 406.441.5443

www.terragraphics.com

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Acronyms and Abbreviations

ASARCO	American Smelting and Refining Company
cfs	cubic feet per second
cm	centimeter
CU	Consolidated-Undrained
CMP	Corrugated metal pipe
EC	Electrical conductivity
DEQ	Montana Department of Environmental Quality
DQO	Data Quality Objective
gpm	gallons per minute
ICP-MS	Inductively Coupled Plasma-Mass Spectrometry
L	liter
mg	milligram
ml	milliliter
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NP/AP	neutralization potential to acid potential ratio
S	Siemens
µmhos	micro mhos (specific conductance) (1 mho = 1 S)
PAG	potentially acid generating
pcf	pounds per cubic foot
PQL	practical quantitation limit
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
RCP	reinforced concrete pipe
RSL	regional screening level
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
Spectrum	Spectrum Engineering
SPLP	Synthetic Precipitation Leaching Procedure
SPT	standard penetration test
TerraGraphics	TerraGraphics Environmental Engineering, Inc.
tsf	tons per square foot
UBMC	Upper Blackfoot Mining Complex
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WRA	Watershed Restoration Agreement
WTP	water treatment plant

Section 1.0 Introduction

TerraGraphics Environmental Engineering, Inc. (TerraGraphics) was retained by the Montana Department of Environmental Quality (DEQ) to perform site evaluations for the Upper Blackfoot Mining Complex (UBMC) during the summer of 2009. These evaluations investigated the geochemical and geotechnical compatibility of the site soils and mine waste as well as that of the surface and groundwater chemistry with the thought of transferring tailings from the Mike Horse impoundment to one or more constructed repositories. This work was performed in general accordance with Task Order 10, and its associated modifications, dated July 1, 2009.

This report presents the results of these evaluations as well as associated discussions, conclusions, and recommendations. Photographs associated with the field work were also taken. Borehole logs, test pit logs, and photos are included in Appendices A, B, and C, respectively.

1.1 Site Location and Background

The UBMC is part of a historic mining area commonly referred to as the Heddleston District. This area is located approximately 15 miles east of the town of Lincoln, in Lewis and Clark County, Montana, as shown in Figure 1. The UBMC is located on U.S. Forest Service (USFS) and patented lands at the headwaters of the Blackfoot River. Mining activity in the UBMC began with the discovery of silver, lead, and zinc-bearing ores in the late 1800s. Primary ore production at the Mike Horse Mine occurred in the 1930s and 1940s. In 1941, the Mike Horse Mining and Milling Company constructed a tailings impoundment on Beartrap Creek.

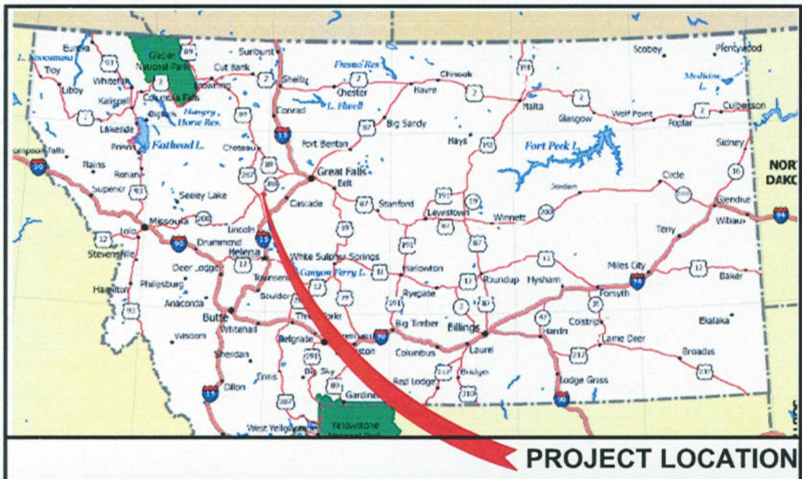
The American Smelting and Refining Company (ASARCO) purchased the Mike Horse Mine and associated properties from the Mike Horse Mine and Milling Company in 1945 and continued mining operations through 1955. Milling operations for the Mike Horse Mine utilized a flotation process to liberate and recover the metals. The flotation process generally requires grinding the ore into a fine powder. The ground ore is then mixed with water, frothing reagents, and collecting reagents. The waste material (tailings) was placed in the tailings impoundment.

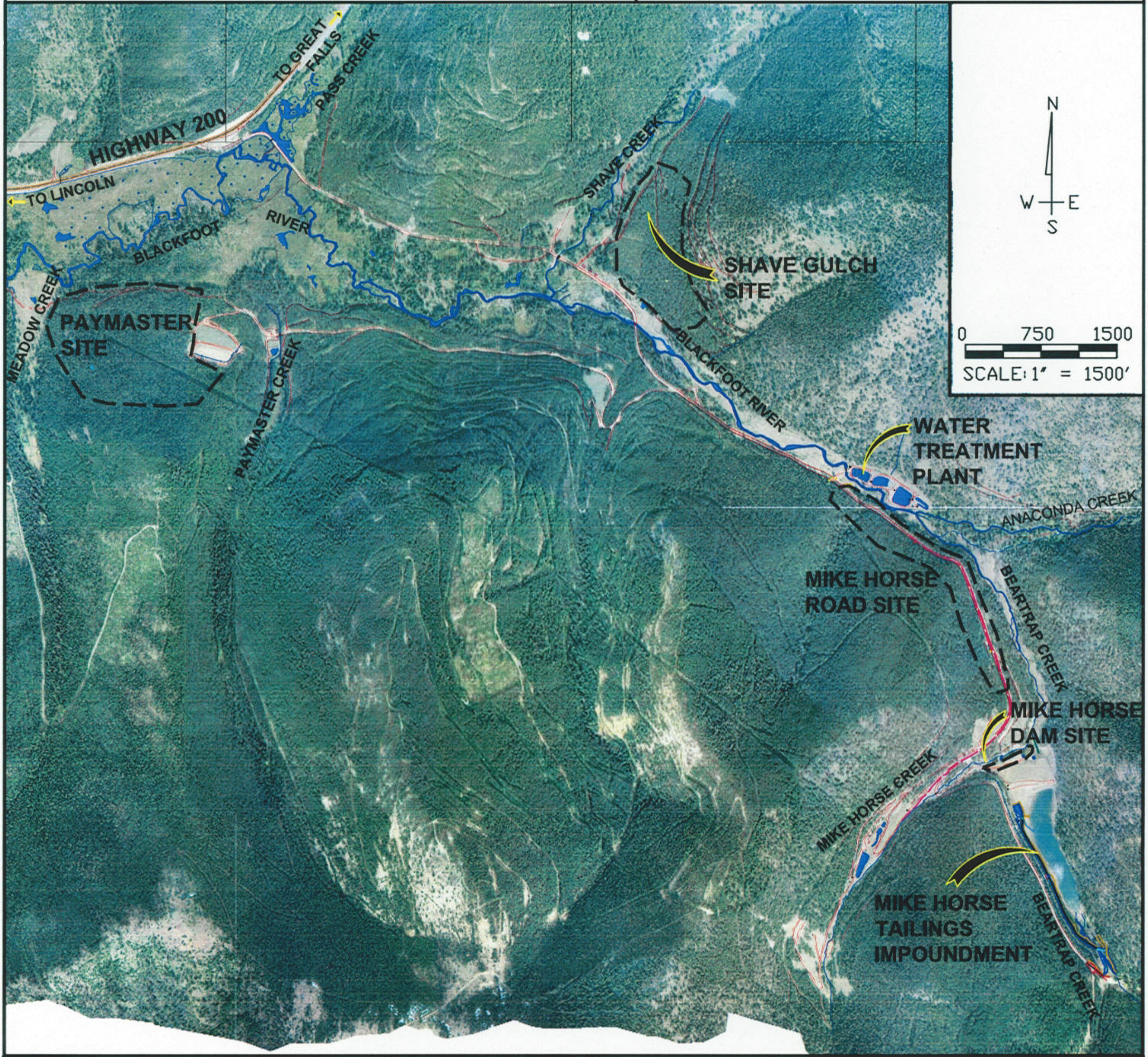
On June 19, 1975, the dam was breached, releasing an estimated 200,000 cubic yards of tailings into the Beartrap Creek and Upper Blackfoot River drainages. A record precipitation event and the blockage of a diversion channel upstream contributed to breeching of the dam. The tailings contain sulfide minerals that oxidize when not in a reducing environment and have the ability to release heavy metals to the stream.

In July 2007, the USFS issued an Action Memorandum calling for the removal of the Mike Horse Dam and impounded tailings, which have been impacting the water quality of the Lower Mike Horse Creek, Beartrap Creek, and the Upper Blackfoot River. The source of uncontrolled releases of heavy metals must be removed to improve these waters and restore the Blackfoot River as cutthroat trout habitat. The State of Montana and the USFS created an agreement in which DEQ will implement the response actions in accordance with the Watershed Restoration Agreement (WRA).

The first step of the WRA is to develop a Preliminary Design Report where the conceptual layout for future construction designs is outlined. Based on the multiple concerns observed by DEQ at the Mike Horse Dam and Impounded Tailings site and the overall UBMC site, DEQ has

UBMC SITE LOCATION MAP





TerraGraphics Environmental Engineering, Inc.	SCALE: As shown DRAWN BY: JM ENGINEER: TS	PROJECT: *UPPER BLACKFOOT MINING COMPLEX*	PROJECT NO: 09208 DATE: 1/04/2010 FIGURE 1

requested that feasible alternatives for materials handling and repository location and design be determined and analyzed for cost and effectiveness. In addition, the tailings volume to be handled during reclamation activities should be estimated as part of the Preliminary Design Report. This report provides the preliminary data required to prepare the Preliminary Design Report.

In the Action Memorandum, the Paymaster site was deemed the preferred repository site based on several factors including slope and ownership. The Paymaster area is on patented ground held by ASARCO. DEQ has requested that an in-drainage repository site be implemented. For safety and cost effectiveness, DEQ, at the time of the Task Order implementation, also requested that the repository design include the requirement that haul routes not cross Highway 200.

During the summer of 2009, TerraGraphics personnel accompanied DEQ and USFS personnel on a site visit to investigate additional in-drainage repository sites. Based on the visual surface observations made on this visit, the Shave Gulch area was determined to be another potential repository site. The test pitting, drilling, and soils testing programs were expanded to include the Shave Gulch site and were included in the Sampling and Analysis Plan (SAP)/Quality Assurance Project Plan (QAPP), dated August 10, 2009 (TerraGraphics, 2009).

During the preparation of this report, a third potential property was identified. This property is west of the UBMC site and is privately owned. No evaluation activities for this property have been performed at the time of this report.

1.2 Purpose and Objectives

This report documents the field activities performed under Task Order 10 and compiles the testing data in an effort to accomplish the following:

- Determine the geotechnical and geochemical properties of the soils at potential repository sites and mine wastes in the area between the Mike Horse Dam toe and Mike Horse Creek;
- Assess the suitability of the site soils for repository construction as to constructability and geochemical stability;
- Excavate test pits to measure the depth to bedrock along the western slope of Mike Horse Creek Road and to aid in site infrastructure improvements between the water treatment plant (WTP) and the Mike Horse town site;
- Sample surface water and groundwater to evaluate existing chemical properties prior to reclamation activities and to prepare a baseline of the water quality in the vicinity of the Mike Horse Dam and impounded tailings;
- Indentify potential hazards, possible historic sites, waste materials, debris, obstacles, and other items that may affect the remedial design and/or the remedial actions; and
- Assist Spectrum Engineering (Spectrum) where needed in its assessments of tailings handling, properties, and quantities as well as groundwater control in and around the Mike Horse Impoundment area.

These activities were performed in substantial compliance with the SAP (TerraGraphics, 2009).

The field activities conducted around the Mike Horse Dam and Impounded Tailings, the Paymaster claim site, and the Shave Gulch site consisted of the following:

- Sampled groundwater from eight monitoring wells around the Mike Horse Dam and Impounded Tailings;
- Sampled surface water from eight locations around the Mike Horse Dam and Impounded Tailings;
- Excavated 10 test pits to establish the extent of tailings northeast of the Mike Horse Dam and south of Mike Horse Creek;
- Drilled and sampled 11 borings and excavated 10 test pits in the proposed repository area at the Paymaster claim site;
- Drilled and sampled two borings and excavated nine test pits at the proposed Shave Gulch repository site;
- Excavated seven test pits along Mike Horse Creek Road between the WTP and the Mike Horse town site; and,
- Conducted general hazard mapping in the vicinity of the Mike Horse Dam and Impounded Tailings, potential repository sites, and the potential access and working areas in between.

The sampling and analysis activities are described in subsequent sections of this report. Conclusions and recommendations based on these activities are also presented.

In addition to the activities cited above, TerraGraphics assisted Spectrum with the following:

- Excavation and sampling of 10 test pits within the Mike Horse Impoundment area;
- Excavation and sampling of 26 test pits in the drainage between the Mike Horse Dam and the WTP;
- Excavation and sampling of one test pit (by hand) at the Red Wing mine site;
- Excavation of a dewatering trench just to the south of the Mike Horse Impoundment;
- Construction of a surcharge settlement pad on saturated tailings in the impoundment;
- Setting and monitoring of seven settlement gauges and five hand-installed piezometers within the surcharge settlement pad;
- Drilling and construction of one dewatering well in the Mike Horse Impoundment area;
- Drilling and construction of five piezometers associated with tailings in the Mike Horse Impoundment; and
- Assignment of geotechnical testing of collected samples.

With the exception of any geotechnical analysis, observations, analyses, and results for the activities cited above are included in the Data Summary Report that is being concurrently prepared by Spectrum. The geotechnical sampling analysis associated with Spectrum's evaluations has been reviewed by TerraGraphics and the results are presented in this report. In summary, Spectrum's activities were performed to quantify and mitigate groundwater flows within the alluvium beneath the tailings and to generally dewater the tailings in the Mike Horse impoundment area.

Also, material handling characteristics of the saturated tailings outside the erosion channel formed after the 1975 dam failure were investigated. The extents, volumes, and characteristics of the tailings contaminated debris and native soils within the drainage between the Mike Horse Dam and the Shave Gulch area were also investigated.

1.3 Sampling and Analysis Plan

The sampling and analysis activities were performed in substantial compliance with the SAP (TerraGraphics, 2009). Modifications to the SAP were required due to field conditions and actual laboratory analysis procedures available. The analytical laboratory was selected by DEQ after the SAP was finalized. The majority of the changes reflect Pace Analytical's laboratory methods and practical quantitation limits (PQLs). These modifications did not adversely impact the quality of the information gathered and maintained the intent of the SAP. These modifications are addressed in Appendix G and are summarized as follows:

Table 2-2

- Manganese PQL was changed from 0.00001 mg/L to 0.005 mg/L;
- Sulfate PQL was changed from 1.0 mg/L to 5 mg/L;
- Method for Carbonate and Bicarbonate was changed from USEPA 310.1 to 300.0;
- Method for Cations was changed from USEPA 200.7 to 200.8;
- Total Hardness was changed from SM2340B to SM2320B; and
- Specific Conductance PQL was changed from 1.0 µmhos/cm to 10 µmhos/cm.

Table 2-3

- Container size was changed from 500 ml to 250 ml for Total Metals and Dissolved Metals;

Figure 4 (Seep Sample Locations, Upper Blackfoot Mining Complex)

- Seeps MHTDS-1 to MHTDS-8 were dry and not sampled.

Table 2-6

- Method No. for pH was changed from USEPA 1501.1 to SM 4500 H&B;
- Method No. for Total Suspended Solids was changed from USEPA 160.2 to SM 2540D;
- Method No. for Acidity was changed from USEPA 305.1 to SM 2310; and
- Method No. for Sulfate was changed from USEPA 375.2 to USPA 300.

Table 2-7

- Modified Proctor Compaction (ASTM D1557) was removed; and
- Unsaturated Hydraulic Conductivity (ASTM D6836) was removed.

Table2-8

- Analytical Method for Total Inorganic Carbon was changed from ASA 29-3.3 to SM 9060.

Section 2.4, third paragraph

- Pressure Meter Tests were removed from the testing program.

Section 6.2, second paragraph

- Matrix spike and matrix spike duplicate samples were not performed with samples from this investigation on two reports. The reports are Pace project number 10111520 and 10111632.

Section 2.0 Sampling and Analysis Procedures

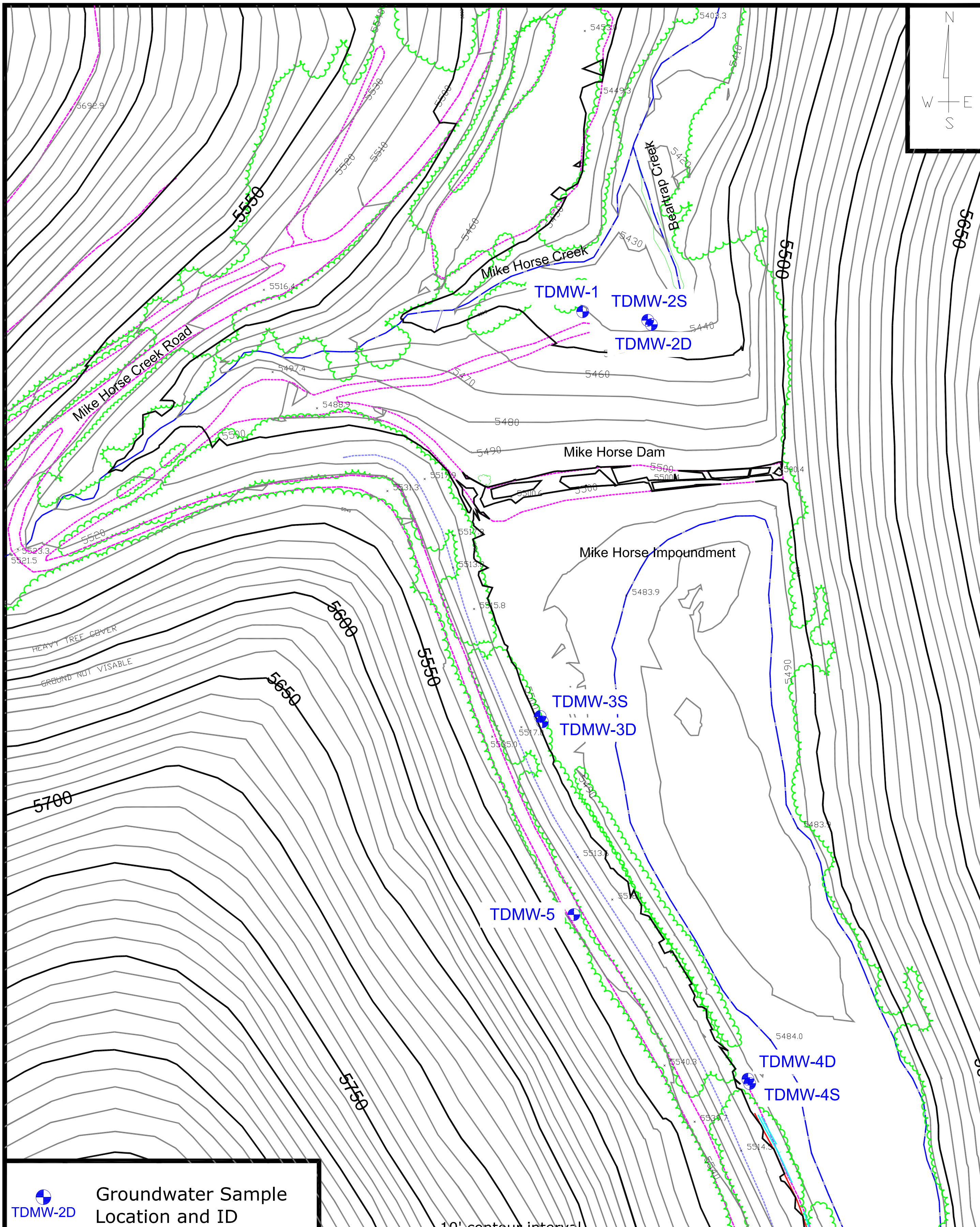
This section describes the sampling and analysis procedures conducted at the UBMC. These procedures are substantially the same for all the areas evaluated. Results associated with these procedures are sorted by area and are discussed in subsequent sections of this report.

2.1 Groundwater Sampling and Analysis

This sub-section describes the groundwater sampling and analysis procedures conducted at the UBMC. The SAP requires that analyses be performed on water samples collected during two consecutive quarters to develop a current baseline of the water quality and to compare this to historical water quality information prior to commencement of construction activities at the Mike Horse Dam and Impounded Tailings site. Groundwater samples were collected by TerraGraphics personnel from six of the eight existing monitoring wells listed in Table 2-1 on August 31 and September 1, 2009 ("fall sampling event"). Monitoring well TDMW-4S was dry during these groundwater sampling activities and therefore was not sampled. Monitoring well TDMW-3S also did not have enough water to sample. A second round of sampling was performed on November 16, 17, and 18, 2009 ("early winter sampling event"). Sample locations are shown on Figure 2. Monitoring wells TDMW-4S and TDMW- 3S were not sampled in November due to the same reasons described for the fall sampling event. Sampling included measuring water level elevations and total depths in each well, purging each well, and retrieving an adequate volume of water for laboratory analysis.

Table 2-1 Monitoring Well Sample Locations

Identification	Location	Last Sampled
TDMW-1	North Side of the Dam	2004
TDMW-2S	North Side of the Dam	2004
TDMW-2D	North Side of the Dam	2004
TDMW-3S	West Side of Impoundment	2007
TDMW-3D	West Side of Impoundment	2007
TDMW-4S	West Side of Impoundment	2007
TDMW-4D	West Side of Impoundment	2007
TDMW-5	West Side of Impoundment	2007



TerraGraphics Environmental Engineering, Inc.	SCALE: 1"=200'	Groundwater Sample Locations Upper Blackfoot Mining Complex	PROJECT NO: 09208
	DRAWN BY: TLS		DATE: 12/1/2009
	ENGINEER: TLS		FIGURE 2

In addition to rigorous decontamination procedures, well sampling proceeded beginning with the well that was expected to be least contaminated and ending with the well that was expected to be most contaminated to further minimize the potential for cross-contamination. Both filtered and non-filtered samples were collected from each well, with the filtered sample collected last. The filtered and unfiltered samples were analyzed for the constituents identified in Table 2-2.

Table 2-2 Groundwater Analytical Program Summary

Analyte	Analytical Method	PQL* ($^{mg}/_{L}$)
Total Metals and Dissolved Metals		
Aluminum	USEPA 200.7/200.8/200.9	0.03
Arsenic	USEPA 200.8/200.9	0.003
Cadmium	USEPA 200.8/200.9	0.00008
Copper	USEPA 200.7/200.8/200.9	0.001
Iron	USEPA 200.7/200.8/200.9	0.05
Lead	USEPA 200.7/200.8/200.9	0.0005
Manganese	USEPA 200.7/200.8/200.9	0.005
Zinc	USEPA 200.7/200.8/200.9	0.01
Major Water Quality Anions (Dissolved)		
Chloride	USEPA 300.0	1.0
Bicarbonate	USEPA 310.1	None
Carbonate	USEPA 310.1	None
Sulfate	USEPA 300.0	5.0
Major Water Quality Cations (Dissolved)		
Calcium	USEPA 200.7	1.0
Magnesium	USEPA 200.7	1.0
Potassium	USEPA 200.7	1.0
Sodium	USEPA 200.7	1.0
Other		
Alkalinity	SM 2320B	N/A
Hardness (Total as $CaCO_3$)	SM 2340B	7
pH	USEPA 150.1/SM 4500 HB	None
Specific Conductance @ 25^{o}C	USEPA 120.1/SM 2510B	10 $^{\mu mhos}/_{cm}$
Field Parameters		
pH, Dissolved Oxygen, Specific Conductance, and Temperature		N/A

*Circular DEQ-7 required reporting values for PQL (Practical Quantitation Limit) (DEQ, 2008).
Method 200.7: Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma – Atomic Emission Spectrometry (USEPA, 1994a).
Method 200.8: Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma-Mass Spectrometry (USEPA, 1994b).
Method 200.9: Determination of Trace Elements by Stabilized Temperature Graphite Furnace Atomic Absorption (USEPA, 1994c).
Method 300.0: Determination of Inorganic Anions by Ion Chromatography (USEPA, 1993).
Standard Method 2320B Alkalinity: Titration Method (SM Committee, 1997a).
Standard Method 2340B Hardness (20th Edition): Hardness by Calculation (SM Committee, 1997b).
Standard Method 2510B Conductivity: Laboratory Method
Standard Method 4500HB pH Value: Electrometric Method

2.1.1 Well Depth and Static Water Level Measurement

Depth to groundwater was measured in the eight monitoring wells following the procedures referenced in the SAP and described below:

- After removing the well cap, the static water level was measured using a water level meter by slowly lowering the water level indicator probe into the well casing.
- As the probe entered the water, a buzzer and indicator light were activated.
- The probe was then gently inserted into and retracted from the water surface so the water surface could be determined accurately.
- The point at which the water level buzzer and light activated represented the depth to water.
- The graduation mark on the water level tape adjacent to the north rim of the polyvinyl chloride (PVC) well casing represented the depth to water.
- This measurement was recorded in a field logbook and on a groundwater sampling form to a precision of 0.01 foot.
- The probe and attached tape was thoroughly washed with a solution of laboratory-grade detergent and distilled water at the beginning of each monitoring event and then rinsed with distilled water prior to use in each well.

2.1.2 Groundwater Well Sampling

A Geotech SS Geosub sampling pump was used to purge and sample the wells. Samples for selected analyses were filtered through a 0.45-micron disposable in-line filter and collected in clean laboratory-supplied bottles in accordance with Table 2-3 of the SAP. The preservation requirements for groundwater constituents as listed in Table 2-3 of the SAP were also followed. Non-disposable sampling equipment was decontaminated between monitoring wells following the equipment decontamination procedure described in Section 2.1.2.2.

2.1.2.1 Monitoring Well Purging Procedure

With the exception of monitoring well TDMW-5, the pump intake was positioned at a level at or slightly above the mid-point of the screened interval. For well TDMW-5, the pump intake was set below the mid-point of the screened interval after the water level had been drawn down below the mid-point prior to the removal of the minimum required volume. During pump deployment, care was taken to gently insert the pump to minimize the disruption of potential fine-grained settlement that may have accumulated in the well. The flow rate was measured by filling a 5-gallon container and measuring the filling rate using a stop watch. During purging, the water level in the well was monitored using a water level meter.

Monitoring wells were purged of a volume equal to a minimum of three times the volume of standing water in the well. Sampling proceeded after specific conductance, temperature, and pH parameters stabilized, as measured and recorded in the field. The volume of water present in each well was computed based on the length of the water column and well casing diameter using the following formula:

$$V = 0.041D^2\left(d_2 - d_1\right)$$

Where:
V = Volume in gallons

D = Inside diameter of well casing in inches
d_2 = Total depth of well in feet
d_1= depth to water surface in feet

The sampling field notes contain the single well volume calculations or determinations that clearly identify the purge volume goal. During sample collection, water chemistry parameters were also measured and recorded in the field notes. The following conditions were used to determine purge stabilization: specific conductance variation of no more than 10 percent and temperature and pH constant for at least three consecutive readings. Copies of the sampling field notes are located in Appendix H.

In the fall sampling event, well TDMW-5 was pumped dry (evacuated) during the purging process. When this occurred, the well was determined to be adequately purged and was sampled after sufficient recovery was observed. Monitoring well TDMW-3S did not contain enough water to purge and obtain a sample. As a result, the field blank sample was labeled as TDMW-3S. The duplicate sample was obtained from TDMW-3D and was labeled as TDMW-3DA.

In the early winter sampling event, well TDMW-5 was again pumped dry (evacuated) during the purging process. As before, the well was determined to be adequately purged and was sampled after sufficient recovery was observed. A duplicate sample was collected from TDMW-5 and labeled TDMW-5-555-111909. The field blank sample was labeled TDMW-15-111809.

2.1.2.2 Sampling Equipment Decontamination Procedure

The purging equipment was decontaminated immediately after use to ensure against cross-contamination between wells. One gallon of distilled water was pumped through the pump immediately after use. Polyethylene tubing was used for each well sampling and either left in the well for future sampling activities or placed in a plastic bag, labeled, and stored in the TerraGraphics Helena, Montana office. The tubing was not stored in the well when water level transducers were installed or when the well casing diameter was too large to allow for recovery of the tubing for sampling in the future.

2.1.3 Sample Collection Protocol

Groundwater samples were collected after field-measured water quality parameters had stabilized and at least three well volumes (or as described previously) were purged. The pump was not turned off nor the pumping rate changed between the purging and sampling process. The unfiltered samples were collected directly from the discharge port and were collected prior to the filtered samples. The filtered samples were collected using an inline disposable cartridge filter capable of filtering to 0.45 micrometers. The cartridge filter was attached to the sample discharge line and the filtered samples were pumped into the sample container directly from the discharge end of the cartridge filter. All sample containers were filled with minimal turbulence by allowing the groundwater to flow from the tubing gently down the inside of the container.

Sample Preservation, Handling and Storage

Once samples were collected, they were cooled to 4ºC in a cooler. A chain of custody record was completed and included in the sample cooler, then the cooler was shipped to Pace Analytical (an approved DEQ laboratory) for analysis.

2.1.4 Groundwater Sample Analytical Program

The samples were analyzed by Pace Analytical in accordance with the methods presented in Table 2-2. Sample container types, preservation techniques, and holding times for the chemical analyses are presented in Table 2-3. Details for collecting quality assurance/quality control (QA/QC) samples are described in Section 3. The type of sampling container and preservative are shown in Table 2-3 (as modified in Section 1.3 of this report). The results of the groundwater analytical results are summarized in Table A-1 (Groundwater Analytical Summary) and Table A-2 (Groundwater Metals Analytical Summary).

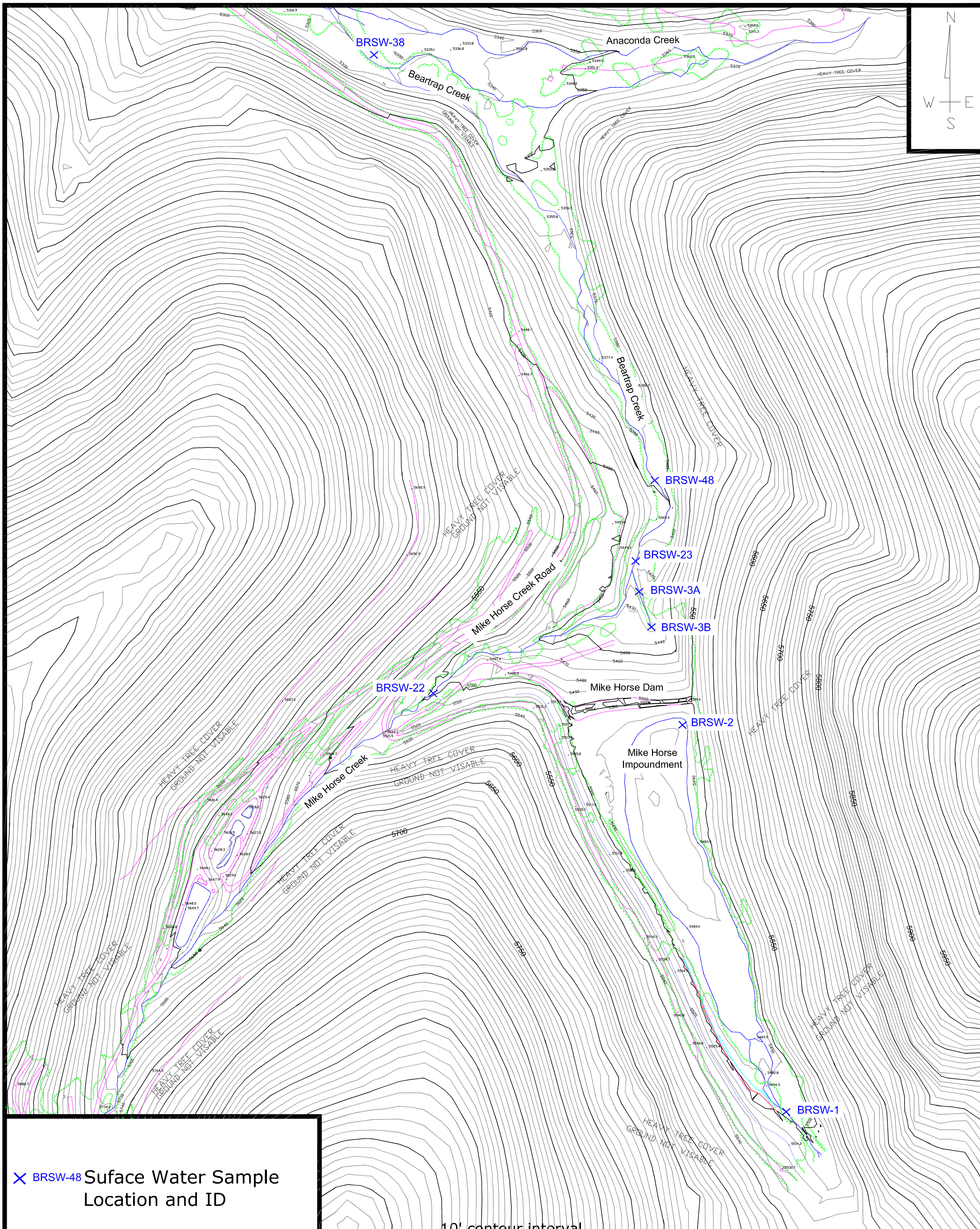
2.2 Surface Water Sampling and Analysis

This sub-section describes the surface water sampling and analysis procedures conducted at the UBMC. Surface water samples were collected and field measurements made by TerraGraphics personnel on August 28, 2009 and November 19, 2009 in substantial accordance with the SAP and the U.S. Geological Survey (USGS) techniques used for water-resource investigations (Wilde, F.D., et al, 1998), which are summarized in Section 2.2.1. Surface water sampling location BRSW-22 on Mike Horse Creek was frozen at the time of the early winter sampling event and a sample could not be obtained.

Table 2-3 lists the sample containers, preservation, and necessary filtration used during sampling. Stream surface water sample locations are shown in Figure 3. Seep surface water sample locations are shown in Figure 4. All seeps were observed to be dry during fall and early winter field activities and were not sampled. Stream sample collection generally proceeded in a downstream to upstream direction to avoid possible contamination of downstream samples due to upstream sampling activities. Surface water sampling locations are summarized in Table 2-4. Surface water sampling consisted of measuring flow, measuring and recording field parameters, and collecting samples. The following sections describe each of these elements.

Table 2-3 Container, Preservative, and Holding Time Requirements

Analyte	Analytical Method	Container and Preservative	Max. Holding Time
Total Metals	USEPA 200.8	250 milliliter (ml), high density polyethylene bottle with chemically-inert-lined cap. Unfiltered. Nitric acid to pH ≤ 2; cool to 4°C.	6 months from collection date
Dissolved Metals	USEPA 200.8	250 ml, high density polyethylene bottle with chemically-inert-lined cap. Filtered. Nitric acid to pH ≤ 2; cool to 4°C	6 months from collection date
Dissolved Anions (Chloride, Bicarbonate, Carbonate, and Sulfate)	USEPA 300.0	250 ml, high density polyethylene bottle with chemically-inert-lined cap. Filtered. No preservation needed; cool to 4°C	28 days from collection date for chloride and sulfate.
Dissolved Cations (Calcium, Magnesium, Potassium, and Sodium)	USEPA 200.7	250 ml, high density polyethylene bottle with chemically-inert-lined cap. Filtered. Nitric acid to pH ≤ 2; cool to 4°C	6 months from collection date
Alkalinity and Hardness	SM 2320B and SM 2340B (respectively)	250 ml, high density polyethylene bottle with chemically-inert-lined cap. No preservation needed; cool to 4°C	14 days from collection date for Alkalinity and 28 days for Hardness.



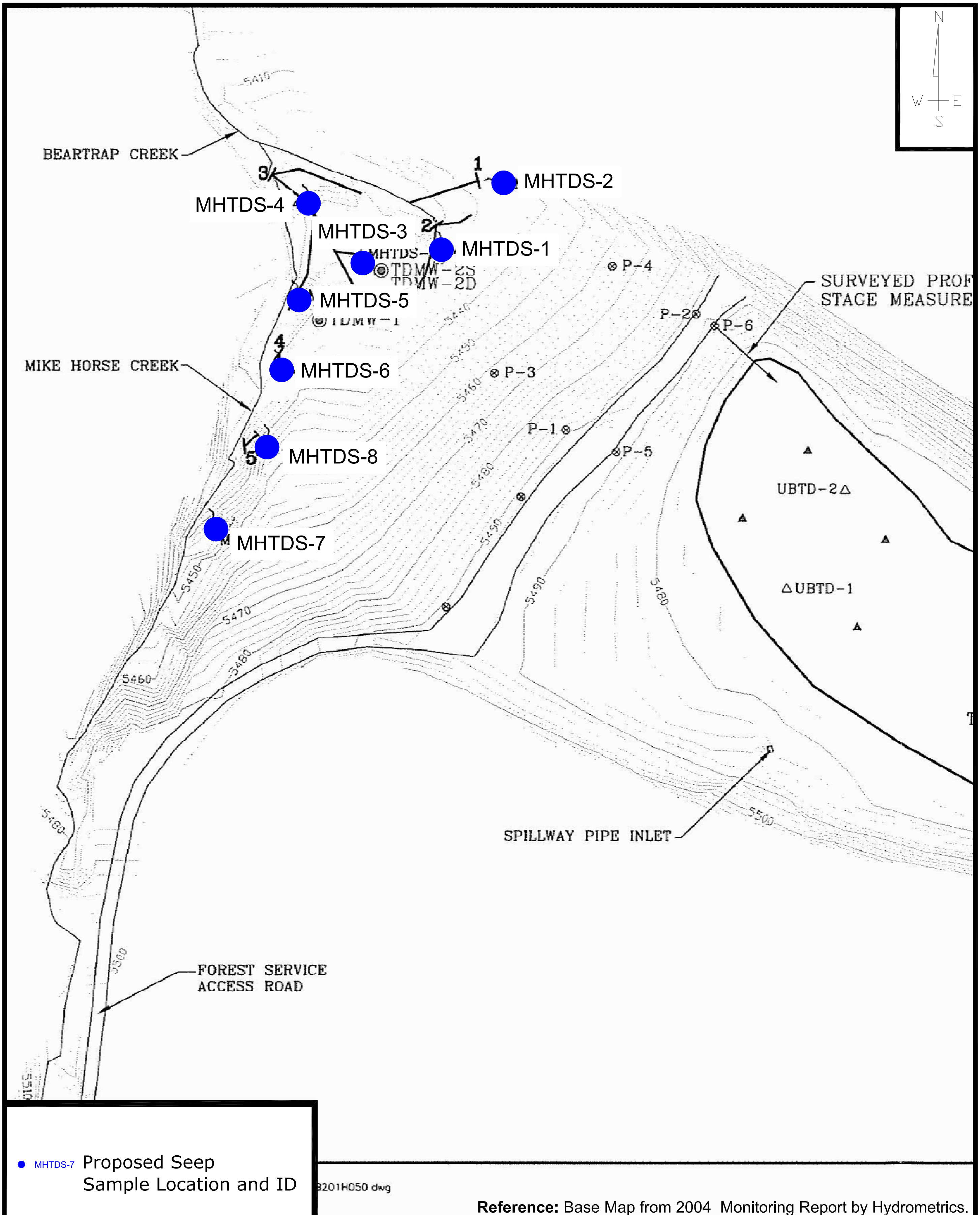
BRSW-48 Suface Water Sample Location and ID

TerraGraphics
Environmental Engineering, Inc.

SCALE:	1"=500'
DRAWN BY:	TLS
ENGINEER:	TLS

Surface Water Sample Locations Upper Blackfoot Mining Complex

PROJECT NO:	09208
DATE:	12/1/2009
FIGURE	3



Reference: Base Map from 2004 Monitoring Report by Hydrometrics.

TerraGraphics Environmental Engineering, Inc.	SCALE: not to scale	Seep Sample Locations Upper Blackfoot Mining Complex	PROJECT NO: 09208
	DRAWN BY: MAP		DATE: 7/21/2009
	ENGINEER: TLS		FIGURE 4

Table 2-4 Surface Water and Seep Sampling Locations

Surface Water Body	Existing Sampling Location	Sample Location	Description/Purpose
Surface Water Sites: Upper Reaches of Blackfoot River and Tributaries			
Beartrap Creek	BRSW-1	Above impoundment	Beartrap Creek water quality above impoundment
Beartrap Creek	BRSW-2	In the impoundment area	Within the impoundment at the northern end
Beartrap Creek	BRSW-3A	Seepage stream at downstream end	Main seepage channel at base of tailings dam
Beartrap Creek	BRSW-3B	Seepage stream at upstream end	Main seepage channel at base of tailings dam
Mike Horse Creek	BRSW-22	Mike Horse Creek upstream of confluence with Beartrap Creek	Mike Horse Creek water quality above dam
Beartrap Creek	BRSW-23	In Beartrap Creek channel below confluence with Mike Horse Creek	Persistent elevated metals concentrations; sample to evaluate loading from mine waste piles and/or seepage from the base of the Mike Horse dam
Beartrap Creek	BRSW-38	In Beartrap Creek upstream of confluence with Anaconda Creek	Upstream of Anaconda Creek and area of streambed tailings
Beartrap Creek	BRSW-48	In Beartrap Creek below the dam	Downstream of confluence of Mike Horse Creek and Beartrap Creek and upstream of Flosse & Louise Mine
Seep Sites at the Toe of Mike Horse Dam **			
Beartrap Creek	MHTDS-1	Above former decant pipe at base of the dam	Dry on 8-28-09 & 11-18-09 (time of sampling)
Beartrap Creek	MHTDS-2	Above MHTDS-1 on east edge of dam face	Dry on 8-28-09 & 11-18-09 (time of sampling)
Mike Horse Creek	MHTDS-3	Sheet flow west of MHTDS-1	Dry on 8-28-09 & 11-18-09 (time of sampling)
Mike Horse Creek	MHTDS-4	Exits from grassy area at dam toe near Mike Horse Creek	Dry on 8-28-09 & 11-18-09 (time of sampling)
Mike Horse Creek	MHTDS-5	Along Mike Horse Creek bank west of MHTDS-4	Dry on 8-28-09 & 11-18-09 (time of sampling)

Table 2-4 Surface Water and Seep Sampling Locations

Surface Water Body	Existing Sampling Location	Sample Location	Description/Purpose
Mike Horse Creek	MHTDS-6	Exits from beneath rock outcrop along Mike Horse Creek west of MHTDS-5	Dry on 8-28-09 & 11-18-09 (time of sampling)
Mike Horse Creek	MHTDS-7	Exits immediately west of pond spillway along Mike Horse Creek	Dry on 8-28-09 & 11-18-09 (time of sampling)
Mike Horse Creek	MHTDS-8	Exits from south bank of Mike Horse Creek downstream from dam spillway	Dry on 8-28-09 & 11-18-09 (time of sampling)

** Note seep sample sites were dry during the fall and early winter testing periods; therefore, no samples were obtained at these sites.

2.2.1 Surface Water Sampling Procedure

Direct Method sampling was utilized to collect water samples directly into the sample container. For shallow stream situations water was collected from below the water surface and in an upstream direction. The unpreserved sample bottles were triple rinsed with stream water at the sample site prior to obtaining the sample. Sample bottles that already had preservative placed by Pace Analytical were not rinsed.

Sample Preservation, Handling and Storage

Once samples were collected, preserved, and cooled to 4ºC in a cooler, a chain of custody record was completed and included in the sample cooler, and the cooler was shipped to Pace Analytical for analysis.

2.2.2 Decontamination

The surface water samples were collected using the direct method, so decontamination was not necessary as new sampling containers were used at each sampling location.

2.2.3 Stream Flow Measurement

Flow measurements were taken utilizing the *"Area-Velocity"* method (Harrelson et al., 1994) using an electronic hand-held flow meter as referenced in the SAP (TerraGraphics, 2009). Stream widths and corresponding depths were measured and recorded in the field to determine cross-sectional areas. Velocities were also measured and recorded in the field at each recorded depth. Stream flows were then calculated using the information recorded in the field. Stream flows are summarized in Appendix D2.

2.2.4 Surface Water Analytical Parameters

Constituents exceeding Montana water quality standards for a class B-1 stream are identified as the basis for the analytical parameters list. Montana water quality standards for metals are defined as total recoverable metals except for aluminum (DEQ, 2008). If the field measured pH was between 6.5 and 9, an aluminum water sample was field filtered with a 0.45 micron disposable in-line filter connected to a pump and the samples were analyzed for dissolved aluminum in general accordance with Circular DEQ-7 (DEQ, 2008). Tables 2-5 and 2-6 summarize laboratory analytical parameters, sample preservation, required bottle size, holding times, PQL, and analytical method numbers. The analytical results and field measurements are summarized in Table B-1 (Surface Water Analytical Summary) and Table B-2 (Surface Water Metals Analytical Summary).

Table 2-5 Surface Water Sampling Requirements

Parameter	Preservation	Bottle Size/Type
Total Recoverable Metals	Nitric acid to pH < 2; Iced to 4°C	250 ml polyethylene
Dissolved Metals	Filtered through 0.45 micron filter; Nitric acid to pH < 2; Iced to 4°C	250 ml polyethylene
Common Ions/Physicochemical	Iced to 4°C	500 ml polyethylene

Table 2-6 Surface Water Analytical Requirements

Parameter	Method NO.	PQL* ($^{mg}/_{L}$)	Max. Holding Time
Physicochemical			
Specific Conductivity	USEPA 120.1 / SM 2510B	None	28 days
pH	SM 4500 H&B	None	Upon arrival at lab
Total Dissolved Solids	USEPA160.1 / SM 2540C	None	7 days
Total Suspended Solids	SM2540D	None	7 days
Hardness	SM 2340B	None	6 months
Acidity	SM 2310	None	14 days
Metals**			
Aluminum†	USEPA 200.8/200.7	0.03	6 months
Arsenic	USEPA 200.8/200.7	0.003	6 months
Cadmium	USEPA 200.8/200.7	0.00008	6 months
Copper	USEPA 200.8/200.7	0.001	6 months

Table 2-6 Surface Water Analytical Requirements

Parameter	Method NO.	PQL* ($^{mg}/_{L}$)	Max. Holding Time
Iron	USEPA 200.8/200.7	0.05	6 months
Lead	USEPA 200.8/200.7	0.0005	6 months
Manganese	USEPA 200.8/200.7	0.005	6 months
Zinc	USEPA 200.8/200.7	0.01	6 months
Common Cations**			
Calcium	USEPA 200.8/200.7	1.0	6 months
Magnesium	USEPA 200.8/200.7	1.0	6 months
Potassium	USEPA 200.8/200.7	1.0	6 months
Sodium	USEPA 200.8/200.7	1.0	6 months
Common Anions**			
Sulfate	SM 300	None	28 Days
Bicarbonate	USEPA 310.1 / SM 2320B	None	14 Days
Carbonate	USEPA 310.1 / SM 2320B	None	14 Days
Chloride	USEPA 300.0	None	28 Days

*Circular DEQ-7 required reporting values for PQL (Practical Quantitation Limit).
** Surface water parameters were analyzed for both total recoverable and dissolved metals.
†Aluminum to be field filtered and analyzed for dissolved aluminum if pH is between 6.5 and 9 per DEQ-7.

2.3 Soil and Tailings Sampling and Analysis

This sub-section describes the soils and tailings sampling and analysis procedures conducted at the UBMC. Samples were collected for geochemical analysis and geotechnical evaluation via test pits and borings.

2.3.1 Test Pits and Borings

TerraGraphics observed and logged the excavation of test pits in the Paymaster claim site, Shave Gulch area, Mike Horse Road, and the area between the Mike Horse Dam and Mike Horse Creek. The test pit and boring locations are shown on Sheets 1 through 4. A total of 11, 9, 7, and 10 test pits were excavated in the Paymaster, Shave Gulch, Mike Horse Road areas, and below the Mike Horse Dam, respectively. The test pits were excavated from September 8 to 11 and 14 to 16, 2009 by Hard Rock Excavation and Road Building using a Komatsu 200 series excavator. The test pits were observed and logged by TerraGraphics personnel during or shortly after excavation. Digital photographs of each test pit were taken and are shown in Appendix C.

TerraGraphics assisted Spectrum to observe the excavation of test pits in the impounded tailings, the Mike Horse Dam, the Beartrap Creek drainage below the dam, and the upper Blackfoot River floodplain. A total of 10, 12, and 1 test pits were excavated in the Mike Horse impoundment and dam, Beartrap Creek, and the Upper Blackfoot River, respectively. The test pits in the impounded tailings and embankment were excavated on October 15, 19, and 20, 2009 by Envirocon using a Caterpillar 200 series excavator. The test pits were logged by Piedmont Engineering (Spectrum sub-consultant) personnel during excavation.

The test pits in the Beartrap Creek drainage and upper Blackfoot River floodplain were excavated on October 16 and 21, 2009 by Thompson Contracting using a Caterpillar 420 backhoe. A total of 12 test pits (one on the 16th and 11 on the 21st) were excavated in the Beartrap Creek area. One test pit was excavated in the Upper Blackfoot River area on October 16, 2009. The test pits were logged by Piedmont Engineering personnel during excavation.

The test pits were generally backfilled after logging of the soil and rock conditions. The backfill was tamped in place with the excavator or backhoe bucket. Some settlement of the test pit backfill should be expected. A few test pits at the Paymaster and Shave Gulch sites were left open to observe if groundwater would collect over time. These test pits were graded to allow wildlife access.

Borings were advanced in the Paymaster claim site and Shave Gulch area – 10 at the Paymaster site and two in the Shave Gulch area. The borings were drilled on September 14, 16, 17, 21, and 22, 2009 by O'Keefe Drilling using a 212 Ford F800 Diesel drill rig with hollow stem augers and down-hole hammer/split spoon sampler. An HQ3 diamond bit attached to a core barrel was used for bedrock coring operations. Standard penetration tests (SPT) were typically performed at 2-foot intervals when advancing through the soil units. Corresponding samples were collected at the SPT intervals. The borings were observed and logged by TerraGraphics personnel during or shortly after drilling of the borings.

2.3.2 Geotechnical Sampling and Analysis

TerraGraphics personnel collected soil samples for geotechnical analysis at the Paymaster and Shave Gulch sites at the time of test pit excavation and drilling operations. Samples were not collected at the Mike Horse Road test pits or in the area below the Mike Horse Dam. The purpose of the Mike Horse Road test pits was to evaluate design efforts required for widening the roadway for construction activities. The purpose of test pitting the area below the Mike Horse Dam was to determine the depth of tailings and impacted soils to prepare a volume estimate for placement in a repository.

Representative soil samples were collected from the test pits and borings. Test pit samples were combined to form a composite sample from each area (one for Paymaster and one for Shave Gulch). Borehole samples were not composited. Test pit samples were placed into a 5-gallon plastic bucket then covered with a lid to seal the sample until delivery to Piedmont Engineering (a DEQ approved geotechnical engineering laboratory) for analysis. The date, sample location, and sample interval were written on the outside of the bucket or bag in indelible ink and recorded in the field book and on the chain of custody form. Borehole samples were placed in 1-gallon heavy duty polyethylene bags for storage and delivery to Piedmont Engineering.

The composite test pit samples represented the material that will be stripped from the hillside, stockpiled, and used to construct the perimeter retaining berm. Separate composite samples were obtained when significant soil differences were observed.

Laboratory tests were performed on the selected samples and composite samples to determine parameters for the design of the perimeter berm(s) and foundation conditions. The geotechnical analyses conducted on samples from the test pitting and borings are listed in Table 2-7.

Table 2-7 Paymaster and Shave Gulch Geotechnical Laboratory Tests

Test	Method
Atterberg Limits	ASTM D4318
Mechanical Grain Size Analysis	ASTM C117/C136
Hydrometer Grain Size Analysis	ASTM D422
Natural Moisture Content	ASTM D2216
Soil Classification	ASTM D2487
Standard Proctor Compaction	ASTM D698
Hydraulic Conductivity	ASTM D5084
Consolidation	ASTM D2435
Consolidated-Undrained (CU) Triaxial Compression	ASTM D4767

The Modified Proctor method was removed from the testing program due to duplication of optimum moisture and maximum dry density information. The hydraulic conductivity method was changed from ASTM D6836 to ASTM D5084. Pressure meter testing was removed due to unsuitability of the soils and rock encountered in the borings. There are no holding times or preservatives for the soils and mine waste samples.

Spectrum collected geotechnical samples during test pitting operations in the Mike Horse impoundment and embankment as well as the Beartrap Creek and Upper Blackfoot River areas. Samples were collected in a similar manner to the procedures described in this subsection. Some large bulk samples were collected in the Mike Horse tailings and embankment and placed in 55-gallon barrels with lids and locking rings. Selected single and composite samples were identified for geotechnical analysis as described in Table 2-7.

2.3.3 Geochemical Sampling and Analysis

Soil samples for geochemical analysis were collected by TerraGraphics personnel at the time of test pit excavation and drilling operations. Sampling associated with the Mike Horse Road test pits was not performed since these test pits were excavated only to determine the depth to and potential rip-ability of the bedrock.

The geochemical samples from the test pitting and borings were analyzed for the parameters listed in Table 2-8. Samples were placed and sealed in 1-gallon heavy duty polyethylene bags for storage and transport to the laboratory. The date, sample location, and interval were written on the outside of the bag in indelible ink and recorded in the field book and on the chain of custody form. There are no holding times, temperature control, or preservatives required for mine waste samples. The analyses were performed by Pace Analytical.

Table 2-8 Tailings Analytical Methods

Parameter	Analytical Method
Soil paste pH and Electrical conductivity (EC)	USDA 2, ASAM 10-3.2, and ASA 10-3
Acid base accounting, including SPLP, SO_4 as S, and total sulfur	EPA 1312, Sobek Modified and USDA23C for lime percentage
Total inorganic carbon	SM 9060
Metals with aqua regia digestion and analysis by ICP-MS	
Aluminum (Al)	SW3050 B and E6010.20
Arsenic (As)	
Cadmium (Cd)	
Copper (Cu)	
Iron (Fe)	
Lead (Pb)	
Manganese (Mn)	
Zinc (Zn)	

SPLP - Synthetic Precipitation Leaching Procedure

Synthetic Precipitation Leaching Procedure Analysis

The synthetic precipitation leaching procedure (SPLP) analysis is used to determine the potential for soil to leach metals to groundwater. In the western states, the procedure uses a pH of 5 to simulate rainwater. The SPLP results (mg/L) are used in combination with the results of a soil sample analysis (mg/kg) from the same location to formulate a soil screening level (SSL). The SSL is the site-specific metal concentration in soil that will potentially leach to groundwater. If a soil sample contains a metal at a greater concentration than the SSL, then unacceptable levels of metals leaching to groundwater would be expected. If all metals concentrations in a soil sample were less than the SSLs, then the leaching of metals to the groundwater would be at a rate acceptable to meet groundwater quality standards. The SSL is calculated using the following equation, provided by DEQ:

$$\text{SSL } ({}^{mg}/_{kg}) = [\text{HHS } ({}^{mg}/_{L}) \text{ / SPLP result } ({}^{mg}/_{L})] \text{ x soil concentration } ({}^{mg}/_{kg}) \text{ x DAF}$$

Where: SSL = soil screening level in ${}^{mg}/_{kg}$

HHS = Circular DEQ-7 human health standard in ${}^{mg}/_{L}$

DAF = dilution-attenuation factor = 10

The dilution-attenuation factor value of 10 is the state specific factor that is listed in Part 2 of the Soil Screening Process – Leaching to Groundwater Flow Chart (DEQ, 2010).

Section 3.0 Quality Assurance/Quality Control

This section describes the quality assurance and quality control (QA/QC) activities, methods, and documentation associated with the analyses presented in this report. All QA/QC activities were performed in substantial compliance with Sections 6 to 11 of the SAP (TerraGraphics, 2009).

The chemical data reduction and review process for this project included data generation and reduction and QA review. TerraGraphics has prepared this data summary report to summarize the analytical results and the QA/QC review. Data quality review responsibilities are summarized below.

Table 3-1 Data Quality Review Responsibilities

Task	Project Laboratory	TerraGraphics
Laboratory data quality review and data reduction	X	
Data Quality Review		X
Quarterly Groundwater Monitoring Reports (include summary of QA/QC review)		X

3.1 Laboratory Data Reduction Procedures

The laboratory performed in-house analytical data reduction under the direction of the laboratory Project Manager. Raw data produced by the analyst were processed and reviewed for attainment of QC criteria as outlined in the SAP/QAPP (TerraGraphics, 2009) and/or established in USEPA methods for overall reasonableness and for transcription or calculation errors.

Laboratory data reduction procedures are those specified in the EPA Publication SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA, 2008a); those specified for the analytical tests summarized in Tables 2-2, 2-3, 2-5, and 2-6; and those described in the laboratory Standard Operating Procedures (SOPs). The data reduction steps were documented, signed, and dated by the analyst.

3.2 Laboratory Qualifiers

Laboratory qualifiers as described and defined in the laboratory QA plans include:

- Concentration below required reporting limit;
- Estimated concentration due to poor spike recovery;
- Concentrations of the chemical also found in laboratory blank; and
- Other sample-specific qualifiers necessary to describe QC conditions.

3.3 Laboratory Recordkeeping

The laboratory maintains detailed procedures for laboratory recordkeeping in order to support the validity of all analytical work. Each data report package submitted to TerraGraphics contained written certification that the requested analytical method was run and that all QA/QC checks were performed. The laboratory program administrator provided TerraGraphics with QC reports of their external audits if appropriate, which will become part of the central project files.

3.4 In-House Laboratory Data Review

The laboratory review was conducted by a laboratory QA reviewer who has the initial responsibility for the correctness and completeness of the data. The laboratory QA reviewer evaluated the quality of the work based on an established set of laboratory guidelines set forth in the SAP/QAPP (TerraGraphics, 2009) to ensure that:

- Sample preparation information is correct and complete;
- Analysis information is correct and complete;
- Appropriate procedures have been followed;
- Analytical results are correct and complete;
- QC sample results are within appropriate QC limits;
- Laboratory blanks are within appropriate QC limits;
- Special sample preparation and analytical requirements have been met; and
- Documentation is complete (all anomalies in the preparation and analysis have been documented; holding times are documented).

3.5 Data Deliverables

To ensure that project chemical data are sufficient to meet both qualitative and quantitative Data Quality Objectives (DQOs), the laboratory provided laboratory data deliverables that permit a limited data quality assessment according to the *Final USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (USEPA, 2004); USEPA Publication SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (USEPA 2008a); and *USEPA Guidance on Environmental Data Verification and Data Validation* (USEPA 2002b).

Information provided will be sufficient to review the data with respect to:

- Holding times and conditions,
- Detection/quantitation limits,
- Surrogate recoveries,
- Laboratory duplicates and Matrix Spikes/Matrix Spike Duplicates (MS/MSD),
- Precision and accuracy,
- Representativeness,
- Comparability,
- Completeness, and
- Method SOP adherence.

All laboratory results submitted to TerraGraphics for this project will be retained in our files and archives. An electronic copy of the data is included on a compact disc and included with this report.

The laboratory prepared and retained (as per in-house laboratory procedures) full analytical and associated QC documentation. The laboratory reported the data as analytical batches of 20 samples or fewer, along with associated QC reporting data. The final analytical data were then provided in a limited deliverable data format as described below.

The analytical results were submitted to TerraGraphics via hard copy and electronic files. The laboratory provided the following hard copy information for each analytical data package submitted for the project:

- The cover sheet listing the samples included in the report, providing narrative comments describing problems encountered in analysis, and identifying any analyses not meeting QC criteria, including holding times;
- Chain of custody forms and cooler receipt forms;
- Tabulated results and reporting limits for all analytes. All analytes were reported for each sample as a detected concentration or as Not Detected above the specific limits of quantitation, which are stated. The laboratory also reported dilution factors, date of extraction, extraction batch number, date of analysis, and analytical batch number for each sample;
- Analytical results for QC sample spikes, laboratory duplicates, initial and continuing calibration verifications of standards and laboratory blanks, standard procedural blanks, laboratory control samples, surrogates, laboratory reference materials, interference check samples, and detection limit check samples; and
- Documentation of data reduction and QC review steps that had been signed and dated by an authorized representative.

3.6 Data Quality Review

The second level of review was conducted by TerraGraphics and included a review of laboratory performance criteria and sample-specific criteria. One hundred percent of the data was reviewed. Additionally, TerraGraphics determined whether the DQOs had been met and calculated the data completeness for the project. The data quality review was performed according to the Data Validation Report provided by DEQ. The Data Validation Report is included in Appendix G.

Section 4.0 Results and Discussions

This section discusses the results of the data collection activities described in Section 2 of this report. The results and the associated discussions are sorted by area and are presented in the following sub-sections.

4.1 Mike Horse

Groundwater, surface water, and soils/tailings sampling was performed in this area. All soil/ tailings sampling was performed with the excavation of test pits as shown on Sheet 1. No borings for sampling or evaluation were drilled in this area. Based on the geochemical analysis, the depth to the base of tailings and impacted soils ranges from 5 feet to over 16 feet below existing grade. Using a polygonal volume calculation method, the estimated volume of tailings and impacted soils in the test pitting area ranges from approximately 25,000 to 30,000 bank cubic yards. This volume will be included in upcoming repository capacity designs and calculations.

4.1.1 Mike Horse Road Test Pits

Test pits were excavated along the up-slope (west) side of Mike Horse Creek Road to determine the depth to competent rock in support of potential road construction in the area. Test pit logs for the Mike Horse Creek Road excavations are shown in Appendix B4. The Mike Horse Creek Road test pit locations are shown on Sheet 4. Table 4-1 summarizes the distance to competent rock adjacent to and above the current road.

Table 4-1 Mike Horse Creek Road Bedrock

Test Pit ID	Estimated Road Width (ft)	Distance to Rock Above Current Road Surface (ft)	Horizontal Distance From Road Edge To Soil Rock Interface on Adjacent Slope (ft)
09-MHRDTP-1	21	2	17
09-MHRDTP-2	26	2	16
09-MHRDTP-3	19	3	14
09-MHRDTP-4	17	0	0
09-MHRDTP-5	15	6	15
09-MHRDTP-6	21	5	18
09-MHRDTP-7	21	7.5	17

Based on the bedrock information presented above, hard ripping and blasting of rock may be required to expand the road into the slope in the area southeast of the WTP and west of the old Mike Horse town site.

4.1.2 Groundwater Results

Groundwater samples were analyzed for constituents identified in Table 2-2. The sample locations are summarized in Table 2-1. The groundwater analytical results are presented in Table A-1 and Table A-2. These tables contain information associated with the recent sampling performed by TerraGraphics and available historical information for wells TDMW-1, 2D, and 2S (October 11, 2001; May 6, 2002; May 29, 2002; July 10, 2002; October 10, 2002; May 19, 2003; October 23, 2003; May 26, 2004; August 31, 2009; September 1, 2009; November 18, 2009; and November 19, 3009). Only information from August, September, and November 2009 is available for wells TDMW-3D, 4D, and 5. Wells TDMW-3 and 4S were dry or did not produce enough water to sample when attempted in both the fall and early winter of 2009. Historical data are not available for these locations as the wells were constructed in August 2006.

Historically (from October 2001), water samples from wells TDMW-1 and TDMW-2D indicate that the concentrations of constituents listed in Table 2-2 have been below groundwater standards. Well TDMW-2S has exceeded the groundwater standard for manganese in 6 out of the 10 sampling events since October of 2001, including the last four. Wells TDMW-3D and TDMW-5 exceeded the groundwater standard for chronic exposure to iron during the fall and early winter sampling events of 2009.

Comparing the 2009 analytical groundwater data to the historical data, the concentrations of the recently sampled dissolved metals of concern are within the historical ranges. Slightly elevated concentrations of calcium, zinc, and sulfate were observed for TDMW-1. These levels are still within acceptable levels and below human health standards. Slightly elevated concentrations of calcium, magnesium, zinc, and sulfate were also observed for TDMW-2S. These levels are also within the acceptable range and below human health standards.

The only available historical data for monitoring wells TDMW-1, TDMW-2D, TDMW-2S, TDMW-3D, and TDMW-3S are ranges of dissolved metals concentrations that were included in Table 3-4 of the Engineering Evaluation/Cost Analysis (EE/CA) (Hydrometrics, 2007). Wells TDMW-1, TDMW-2S, and TDMW-3D contained sulfate levels greater than 100 mg/L on August 31, 2009 and November 18, 2009. The measured total and dissolved manganese concentrations for the August 31, 2009 and November 18, 2009 sampling of TDMW-2S were higher than any of the previous available results. The dissolved manganese levels were also much higher than previously measured levels. The cause is unknown at this time but may be a result of lowering the water level within the impoundment. The laboratory analysis data are shown in Appendix D1.

4.1.3 Surface Water

Surface water samples were analyzed for constituents identified in Table 2-6. The sampling requirements listed in Table 2-5 were also followed. The sample locations are summarized in Table 2-4. The surface water analytical results are presented in Table B-1 and Table B-2, which contain data from samples collected in the fall and early winter of 2009 by TerraGraphics as well as available historical data for the same sites. The 2009 data have been reviewed for QA/QC purposes, as listed in the SAP. BRSW-22 was not sampled during the early winter of 2009 because it was frozen solid. The historical data were compiled by Spectrum Engineering from the available Hydrometrics and Tetra Tech data. The historical data date back to the following for the locations listed:

- BRSW-1 August 12, 1991;
- BRSW-2 August 12, 1991;
- BRSW-3A October 11, 2000;

- BRSW 3B October 11, 2000;
- BRSW-22 October 26, 1993;
- BRSW-23 October 26, 1993;
- BRSW-38 April 28, 1999; and
- BRSW-48 October 19, 1999.

Sample BRSW-22A is a duplicate of sample BRSW-22 and BRSW-38A is the field blank for the fall 2009 sampling event. Sample BRSW-3A-11202009 is a duplicate of BRSW-3A-112009 and BRSW-38A-112009 is the field blank for the early winter 2009 sampling event. All the seeps at locations MHTDS-1 to MHTDS-8 (downstream toe of the Mike Horse dam) were dry at the time of both fall and early winter sampling in 2009. All other locations are associated with streams or the Mike Horse Impoundment. The laboratory analysis data are shown in Appendix D1.

A comparison of the 2009 analytical surface water data with the historical data indicates that the metals of concern (cadmium, lead, manganese, and zinc) that have generally exceeded the human health standard are remaining consistently high. BRSW-2, located within the northeast corner of the Mike Horse impoundment, had a significantly reduced water level during the August 28, 2009 and November 19, 2009 sampling events from past years, which may have influenced the temperature, common anions, common cations, iron, lead, and manganese concentrations. Keeping the impounded water level to a minimum in the Mike Horse Impoundment reduces the amount of water to be handled during reclamation activities; however, the tailings will retain some water that will require handling during reclamation.

A review of the sampling data indicates that the surface water standards for human health have not been exceeded in BRSW-1 since November 13, 1991, with the exception of dissolved oxygen. Dissolved oxygen has historically fallen out of the standard range of 3.0 to 9.5 mg/L (mostly high). Please note that if the human health standards are exceeded, the acute and chronic aquatic life water standards are also exceeded, with the exception of aluminum, arsenic, and iron (chronic). Flow at the time of the fall sampling was calculated to be 0.42 cubic feet per second (cfs) or 190 gallons per minute (gpm). Flow at the time of the winter sampling was calculated to be 0.47 cfs or 212 gpm.

The surface water standards for human health exposure to iron, dissolved oxygen (low), and pH (high) were exceeded at BRSW-2 during the August 2009 sampling event. The surface water standards for human health exposure to iron and dissolved oxygen (high) were exceeded during the November 2009 sampling event. The standard for iron had not been exceeded since October 23, 1995. No historical data for dissolved oxygen are available for BRSW-2 but pH levels have historically and during the November 2009 sampling event met the standard. Flow at the time of both 2009 sampling events was stagnant.

With the exception of dissolved oxygen and manganese, BRSW-3A did not exceed the surface water human health standards for any constituent during the 2009 samplings events. Dissolved oxygen was low in August and high in November. The standard was met for manganese in August but exceeded in November. Manganese levels have consistently exceeded the human health surface water standards prior to the 2009 sampling events. Cadmium has sporadically exceeded the surface water standard prior to June 2004. Iron and lead levels have not exceeded the standards since 2002. Zinc did not significantly exceed the standard since 2001 (slightly exceed in April 2004). Flow during the fall of 2009 was estimated to be 0.33 cfs or 148 gpm. The flow during November was calculated to be 0.15 cfs or 68 gpm.

With the exception of dissolved oxygen and manganese, the surface water human health standards in BRSW-3B were not exceeded for any constituent during the 2009 sampling events. Dissolved oxygen was low in August and high in November. The standard was met for manganese in August but exceeded in November. Manganese levels have generally exceeded the human health surface water standards prior to the 2009 sampling events. Cadmium has generally exceeded the surface water standards prior to October 2000. Iron has not exceeded the standard since June of 2003. Lead levels have only exceeded the standards in October of 2004. Zinc has sporadically exceeded the standards since April of 2001. Sample results indicated that this location has had sporadic low pH values prior to May of 2003. Flows were too low to estimate during the 2009 sampling events.

BRSW-22 was not sampled in November of 2009 because it was frozen solid. This source has consistently exceeded the surface water standards for cadmium, copper, lead, manganese, and zinc. Aluminum has sporadically exceeded the water standards. Iron has only occasionally exceeded the standards prior to 2001. Zinc and lead trends show these concentrations to be dropping. Low dissolved oxygen was recorded during the August 28, 2009 sampling event. No other historical dissolved oxygen data are available for this site. Flow at the time of sampling was calculated to be 0.05 cfs or 21 gpm in the fall of 2009.

BRSW-23 has also consistently exceeded the human health surface water standards for manganese and, to a slightly lesser extent, total lead. Iron, zinc, and cadmium have sporadically exceeded the standard over the years. Low dissolved oxygen was recorded in August and high dissolved oxygen was recorded in November of 2009. No other historical dissolved oxygen data are available for this site. Flow at the time of sampling was calculated to be 0.65 cfs or 292 gpm in the fall and 0.42 cfs or 188 gpm in November of 2009.

BRSW-38 has consistently exceeded the surface water standards for manganese and, to a slightly lesser extent, cadmium and total lead. Iron, zinc, and cadmium have sporadically exceeded the standard over the years. Aluminum has sporadically exceeded the aquatic life standards. Low dissolved oxygen was recorded in August and high dissolved oxygen was recorded in November of 2009. No other historical dissolved oxygen data are available for this site. Flow at the time of sampling was calculated to be 0.89 cfs or 400 gpm in August and 0.74 cfs or 334 gpm in November of 2009.

A review of the data associated with BRSW-48 indicates water quality similar to that at BRSW-38, but far fewer historical data points (8 as opposed to approximately 26) are available for comparison. The human health surface water standards for iron and lead were exceeded during the November 2009 sampling event but not during the August event. Manganese has exceeded the standard since sampling began. Cadmium, zinc, and to a lesser extent copper have exceeded the aquatic life water standards. Flow at the time of sampling was calculated to be 0.95 cfs or 426 gpm in August and 0.51 cfs or 230 gpm in November of 2009.

4.1.4 Soils and Tailings Geochemical Analysis

The Mike Horse soils and tailings geochemical samples were analyzed in 2009 for constituents identified in Table 2-8. The samples were collected at various depths in test pits excavated in the area between the downstream toe of the Mike Horse Dam and Mike Horse Creek. The geochemical analytical results are presented in Table C-1 (Mike Horse Soils/Tailings Geochemical Summary) as well as Sheet 1.

The test pit logs are located in Appendix B3. A more detailed geochemical evaluation of the laboratory results is included in Appendix F1 (pHase Geochemistry, 2009). The laboratory analysis report is located in Appendix F2. These test pits were left open for a few days after excavation at the request of the USFS so they could observe the materials in the pit walls. After being left open for a day, white salts were observed to be precipitating on the pit walls. The precipitate appeared to be the same as that observed inside the Mike Horse Impoundment in the tailings above the water line. The vast majority of the materials already appeared to be oxidized except for the occasional lenses or layers of gray flotation tailings, as encountered within the Mike Horse Impoundment.

Conductivity values ranged from moderate to high (880 to 14,300 µS/cm). The pH of the soils was generally acidic with a variable sulfur content averaging approximately 3.7%, suggesting a mixture of soils and tailings. An apparent relationship exists between sulfur and the neutralization potential where samples with higher sulfur content have a higher neutralization potential. Neutralization potential values ranged from non-detect (<0.5 tons/1000) to significant (186 tons/1000). Based on the neutralization potential to acid potential ratio (NP/AP) observed by pHase Geochemistry, nearly all of the Mike Horse samples analyzed are potentially acid generating (PAG).

The soil samples were compared to the residential soils concentrations listed in the Regional Screening Level (RSL) for Chemical Contaminants at Superfund Sites (MDEQ, 2009). The concentrations for residential soils were used in the comparison as the screening levels are the most conservative.

The total manganese concentration in the majority of samples exceeded the RSL. A general summary of the analyzed constituents by test pit is as follows:

In test pit 09-MHTP-1, the total metals concentrations for arsenic, iron, lead, and manganese decreased below RSLs between the samples obtained at 10 feet and 16 feet depth. Based on the geochemical analyses, the depth of tailings and impacted soils appears to be approximately 13 feet below existing grade. This area appears to have been built up over time by the various mine operators with tailings and waste rock materials. As such, the depth to the base of tailings and impacted soils was difficult to estimate.

In test pit 09-MHTP-2, the total metals concentrations for all metals analyzed were below RSLs for all 3 samples. Based on the geochemical analyses, the depth of tailings and impacted soils appears to be 5 feet below existing grade.

In test pit 09-MHTP-3, the total metals concentrations for arsenic and lead decreased below RSLs between the samples obtained at 7 feet and 8 feet depth. Manganese levels exceeded the RSLs for all three samples. Based on the geochemical analyses, the depth of tailings and impacted soils is 7½ feet below existing grade.

In test pit 09-MHTP-4, the total metals concentrations for arsenic, iron, lead, and manganese decreased below RSLs between the samples obtained at 9 feet and 9½ feet. Based on the geochemical analyses, the depth of tailings and impacted soils appears to be 9 feet below existing grade.

In test pit 09-MHTP-5, the total metals concentrations for arsenic, iron, lead, and manganese decreased below RSLs between the samples obtained at 6½ feet and 7 feet. Based on the geochemical analyses, the depth of tailings and impacted soils appears to be 6½ feet below existing grade.

In test pit 09-MHTP-6, the total metals concentrations for iron, lead, and manganese decreased below RSLs between the samples obtained at 6½ feet and 7½ feet. The arsenic concentration fell below the RSL in the 6 foot sample but exceeded the screening level in the 5½, 6½, and 7½-foot samples. Based on the geochemical analyses, the depth of tailings and impacted soils may be 8 feet below existing grade; however, the arsenic concentration is slightly above the screening level of 40 mg/kg.

In test pit 09-MHTP-7, only the total metals concentration for arsenic exceeded the RSL. Based on the geochemical analyses, the depth of tailings and impacted soils appears to be 8 feet below existing grade.

In test pit 09-MHTP-8, the total metals concentrations for lead and manganese decreased below RSLs between the samples obtained at 9½ feet and 10 feet. Based on the geochemical analyses, the depth of tailings and impacted soils is 9½ feet below existing grade.

In test pit 09-MHTP-9, the total metals concentrations for arsenic, iron, lead, and manganese remained above RSLs in both samples obtained. Based on the geochemical analyses, the depth of tailings and impacted soils appears to extend beyond 16 feet below existing grade and into the alluvium in this test pit. Gray fine tailings were observed within the walls of the test pit and appear to have filtered into the coarser grained material used to build the benched area upon which this test pit is located. Samples were obtained at depths of approximately 10 feet and 16 feet, just above the groundwater level.

In test pit 09-MHTP-10, the total metals concentrations for arsenic, iron, lead, and manganese remained above RSLs in both samples obtained. Based on the geochemical analyses, the depth of tailings and impacted soils appears to extend beyond 16 feet below existing grade and into the alluvium in this test pit. Gray fine tailings were observed within the walls of the test pit and appear to have filtered into the coarser grained material used to build the benched area upon which this test pit is located. Samples were obtained at depths of approximately 8 feet and 16 feet, just above the groundwater level of 17 feet.

In 09-MHTP-9 and 09-MHTP-10, samples were not obtained below the groundwater level as representative samples could no longer be obtained. A reddish brown oxidized zone appeared in the alluvium where the groundwater level fluctuates and a very dark brown reducing zone appeared below the groundwater level. Metal concentrations exceed RSLs in this area as well. It is not known if these metals are naturally occurring or as a result of the dam failure. Similar conditions were observed in the native soils while assisting Spectrum personnel with their test pits excavated in the drainage below the Mike Horse Dam, indicating that the metals may occur naturally.

TerraGraphics assisted Spectrum with sampling of soils and tailings associated with the 1975 dam failure down Beartrap Creek below the dam and along the upper Blackfoot River to the confluence with Shave Creek. The samples were collected from test pits excavated with a rubber-tired backhoe to minimize site disturbance. The samples were collected for geochemical analysis to determine the suitability of the soils for stream reclamation and possible repository construction.

TerraGraphics also assisted Spectrum in collecting tailings samples within the Mike Horse Impoundment for geochemical analyses to determine the suitability for use as a low permeability component associated with repository construction. The samples were collected from test pits excavated with a tracked excavator. The results and recommendations associated with these activities will be presented in a Spectrum report.

4.2 Paymaster

Only soil sampling was performed in the Paymaster area. All soil sampling was accomplished with the excavation of test pits and the drilling of boreholes. Selected samples were analyzed for geochemical and geotechnical properties. The test pit and borehole locations are shown on Sheet 2. The Boring Logs and Test Pit Logs are included in Appendix A and Appendix B, respectively.

4.2.1 Soil Geochemical Analysis

Soil geochemical samples were analyzed for constituents identified in Table 2-8. The samples were collected at various depths from test pits in the area. Two borehole samples from 09-PMBH-2 were analyzed for geochemical properties as the drillers commented on the odor of the samples. These were the only samples for which the drillers commented on the soil odor. Samples were obtained from 5 to 10 feet (cuttings) and 6 to 8 feet (split spoon sample) below grade and submitted for analysis. The geochemical properties of these two borehole samples appear to be similar to the other Paymaster soil samples and no outstanding parameters were observed. The geochemical analytical results are presented in Table C-2 (Paymaster Soils Geochemical Summary) and on Sheet 2. A more detailed geochemical evaluation of the laboratory results is included in Appendix F1 (pHase Geochemistry, 2009). The laboratory analysis report is located in Appendix F2. The analytical results indicate that the soils may leach out toxic metals when in contact with water.

4.2.1.1 Soil Geochemical Data Results

As the Paymaster site is located within a naturally mineralized area of the UBMC, high concentrations of iron, lead, and manganese appear to be prevalent throughout the soils in the Paymaster testing area when compared to the RSLs (MDEQ, 2009). Elevated amounts of arsenic and cadmium were also found in isolated locations. Conductivity values were low (60 to 650 µS/cm). The pH of the soils ranges from neutral to acidic; however, the sulfur content is rather low indicating minimal potential for acid generation (non-PAG). Comparing the total metals concentrations to the background concentrations for the Western U.S. Soils Mean (MDEQ, 2005), all the soil samples exceeded the background levels for arsenic, copper, iron, and zinc with the majority of the samples exceeding background for lead and manganese. This indicates that the soils at the Paymaster site have naturally high background concentrations of these metals. The SSL results from the soils sampled at the Paymaster site indicate that if these materials are excavated and in contact with water, the resulting leachate, estimated by the SPLP concentrations, will exceed the RSLs. Metal precipitates may also form in the water.

The combination of total metals concentrations measured in the soil, elevated levels of metals measured in the SPLP analyses, and total metals concentrations exceeding the calculated soil screening level provides multiple lines of evidence that the Paymaster site is already leaching metals into the groundwater or will leach them once the site is disturbed. In addition, a review of the 2007 and 2008 groundwater data from monitoring wells in the vicinity of the existing Paymaster repository (PMGW-116, PMGW-117, PMGW-118, PMGW-119, PMGW-120, PMPZ-3 and PMPZ-4) indicates measureable concentrations of cadmium, copper, iron, lead, manganese, and zinc.

4.2.2 Subsurface Conditions

A review of the test pit and borehole logs indicates that approximately 2 to 6 inches of topsoil or forest duff covers the site surface. Isolated areas with as little as 1 inch and as much as 18 inches of topsoil or duff were observed. Other isolated areas associated with dense vegetation and root systems with two or more feet of topsoil may be encountered during construction. Colluvium was encountered beneath the topsoil/duff layer. The colluvium generally consists of silty sands and gravels or, to a lesser extent, silts that extended to a depths ranging from 1 to 6 feet below existing grade.

Beneath the colluvium, weathered to highly weathered diorite was encountered. The diorite is 1 to 6 feet below ground surface (bgs). The diorite appears to be easily ripped to a depth of 4 feet to over 17 feet, depending on proximity to the diorite outcrop along the western boundary of the site. The weathered diorite, once excavated, generally consists of poorly sorted, silty sands and gravels with cobbles and boulders increasing with depth. Iron, manganese, and to a lesser extent, copper staining was observed in the weathered diorite. Some sandy lean clays were also observed in the weathered diorite. These clays are nearly vertically oriented and, at times, bend downhill, indicating that they are hydrothermal in origin and not a product of weathering. The lateral extent of these clayey layers between the test pits is unknown.

Geotechnical soil samples were analyzed for properties identified in Table 2-7. The geotechnical results are presented in Tables D-1 and D-2 and the Geotechnical Data Summary in Appendix F3. Tables D-1 and D-2 and Appendix F3 contain information associated with the 2009 sampling performed by TerraGraphics.

A total of 23 samples from boreholes and four samples from test pits were analyzed. The soils consist of silty and clayey sands with some silt and gravel units from the 09-PMBH-9 area and lean clay units from the 09-PMBH-5 area. The maximum dry density and optimum moisture as determined by standard Proctor (ASTM D698) range from 114 to 134 pounds per cubic foot (pcf) at 9 to 16 percent, respectively, with an average of 126 pcf at 14 percent moisture. The sample analysis indicates that the natural moisture content of the soils ranges from 4.45 to 30.57 percent with an average of 15 percent.

In-situ dry density as determined by nuclear density gauge ranged from 90 to 110 pcf, with an average of 102 pcf. Based on average in-situ density values compared to average Proctor values, it appears that the average in-place compaction of the native soils is approximately 81 percent. Typically, it can be expected that the surface soils will be looser and denser with increasing depth. The triaxial shear testing for the samples analyzed indicates the effective friction angle for granular soils with no appreciable clay content is approximately 38 degrees with a cohesive strength of 0 psf. Analysis indicates an effective friction angle of approximately 25 degrees and a cohesive strength of approximately 1,445 psf for granular soils with significant clay content. The laboratory analysis data are located in Appendix F3.

4.3 Shave Gulch

Soil and bedrock were sampled in the Shave Gulch area. All soil sampling was performed with the excavation of test pits and the drilling of boreholes. Selected samples were analyzed for geochemical and geotechnical properties. The test pit and borehole locations are shown on Sheet 3. The Boring Logs and Test Pit Logs are included in Appendix A and Appendix B, respectively.

4.3.1 Soil Geochemical Analysis

Selected soil geochemical samples were analyzed for constituents identified in Table 2-8. The samples were collected at various depths in test pits in the area. The geochemical analytical results are presented in Table C-3. A more detailed geochemical evaluation of the laboratory results is included in Appendix F1 (pHase Geochemistry, 2009). The laboratory analysis data are located in Appendix F2.

4.3.1.1 Soil Geochemical Data Results

As the Shave Gulch site is located within a naturally mineralized area of the UBMC, high concentrations of iron, lead, and manganese appear to be prevalent throughout the soils in the sampling area, with elevated amounts of arsenic generally below the MDEQ action level of 40 mg/kg. Conductivity values were low (60 to 310 µS/cm). The pH of the soils is neutral to slightly acidic; however, the sulfur content is variable but low, indicating minimal potential for acid generation (non-PAG with a few samples considered uncertain as to acid generation potential). Comparing the total metals concentrations to the background concentrations for the Western U.S. Soils Mean (MDEQ, 2005), all the soil samples exceeded the background levels for arsenic, copper, lead, and zinc with the majority of the samples exceeding background for iron and manganese. This indicates that the soils at the Shave Gulch site have naturally high background concentrations of these metals. The SSL results from the soils at the Shave Gulch site indicate that if these materials are excavated and in contact with water, the resulting leachate, estimated by the SPLP concentrations, will exceed RSLs. Metal precipitates may also form in the water.

With the combination of total concentrations of arsenic, iron, lead, and manganese measured in the soil, elevated levels of these metals measured in the SPLP analyses, and total concentrations exceeding the calculated soil screening level for these metals, there are multiple lines of evidence that indicate that the Shave Gulch site is already or will leach these metals into groundwater once the site is disturbed. However, there are no water monitoring stations in the immediate vicinity of the testing area for confirmation testing.

4.3.2 Subsurface Conditions

A review of the test pit and borehole logs indicates that less than 6 inches of topsoil or forest duff covers the site surface. Isolated areas associated with dense vegetation and root systems with 2 feet or more of topsoil may be encountered during construction. Beneath the topsoil layer, colluvium consisting of silts and minor sands and gravels was encountered to a depth of 2-10 feet below existing grade. Underlying the colluvium, weathered to highly weathered diorite was encountered. The diorite appears to be easily ripped to a depth of 9 feet to over 19 feet. The weathered diorite generally consists of poorly sorted, silty sands and gravels, with cobbles and boulders increasing with depth.

Weathered argillite was observed below the diorite at a depth of 5 feet in test pit 09-SGTP-6. No diorite was observed in test pit 09-SGTP-02, but weathered argillite was observed at a depth of 3 feet. Iron, manganese and, to a lesser extent, copper staining was observed in the weathered diorite. Some sandy lean clays are also associated with the weathering process. In boring 09-SGBH-2 highly fractured porphyry was encountered at a depth of approximately 22 feet bgs. The porphyry lies beneath the argillite and appears to be bleached when compared to the porphyry ore observed in the Mike Horse Mine area. A small amount, estimated to be less than three percent, of sulfide minerals (pyrite, chalcopyrite, pyrrhotite, and possibly arsenopyrite and galena) was observed with a hand lens in the core sample.

Geotechnical soil samples were analyzed for the properties identified in Table 2-7. The samples were collected at various depths in test pits and borings in the area. The geotechnical results are presented in the Geotechnical Data Summary in Appendix F3. This table contains information associated with the 2009 sampling performed by TerraGraphics. The laboratory analysis data are located in Appendix F3.

A total of 10 samples from boreholes and five samples from test pits were analyzed. Analysis of the samples indicates that the soils consist of silts and clayey sands. The maximum dry density and optimum moisture as determined by standard Proctor (ASTM D698) ranges from 127 to 134 pcf and 8 to 11 percent, respectively, with an average of 130 pcf at 10 percent moisture. The sample analysis indicates that the natural moisture content of the soils ranges from 4.58 to 22.14 percent, with an average of 12 percent.

In-situ dry density as determined by nuclear density gauge ranged from 82 to 102 pcf, with an average of 94 pcf. Based on average in-situ density values compared to average Proctor values, it appears that the average in-place compaction of the native soils is approximately 72 percent. Typically, it can be expected that the surface soils will be looser at the surface and denser at depth. The triaxial shear testing for the samples analyzed indicates the effective friction angle is approximately 38 degrees with a cohesive strength of 0 psf. The laboratory analysis data are located in Appendix F3.

4.4 Mike Horse Impoundment and Embankment (Spectrum Data)

A review of Spectrum’s test pit logs and geotechnical analysis, as well as TerraGraphics’ field observations, indicates that the observed tailings consist of saturated, fine sandy silt and saturated, silty fine sand. Test pits were excavated to the maximum extent of the excavator (15 feet) or until caving prevented further excavation. None of the test pits extended to the alluvial soils underlying the tailings.

The unconfined compressive strength of the tailings at various depths was determined in the field with a pocket penetrometer. These penetrometer readings indicate that the saturated tailings have an unconfined compressive strength of 0 tons per square foot (tsf). The tailings in their current state, with such low unconfined compressive strength, would be considered to have an effective friction angle of 0 degrees.

A review of Spectrum's test pit logs and available (at the time of this report) geotechnical analysis, as well as our own field observations, indicates that the observed embankment soils consist of silty sand as well as poorly graded fine sand with clayey gravels found in the area of the repairs made after the 1975 breach. Spectrum's test pit logs are not included in this report.

4.5 Beartrap Creek and Upper Blackfoot River (Spectrum Data)

A review of Spectrum's test pit logs and available (at the time of this report) geotechnical analysis, as well as our own field observations, indicate that the observed Beartrap Creek floodplain consists of poorly graded, silty gravels over poorly graded and silty sands. These soils overlie organic clays and silts in some areas. The organic clays and silts appear to be the original surface soil unit prior to the dam failure. The absence of the organic clay and silt layer in some areas may be due to scouring of the area during the dam failure. Cobbles and boulders up to 24 inches in diameter were observed in localized areas in the overlying gravels and sands.

Mine waste or heavy mineralization was observed in the overlying gravels and sands to depths of 2 to 10 feet. Iron cemented gravels were observed in test pit STP-20 at a depth of 2.5 feet. Groundwater was observed in some test pits excavated in the valley bottom at approximately the same elevation as the adjacent creek. Excavation was stopped when groundwater was encountered. Spectrum's test pit logs are not included in this report.

One test pit was excavated in the upper Blackfoot River floodplain approximately 200 feet upstream from the confluence with Shave Creek. A review of Spectrum's test pit logs and available (at the time of this report) geotechnical analysis, as well as our own field observations, indicates that the observed soils consist of approximately 7 feet of silty sands over poorly sorted gravels. Tailings were observed to a depth of approximately 3.5 feet. The soils are wet at the surface and trend to saturated at approximately 4 feet and deeper. A paleo-soil horizon was observed in the overlying sands that appears to be the original topsoil layer before being covered with tailings from the 1975 failure event.

Section 5.0 Hazard Mapping

Hazard mapping was performed by TerraGraphics personnel on August 11, 12, and 19, 2009. Locations of potential hazards such as possible historic sites, waste materials, debris, obstacles, and other items that may affect the remedial design/remedial action were recorded. The locations were recorded and the features photographed. A photographic record of the observed hazards is located in Appendix C2. The locations of the observed hazards are shown on Sheets 5 and 6. A summary of the mapped hazards are presented in Table 5-1.

Table 5-1 Hazard Mapping Summary*

Photograph Number	Sheet Number	Description
1	5	Waste Pile Below Mary P Collapsed Adit
2	5	Waste Pile Below Mary P Collapsed Adit
3	5	Monitoring Wells Across From Mary P Piles
4	5	Historic Building Between Paymaster & Mike Horse Creek Roads
5	5	Hill Side Cut Above Photo 4
6	5	Trench Along Overgrown Exploration Road Above Paymaster Rd
7	5	Monitoring Wells at Corner of Paymaster Rd.
8	5	Tailings Dumped Below Paymaster Road (Edith Workings?)
9	5	Detention Pond Below Paymaster Road (Edith Workings?)
10	5	Debris Pile Along Paymaster Rd.
11	5	Paymaster Creek Monitoring Well PMP-3
12	5	Paymaster Road Monitoring Wells PMPZ-1 & PMPZ-2
13	5	Acid Seep And Tailings on N Side of Paymaster Rd.
14	5	Paymaster Creek
15	5	Monitoring Wells PMGW-118 & PMGW-119
16	5	Monitoring Well PMGW-117
17	5	Monitoring Well PMGW-116
18	5	Dozed Exploration Pit or Pond Along Paymaster Road
19	5	24" CMP & 54" RCP Culvert Crossings on Mike Horse Creek Road
20	5	Mike Horse Creek Road Overhead Power Line Crossing
21	5	Collapsing Building
22	5	Collapsing Building
23	5	Collapsing Building
24	5	Power Pole At Intersect Of Shave Creek & Mike Horse Creek Roads
25	5	Collapsing Building
26	5	Old Building in Shave Gulch Along Exploration Rd
27	5	Mike Horse Road Culvert, Power, & Telephone Crossing of Wetlands
28	5	Power Junction Box Along Mike Horse Creek Road
29	5	Mike Horse Creek 12" CMP Culvert Crossing
30	5	Mike Horse Creek 24" CMP & 54" RCP Culvert Crossings
31	5	Telephone Pedestal

Table 5-1 Hazard Mapping Summary*

Photograph Number	Sheet Number	Description
no photo	5	WTP: Caustics, Underground Utilities, Propane Tanks, Wells, & Culverts
no photo	5	Erosion Area by WTP Reported, by G. Kornic, to be “Hollow Sounding”
32	6	Mike Horse Creek Road Damaged 24" CMP Culvert Crossing
33	6	Pipe From Mike Horse Adit to WTP
34	6	Seep In Lower Mike Horse Mine Road With Pipe Work
35	6	Seep In Lower Mike Horse Mine Road
36	6	Junction Boxes In Lower Mike Horse Road
37	6	Retaining Wall
38	6	Flume From Old Diversion Ditch and 24" RCP
39	6	Flume From Old Diversion Ditch
40	6	Area of Anaconda Shaft & Reclaimed Collar - Workings Extend Under Blackfoot R.
41	6	Mike Horse Tailings Impoundment
42	6	Mike Horse Tailings Impoundment
43	6	Estimated Location of Mike Horse Abandoned Septic System
44	6	Subsidence of Collapsed Adit Under Mike Horse Creek Road
45	6	Pipeline & Repair Pit Along Mike Horse Creek Road
46	6	Pipe in Pit Shown in Photo 45
47	6	Mike Horse Creek Road Repair Pit & Foam Insulated Pipe Cleanouts
48	6	Mike Horse Creek Road Repair Pit & Pipe Repair
49	6	Mike Horse Creek Road Repair Pit & Foam Insulated Pipe Cleanouts
50	6	Mike Horse Creek Road Repair Pit & Foam Insulated Pipe Cleanouts
51	6	Mike Horse Creek Road Repair Pit & Foam Insulated Pipe Cleanouts
52	6	Mike Horse Creek Road Repair Pit & Foam Insulated Pipe Cleanouts

* The various abandoned mine workings around the site are not included in this table but are generally shown on Sheets 5 & 6. Not all workings are shown. Some working may have been obscured from view during the hazard mapping and not logged.

Section 6.0 Summary and Conclusions

This section discusses the conclusions and recommendations to advance the project based on the activities and analysis cited previously in this report.

6.1 Surface Water

Comparing the fall and early winter, 2009 analytical surface water data in the Mike Horse area to the historical data, some of the metals of concern (cadmium, lead, manganese, and zinc) have generally exceeded the human health and aquatic standards but appear to remain consistent. The 2009 dewatering of the Mike Horse Impoundment has affected the water quality in BRSW-2, which is located within the impoundment at the northeastern end. The reduced pool of water and subsequent drying of the tailings has caused metal salts to precipitate on the surface of the tailings and appears to be a source of the water quality degradation.

Surface water runoff rates in Beartrap Creek in the vicinity of the Mike Horse Impoundment will vary greatly depending on the time of year and are directly influenced by storm events and groundwater. Estimate flow rates range from less than 250 gpm to several thousand gpm. Summer surface water quality is primarily driven by shallow groundwater discharge to the streams and is expected to be very similar to the water quality data reported herein. Data collected in 2009 at BRSW-22, located in Mike Horse Creek upstream of the confluence with Beartrap Creek indicate that the water quality is improving in Mike Horse Creek. This may be a result of the Mike Horse seep capture system which was installed in the fall of 2008.

6.2 Groundwater

Historically, several analyzed constituents have exceeded the human health standards. The 2009 dewatering of the Mike Horse Impoundment has allowed the surficial tailings to begin to dry; however, additional work will be required to dewater the tailings during reclamation activities.

Shallow groundwater base flow during the summer months below the Mike Horse Dam and Impoundment is expected to be less than approximately 150 gpm. During the spring melt, groundwater flow rates will increase as they are tied with surface water runoff rates. Long-term groundwater quality should be consistent with that reported herein, and should increase during the spring runoff season, as has been observed in past years.

6.3 Repositories

Based on the geotechnical observations and analysis, the repository site soils are suitable for the construction of repository retaining berms and holding areas. The geometry of a hillside repository, along with tailings, require a relatively flat slope that may limit containment capacity and may require the construction of multiple facilities. The geochemical properties of the soils may also limit their use as discussed in a subsequent subsection of this report.

Geotechnical analysis of the impounded tailings indicates that 25 percent slopes can be constructed behind the containment embankment with the minimum required factor of safety.

6.3.1 Geotechnical Properties

The weathered bedrock in the repository areas appears to be easily ripped from a depth of 4 to over 19 feet in some areas. At this point in the preliminary design process, we recommend that significant clay deposits be removed prior to construction of embankments and other structures. If not removed, design accommodations for the increased likelihood of sliding and settlement would be required. The geotechnical properties of the tested soils at the Paymaster and Shave Gulch sites appear suitable for construction of retention berms and as bearing surfaces for a repository. A concern that remains is the approximate 25 percent slopes encountered at each site. Evaluation of the impounded tailings is underway at this time by Spectrum. Geotechnical information (such as strength) associated with the tailings will also be used as design parameters of any repository retaining system.

6.3.2 Geochemical Properties

The geochemical properties of the repository site soils indicate that the Paymaster and Shave Gulch sites are naturally mineralized and contain relatively high background concentrations of iron and manganese. Soils at the Paymaster and Shave Gulch sites should be segregated during construction to prevent leaching of metals when in contact with groundwater, surface water, or leachate. These properties preclude the material from being used in stream restoration. Shielding of contaminated soils with more geochemically compatible soil or with synthetic materials may be required. Additionally, materials transported from other areas of the UBMC (such as the area between the Mike Horse Dam and the WTP) may also have similar geochemical properties as the repository sites. This may be due to either contamination from the dam failure or natural occurrence in the native soils. Multiple lines of evidence exist that indicate that the Paymaster and Shave Gulch soils may generate leachate once exposed to water. An evaluation of the leaching potential compared to the cleanup levels should be performed prior to preparing specific recommendations for use of these soils.

6.3.3 Hazards

The photographed and mapped hazards generally indicate that care must be taken while developing the infrastructure of the site for construction activities. The most obvious hazards include overhead and underground utilities, the WTP, and cultural/historic sites. The not-so-obvious hazards include the abandoned underground mining activities that have been obscured by decades of inactivity and vegetative overgrowth. These abandoned mining areas are generally labeled, and known underground workings are included on the Hazard Site Maps, Sheets 5 and 6.

Mr. George Kornic, a local resident at the site, has provided a wealth of knowledge on the site (Kornic, pers. comm., August 2009). The area around the WTP will require the most care and monitoring during construction. A 200-foot deep shaft with approximately 1,700 feet of internal drifts at various levels crosses and underlies the Blackfoot River near the WTP. Mr. Kornic recalls that while operators were preparing the WTP area for construction, an excavator was almost lost in subsiding ground in the Blackfoot River. The excavator was extricated with great effort and it took two D-8 dozers to backfill the workings with alluvium soils.

A subsidence area is located just above the WTP on the Mike Horse Creek Road where an old adit, which may date back to the late 1800s, is collapsing. Mr. Kornic recalled that within the last two years, a County Road Maintenance crew hauled in two truck loads of road base to fill the subsidence in the road. During the summer of 2009, minimal subsidence was observed on the west side of the road and is shown in photo 44 of the Hazards Photo Log, located in Appendix C2. The area has been backfilled and obscured during the Mike Horse Creek Road pipeline repair activities.

The old septic tank may also still remain in the old town site of Mike Horse and will likely require decommissioning if the site is used as a borrow source or staging area. A garbage dump site is reported by Mr. Kornic to exist at the southern end of the impoundment. Some scattered debris has been observed during excavations in this area. Wooden framing to form a water collection shaft is also buried at the southern end of the impoundment. The road along the western slope of the impoundment has been moved up-slope several times as the impoundment level increased. Opening these old roads may prove useful during construction.

Section 7.0 References

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**Upper Blackfoot Mining Complex
Groundwater Analytical Results
TO 10 - Summer Field Work**

TerraGraphics Environmental Engineering, Inc.

Sample ID	Collection Date	Field Parameters SC (µmhos/cm)	Field Parameters pH (s.u.)	Field Parameters Temperature (^oC)	Physiochemical SC (µmhos/cm)	Physiochemical pH (s.u.)	Physiochemical Hardness (mg/L)	Common Anions Sulfate (mg/L)		Bicarbonate as HCO_3 (mg/L)		Carbonate as CO_3 (mg/L)		Alkalinity, Total as $CaCO_3$ (mg/L)		Chloride (mg/L)		Common Cations Calcium Diss. (mg/L)		Magnesium Diss. (mg/L)		Potassium Diss. (mg/L)		Sodium Diss. (mg/L)	
								result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag
TDMW-1	18-Nov-09	516	6.84	8	489	7	260	178		101		5	U	101		1	U	52.1		31.6		1.1		1.6	
TDMW-1	31-Aug-09	463	7.05	8.31	470	7.1	241	160		88.8		5	U	88.8		1	U	45.4		31.1		1.1		5	U
TDMW-1	26-May-04	203	7.59	7		7.5		30						82				22		13		1	U	1	
TDMW-1	26-May-04	205	7.59	7		7.5		30						82				22		13		1	U	1	
TDMW-1	23-Oct-03	215	7.1	9.4		8		21		122		2	U	100				23		14		5	U	5	U
TDMW-1	19-May-03					7.6		24						76				20		11		1	U	1	
TDMW-1	19-May-03	154	6.2	14.3		6.8		20		92		2	U	75				19		11		5	U	5	U
TDMW-1	10-Oct-02	227	6.69	10.1		7.5		25		124		1	U	102				25		15		5	U	5	U
TDMW-1	10-Jul-02	180	7.5	26.3		6.6		18		99		1	U	81				20		12		5	U	5	U
TDMW-1	29-May-02	195	7.36	6.2		6.6		36		77		1	U	63				21		12		5	U	5	U
TDMW-1	6-May-02	218	7.36	5.9		6.7		41		85		1	U	70				23		13		5	U	5	U
TDMW-1	10-Oct-01	254	7.12	10.2		7.3		21		126		1	U	103						14		5	U	5	U
TDMW-2D	18-Nov-09	253	7.22	7.7	223	7.5	123	28.2		102		5	U	102		1	U	26.6		13.6		1	U	1.3	
TDMW-2D	31-Aug-09	228	7.23	8.37	228	7.4	116	24.2		103		5	U	103		1	U	24		13.7		1	U	5	U
TDMW-2D	26-May-04	202	6.93	8.7		7.5		23						96				24		14		1	U	1	
TDMW-2D	23-Oct-03	205	7.3	9.1		7.9		23		124		2	U	102				22		12		5.0	U	5	U
TDMW-2D	19-May-03	193	6.2	8.8		7.3		28		112		2	U	92				23		13		5	U	5	U
TDMW-2D	10-Oct-02	191	6.6	9.6		7.5		11		124		1	U	102				23		13		5	U	5	U
TDMW-2D	10-Jul-02	263	7.73	20.6		6.5		23		113		1	U	93				24		14		5	U	5	U
TDMW-2D	29-May-02	229	7.34	9.6		6.5		26		112		1	U	92				25		14		5	U	5	U
TDMW-2D	6-May-02	201	7.57	9.1		7.1		24		110		1	U	90				23		13		5	U	5	U
TDMW-2D	10-Oct-01	233	7.39	10.5		7.5		12		127		1	U	104				23		13		5	U	5	U
TDMW-2S	18-Nov-09	900	6.8	7	560	7.1	351	232		105		5	U	105		1	U	72.8		41.1		1.1		1.5	
TDMW-2S	31-Aug-09	509	6.89	9.6	497	7	250	157		103		5	U	103		1	U	49.3		30.7		1.1		5	U
TDMW-2S	26-May-04	207	7.17	8		7.5		31						92				25		13		1	U	1	
TDMW-2S	23-Oct-03	235	7.3	9.8		7.7		29		126		2	U	103				25		14		5	U	5	U
TDMW-2S	19-May-03	184	6.1	7.5		7.3		32		98		2	U	80				23		12		5	U	5	U
TDMW-2S	10-Oct-02	221	6.72	10.3		8.1		19		122		1	U	100				26		14		5	U	5	U
TDMW-2S	10-Jul-02	168	7.81	22.4		6.5		29		104		1	U	85				24		13		5	U	5	U
TDMW-2S	29-May-02	240	7.61	8		6.5		37		100		1	U	82				27		15		5	U	5	U
TDMW-2S	6-May-02	187	7.59	7.7		6.8		28		93		1	U	76				21		11		5	U	5	U
TDMW-2S	10-Oct-01	246	6.67	10.9		7.2		22		134		1	U	110				24		13		5	U	5	U
TDMW-3D	18-Nov-09	612	7.53	6.87	564	7.7	303	263		64.2		10	U	64.2		2	U	73.2		29.1		0.68		2.1	
TDMW-3D	31-Aug-09	404	7.45	8.5	346	7.6	169	107		70.1		5	U	70.1		1	U	39.5		17.2		1	U	2.1	

TABLE A-1
GROUNDWATER
ANALYTICAL SUMMARY

Upper Blackfoot Mining Complex
Groundwater Analytical Results
TO 10 - Summer Field Work

Sample ID	Collection Date	Field Parameters			Physiochemical			Common Anions										Common Cations							
		SC (µmhos/cm)	pH (s.u.)	Temperature (°C)	SC (µmhos/cm)	pH (s.u.)	Hardness (mg/L)	Sulfate (mg/L)		Bicarbonate as HCO_3 (mg/L)		Carbonate as CO_3 (mg/L)		Alkalinity, Total as $CaCO_3$ (mg/L)		Chloride (mg/L)		Calcium Diss. (mg/L)		Magnesium Diss. (mg/L)		Potassium Diss. (mg/L)		Sodium Diss. (mg/L)	
								result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag
TDMW-4D	19-Nov-09	242	7.65	5.62	194	7.7	105	21.3		114		10	U	114		1	U	22.3		11.9		1	U	2.6	
TDMW-4D	31-Aug-09	216	7.61	6.23	204	7.6	103	19.9		87		5	U	87		1	U	21.1		12.3		1	U	5	U
TDMW-5	19-Nov-09	271	8.14	6.05	250	8.3	125	48		94.4		5	U	94.4		1	U	27.8		13.5		1	U	2.9	
TDMW-5	1-Sep-09	308	8.04	7.42	306	8	151	53		115		5	U	115		1	U	35.1		15.4		1	U	5.9	U
Groundwater Standards	MDEQ 2008	--	6.5-8.5	--	--	6.5-8.5	--	--		--		--		--		--		--		--		--		--	

Notes:
SC - Specific Conductance
- concentrations exceed MDEQ 2008 groundwater standard.
Flag Qualifiers: J - estimated concentration above the adjusted method detection limit and below the adjusted reporting limit
U - the compound was analyzed for, but not detected
Quotation marks were left around flags in historic data.
TDMW-3S and TDMW-4S were either dry or did not contain enough water for sampling on 31-Aug-09.

TABLE A-2
GROUNDWATER
METALS ANALYTICAL SUMMARY

Upper Blackfoot Mining Complex
Groundwater Analytical Results
TO 10 - Summer Field Work

Sample ID	Date Collected	Aluminum (mg/L)				Arsenic (mg/L)				Cadmium (mg/L)				Copper (mg/L)				Iron (mg/L)				Lead (mg/L)				Manganese (mg/L)				Zinc (mg/L)			
		Dissolved	**flag**	**Total**	**flag**	**Dissolved**	**flag**	**Total**	**flag**	**Dissolved**	**flag**	**Total**	**flag**	**Dissolved**	**flag**	**Total**	**flag**	**Dissolved**	**flag**	**Total**	**flag**	**Dissolved**	**flag**	**Total**	**flag**	**Dissolved**	**flag**	**Total**	**flag**	**Dissolved**	**flag**	**Total**	**flag**
TDMW-1	18-Nov-09	0.03	U	0.03	U	0.003	U	0.003	U	0.00052		0.00055		0.001	U	0.001	UJ	0.05	U	0.05	U	0.0005	U	0.0005	U	0.005	U	0.005	U	0.23		0.23	
TDMW-1	31-Aug-09	0.03	U	0.03	U	0.003	U	0.003	U	0.00048		0.0005		0.001	U	0.001	U	0.05	U	0.05	U	0.0005	U	0.0005	U	0.005	U	0.005	U	0.19		0.18	
TDMW-1	26-May-04	0.05	"U,J"			0.005	"U,J"			0.0001	"U,J"			0.001	"U,J"			0.01	U			0.003	"U,J"			0.01	U			0.01	J		
TDMW-1	26-May-04	0.05	"U,J"			0.005	"U,J"			0.0001	"U,J"			0.002	J			0.01	U			0.003	"U,J"			0.01	U			0.01	J		
TDMW-1	23-Oct-03	0.05	"U,UJ"			0.005	U			0.0001	U			0.001	U			0.02	U			0.003	"U,UJ"			0.03				0.02	UJ		
TDMW-1	19-May-03	0.05	U			0.005	U			0.0001	U			0.001	U			0.01	U			0.003	U			0.01	U			0.01	U		
TDMW-1	19-May-03	0.05	U			0.005	U			0.0001	U			0.001	"U,UJ"			0.02	U			0.003	U			0.01	U			0.01			
TDMW-1	10-Oct-02	0.05	U			0.005	U			0.0001	U			0.0013	UJ			0.02	U			0.003	U			0.01	U			0.01	U		
TDMW-1	10-Jul-02	0.05	U			0.005	U			0.0001	U			0.001	U			0.02	U			0.003	U			0.01	U			0.012			
TDMW-1	29-May-02	0.05	U			0.005	U			0.0001	U			0.001	U			0.02	U			0.002	U			0.005	U			0.017			
TDMW-1	6-May-02	0.05	U			0.005	"U,J"			0.0011				0.003				0.02	U			0.003	U			0.018				0.097			
TDMW-1	10-Oct-01	0.05	U			0.005	U			0.0002	U			0.001	U			0.02	U			0.003	U			0.01	U			0.04	UJ1		
TDMW-2D	18-Nov-09	0.03	U	0.86		0.003	U	0.003	U	0.00008	U	0.00008	U	0.001	U	0.0039	J	0.05	U	0.7		0.0005	U	0.002		0.005	U	0.022		0.01	U	0.011	
TDMW-2D	31-Aug-09	0.03	U	0.35		0.003	U	0.003	U	0.00008	U	0.00008	U	0.001	U	0.0024		0.05	U	0.29		0.0005	U	0.0016		0.005	U	0.015		0.01	U	0.01	U
TDMW-2D	26-May-04	0.05	"U,J"			0.005	"U,J"			0.0001	"U,J"			0.001	"U,J"			0.01	U			0.003	"U,J"			0.01	U			0.01	U		
TDMW-2D	23-Oct-03	0.05	"U,UJ"			0.005	U			0.0001	U			0.001	U			0.02	U			0.003	"U, UJ"			0.01	U			0.01	U		
TDMW-2D	19-May-03	0.05	U			0.005	U			0.0001	U			0.001	"U,UJ"			0.02	U			0.003	U			0.01	U			0.01	U		
TDMW-2D	10-Oct-02	0.05	U			0.005	U			0.0001	U			0.0015	UJ			0.02	U			0.003	U			0.01	U			0.01	U		
TDMW-2D	10-Jul-02	0.05	U			0.005	U			0.0001	U			0.001	U			0.02	U			0.003	U			0.01	U			0.01	U		
TDMW-2D	29-May-02	0.05	U			0.005	U			0.0001	U			0.001	U			0.02	U			0.002	U			0.01	U			0.01	U		
TDMW-2D	6-May-02	0.05	U			0.005	"U,J"			0.0001	U			0.001	U			0.02	U			0.003	U			0.01	U			0.01	U		
TDMW-2D	10-Oct-01	0.11				0.005	U			0.0002	U			0.001	U			0.045				0.003	U			0.019				0.039	UJ1		
TDMW-2S	18-Nov-09	0.03	U	0.03	U	0.003	U	0.003	U	0.00072		0.00077		0.001	U	0.001	U	0.089		0.13		0.0005	U	0.0005	U	7		8.9		1.6		1.9	
TDMW-2S	31-Aug-09	0.03	U	0.03	U	0.003	U	0.003	U	0.00044		0.00046		0.001	U	0.001	U	0.05	U	0.092		0.0005	U	0.0014		3		3.4		0.74		0.79	
TDMW-2S	26-May-04	0.05	"U,J"			0.005	"U,J"			0.0001	"U,J"			0.001	"U,J"			0.01	U			0.003	"U,J"			0.05				0.01	J		
TDMW-2S	23-Oct-03	0.05	"U,UJ"			0.005	U			0.0002				0.001	UJ			0.05				0.01	J			0.2				0.04	UJ		
TDMW-2S	19-May-03	0.05	U			0.005	U			0.0001	U			0.003	J			0.02	U			0.003	U			0.01				0.02			
TDMW-2S	10-Oct-02	0.05	U			0.005	U			0.0001	U			0.0015	UJ			0.02	U			0.003	U			0.041				0.028			
TDMW-2S	10-Jul-02	0.05	U			0.005	U			0.0001	U			0.001	U			0.02	U			0.003	U			0.05				0.029			
TDMW-2S	29-May-02	0.05	U			0.005	U			0.0001	U			0.001				0.02	U			0.002	U			0.01	U			0.018			
TDMW-2S	6-May-02	0.05	U			0.005	"U,J"			0.0001	U			0.001	U			0.02	U			0.003	U			0.01	U			0.011			
TDMW-2S	10-Oct-01	0.05	U			0.005	U			0.00028				0.001				0.02	U			0.003	U			0.085				0.071	UJ1		
TDMW-3D	18-Nov-09	0.027		6.3		0.0005	U	0.0089		0.00008	U	0.00059		0.0005	U	0.018	J	0.05	U	11.2		0.0001	U	0.039		0.0041		0.81		0.0052		0.13	
TDMW-3D	31-Aug-09	0.03	U	5.1		0.003	U	0.0062		0.00008	U	0.0003		0.001	U	0.014		0.05	U	6.7		0.0005	U	0.026		0.005	U	0.45		0.01	U	0.08	

TABLE A-2
GROUNDWATER
METALS ANALYTICAL SUMMARY

Upper Blackfoot Mining Complex
Groundwater Analytical Results
TO 10 - Summer Field Work

TerraGraphics Environmental Engineering, Inc.

Sample ID	Date Collected	Aluminum (mg/L)				Arsenic (mg/L)				Cadmium (mg/L)				Copper (mg/L)				Iron (mg/L)				Lead (mg/L)				Manganese (mg/L)				Zinc (mg/L)			
		Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag
TDMW-4D	19-Nov-09	0.03	U	3.8		0.003	U	0.01		0.00008	U	0.00023		0.0014		0.11	J	0.05	U	5.3		0.0005	U	0.023		0.012		0.22		0.01	U	0.058	U
TDMW-4D	31-Aug-09	0.03	U	0.03	U	0.003	U	0.003	U	0.00008	U	0.00008	U	0.001	U	0.001	U	0.05	U	0.05	U	0.0005	U	0.0005	U	0.007		0.0071		0.01	U	0.01	U
TDMW-5	19-Nov-09	0.03	U	2.1		0.003	U	0.003	U	0.00008	U	0.00042		0.001	U	0.04	J	0.05	U	5.9		0.0005	U	0.015		0.005	U	0.33		0.012		0.069	
TDMW-5	1-Sep-09	0.03	U	0.48		0.003	U	0.003	U	0.00013		0.00039		0.001	U	0.012		0.05	U	1.4		0.0005	U	0.014		0.005	U	0.18		0.021		0.055	
Groundwater Standards (mg/L)	**Human Health**	--				**0.01**				**0.005**				**1.3**				**0.3***				**0.015**				**0.05***				**2.0**			

Notes:
-- - indicates no standard
 - concentrations exceed human health groundwater standard.
Flag Qualifiers: J - estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.
U - the compound was analyzed for, but not detected.
Quotation marks were left around flags in historic data.
TDMW-3S and TDMW-4S were either dry or did not contain enough water for sampling on 31-Aug-09.

TABLE B-1
SURFACE WATER
ANALYTICAL SUMMARY

Upper Blackfoot Mining Complex
Surface Water Analytical Results
TO 10 - Summer Field Work

TerraGraphics Environmental Engineering, Inc.

Sample ID	Collection Date	Field Parameters					Physiochemical									Common Anions										Common Cations							
		Specific Conductance (µmhos/cm)	pH (s.u.)	Temperature (°C)	Dissolved Oxygen (mg/L)	Discharge (cfs)	Specific Conductance (µmhos/cm)	pH (s.u.)	Hardness (mg/L)	Acidity as $CaCO_3$ (mg/L)		Total Dissolved Solids (mg/L)		Total Suspended Solids (mg/L)		Alkalinity, Total as $CaCO_3$ (mg/L)		Bicarbonate as HCO_3 (mg/L)		Carbonate as CO_3 (mg/L)		Chloride (mg/L)		Sulfate (mg/L)		Calcium Diss. (mg/L)		Magnesium Diss. (mg/L)		Potassium Diss. (mg/L)		Sodium Diss. (mg/L)	
										result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag
BRSW-1	19-Nov-09	178	7.94	1.27	59.5	0.22	186	8.2	103	5	U	196	J	0.98	U	99.9		99.9		10	U	1	U	6.7		20.6		12.6		0.33		1.2	
BRSW-1	28-Aug-09	203	8.01	6.98	1.94	0.42	210	8.2	109	5	U	114		1	UJ	111		111		5	U	1	U	6.1		22.1		13		1	U	1.2	
BRSW-1	23-Oct-98		7.59	4.9	10.87	0.203		8				120		2.2		104		127		1	U			7.3		22		13		5	U	5	U
BRSW-1	5-May-98		8.63	7.2	10.53	0.992		8				77		11		79		96		1	U			5.5		16		9.8		2	U	2	U
BRSW-1	21-Oct-97		8.14	4.2	11.29	0.2691		8.1				123		1.6		101		101		1	U			6.6		22		13		2	U	2.2	
BRSW-1	27-May-97		7.27	4.8	10.7	7.49		8				98		1	U	78		95		1	U			2	U	17		9.7		3.4		2	U
BRSW-1	26-Oct-93		8	3.2	15.9	1.07		8.3				106		1	U	94		94				2	U	3.1	J4			12		5	U	5	U
BRSW-1	2-Jun-92		8.28	6.9	11	0.7944		8.2				117		1	U	97		97				2	U	5.6		24		14		2	U	2	U
BRSW-1	19-May-92		7.87	6.5	11	1.2639		8.1				106		1	U	93		93				2	U	2.3		21		13		2	U	2	U
BRSW-1	5-May-92		7.93	4	10.79	1.3		7.6				105		1.6		76		76				2	U	6.4		18		10		2	U	2	U
BRSW-1	16-Apr-92		7.43	2.9	11.7	0.253		7.8				112		1.1		76		76				2	U	7.8		21		12		2	U	2	U
BRSW-1	13-Nov-91		7.66	3.2		0.113		7.8				113		1	U	92		92				1.2		9.4		24		14				1.7	
BRSW-1	13-Sep-91		7.78	7.2		0.14		8				98		1	U	96		96				1.1	UJ1	2	U	25		14				1.4	UJ1
BRSW-1	12-Aug-91		8.31	11.5		0.46		8				133		1	U	102		102				1	U	3.4		24		14				1.2	
BRSW-2	19-Nov-09	278	6.39	2.3	42.5	0	2620	6.6	1750	11.6		2770		6.4	J	46.3		46.3		5	U	1	U	2010		411		175		4.7		2.4	
BRSW-2	28-Aug-09	406	8.5	19.31	1.14	0	410	8.8	203	5	U	306		18	J	56.2		56.2		5	U	1	U	163		45.6		21.6		1	U	1	U
BRSW-2	22-Oct-96		8.04	0.4				8.2				116		1	U	90		90		1	U			8.8		17				2.5	J4S	2	U
BRSW-2	20-May-96		7.96	6.4				7.5				85		3.2	J4S	56		56		1	U			7.2	J4S	15				1.5	"UJ1, J4S,J2"	1	U
BRSW-2	23-Oct-95		8.19	2.7				8.5				137		3.8		84		84		1	U			9.1		19				2	"U,U J4D"	2	U
BRSW-2	1-May-95		7.88	8.6				8		5	U	98		7.6	"J4S, J2"	75		75		1	U			12		20				2	U	2	U
BRSW-2	26-Oct-94		8.29	4.4				7.9	99	5	U	133		4		93								16		24				2	U	2	U
BRSW-2	18-May-94		7.64	7.3				8.2		1	U	83		1	U	75		75						4.7		23				2.5		1.4	
BRSW-2	26-Oct-93		7.55	6				8.4	108			106		1	U	89		85				2	U	7.8	J4					5	U	5	U
BRSW-2	3-Jun-93		7.26	9.4				7.7	99			98	J4	6.1		76								2	U	17							
BRSW-2	3-Jun-92		8.74	13.3				8.5	102			113		1	U	96		82				2	U	7.4		22				2	U	2	U
BRSW-2	19-May-92		8.23	14.6				8.2	118			114		1.8		83		83				2	U	8.5		21				2	U	2	U
BRSW-2	5-May-92		8.87	13.6				8.4	115			128		1.9		80		70				2	U	11		23				2	U	2	
BRSW-2	17-Apr-92		8.24	6.5				8.1	98			132		4.8		84		84				2	U	15		27				2	U	2	U
BRSW-2	13-Nov-91		8.99	0.5				8.1	106			112		1.3		90		90				1.4		2	U	21						2	
BRSW-2	13-Sep-91		9.01	13.8				8.5				98		1	U	2		76				1	U	2	U	18						1.4	UJ1
BRSW-2	12-Aug-91		8.9	20.5				8.2		5	U	131		2.5		88		88				1	U	2.6		21						1	
BRSW-3A	19-Nov-09	357	7.31	5.51	60.4	0.11	322	7.4	173	5	U	293	J	1	U	96.3		96.3		5	U	1	U	87.3		34.6		21.2		1	U	1.5	
BRSW-3A	28-Aug-09	289	7.25	10.24	1.08	0.12	289	7.5	144	5	U	177		1	UJ	99		99		10	U	1	U	53.7		29.6		17.1		1	U	1.4	

Upper Blackfoot Mining Complex
Surface Water Analytical Results
TO 10 - Summer Field Work

		Field Parameters					Physiochemical									Common Anions										Common Cations							
Sample ID	Collection Date	Specific Conductance (µmhos/cm)	pH (s.u.)	Temperature (°C)	Dissolved Oxygen (mg/L)	Discharge (cfs)	Specific Conductance (µmhos/cm)	pH (s.u.)	Hardness (mg/L)	Acidity as $CaCO_3$ (mg/L)		Total Dissolved Solids (mg/L)		Total Suspended Solids (mg/L)		Alkalinity, Total as $CaCO_3$ (mg/L)		Bicarbonate as HCO_3 (mg/L)		Carbonate as CO_3 (mg/L)		Chloride (mg/L)		Sulfate (mg/L)		Calcium Diss. (mg/L)		Magnesium Diss. (mg/L)		Potassium Diss. (mg/L)		Sodium Diss. (mg/L)	
										result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag
BRSW-3A	12-Oct-04		6.87	10.3		0.11		7.9				127	J	10	U	100	J							27	J	25	J	14	J	1	"U,J"	1	J
BRSW-3A	14-Jun-04		6.9	10.9		0.34		7.7				179	UJ	10	U	80	UJ							69		27		17		1	U	1	U
BRSW-3A	26-May-04		7.64	8.2		0.65		7.6				232		10	U	73								109		32	J	20		1	U	1	
BRSW-3A	28-Apr-04		6.83	5.1		0.38		7.3				237	UJ	10	U	74	UJ							110		34		21		1	U	1	UJ
BRSW-3A	21-Oct-03		7.3	10				7.9				129		1	"U,UJ"	103		126		2	U			14		25		14		5	U	5	U
BRSW-3A	25-Jun-03		6.4	8		0.7		8				140		1	U	84		102		2	U			35		21		15		5	U	5	U
BRSW-3A	19-May-03		6.5	13.5		0.7		7.3				207		1	U	70		85		2	U			66		26		15		5	U	5	U
BRSW-3A	28-Apr-03		6.7	5.4		0.6		6.6				212		1	U	62		76		2	U			114		29		17		5	U	5	U
BRSW-3A	3-Oct-02		7.65	9.4		0.05		7.3				154		1	U	100		122		1	U			30		27		15		5	U	5	U
BRSW-3A	10-Jul-02		7.56	13.8		0.6		7.3				168		1	U	73		89		1	U			64		27		14		5	U	5	U
BRSW-3A	29-May-02		7.48	12.6		0.61		6.5				206		1	U	67		82		1	U			92		32		19		5	U	5	U
BRSW-3A	6-May-02		6.68	8		0.26		6.6				239		5.5		66		81		1	U			95		32		19		5	U	5	U
BRSW-3A	17-Oct-01		7.86	9.4		0.168		7.7				169		1.3		96		96						46		28		18		5	U	5	U
BRSW-3A	26-Jun-01		7.91	10.2		0.56		7.9				191		1	U	93								94		29		17		2	U	1.5	
BRSW-3A	22-May-01		7.33	11.6		0.42		7.7				220		1	U	67								116		32		19		2	U	2	U
BRSW-3A	25-Apr-01		6.75	8.7		0.16		7.3				375		12		63								249		52		30		2	U	2	U
BRSW-3A	11-Oct-00		7.37	8.2		0.12		7.9				164		1	U	104		127		1	U			43		24		15		5	U	5	U
BRSW-3B	19-Nov-09	359	7.18	6.83	59.3	0.01	324	7.8	168	5	U	308	J	1	U	98.1		98.1		5	U	1	U	85.9		33.7		20.4		1	U	1.4	
BRSW-3B	28-Aug-09	280	7.2	8.64	0.86	0.33	291	7.4	140	5	U	25		4.1	J	104		104		5	U	1	U	50.1		28.1		17.1		1	U	1.4	
BRSW-3B	12-Oct-04		6.8	10.2		0.11		8				110	J	10	U	100	J							41	J	24	J	13	J	1	"U,J"	1	J
BRSW-3B	14-Jun-04		6.99	11.4				7.6				193	UJ	10	U	76	UJ							81		31		19		1	U	1	UJ
BRSW-3B	26-May-04		7.58	8.2				7.6				223		10	U	69								95		29	J	17		1	U	1	
BRSW-3B	28-Apr-04		6.83	4.2				7.2				259	UJ	10	U	64	UJ							130		34		20		1	U	1	UJ
BRSW-3B	21-Oct-03		7.4	10.6		0.08		7.9				142		1	"U,UJ"	104		127		2	U			34		28		16		5	U	5	U
BRSW-3B	25-Jun-03		7.5	9.4				8.1				110		1	U	81		99		2	U			18		19		12		5	U	5	U
BRSW-3B	19-May-03		6.3	11.4				7.2				193		1	U	68		83		2	U			51		25		14		5	U	5	U
BRSW-3B	28-Apr-03		6.6	3.9				6.4				496		30		50		61		2	U			330		60		38		5	U	5	U
BRSW-3B	3-Oct-02		7.72	8.4		0.003		7.5				180		1	U	100		122		1	U			46		32		17		5	U	5	U
BRSW-3B	10-Jul-02		7.27	13.4		0.11		7.4				180		1	U	78		95		1	U			70		29		17		5	U	5	U
BRSW-3B	29-May-02		7.1	10.8				6.4				203		2.4		60		73		1	U			101		34		19		5	U	5	U
BRSW-3B	6-May-02		6.64	6.64				6.5				380		16		46		56		1	U			222		44		27		5	U	5	U
BRSW-3B	17-Oct-01		8.06	9.7		0.168		7.6				136		1.5		97		118		1	U			23		26		15		5	U	5	U
BRSW-3B	26-Jun-01		8.23	9.3		0.56		7.4				172		1	U	83								53		24		13		2	U	1	
BRSW-3B	22-May-01		7.27	10.2		0.42		7.8				140		1	U	67								72		26		15		2	U	2	U
BRSW-3B	25-Apr-01		6.23	5.9		0.14		6.7		16		433		34		31								296		58		32		2	U	2	U

TABLE B-1
SURFACE WATER
ANALYTICAL SUMMARY

Upper Blackfoot Mining Complex
Surface Water Analytical Results
TO 10 - Summer Field Work

		Field Parameters					Physiochemical											Common Anions										Common Cations							
Sample ID	Collection Date	Specific Conductance (µmhos/cm)	pH (s.u.)	Temperature (°C)	Dissolved Oxygen (mg/L)	Discharge (cfs)	Specific Conductance (µmhos/cm)	pH (s.u.)	Hardness (mg/L)	Acidity as $CaCO_3$ (mg/L)		Total Dissolved Solids (mg/L)		Total Suspended Solids (mg/L)		Alkalinity, Total as $CaCO_3$ (mg/L)		Bicarbonate as HCO_3 (mg/L)		Carbonate as CO_3 (mg/L)		Chloride (mg/L)		Sulfate (mg/L)		Calcium Diss. (mg/L)		Magnesium Diss. (mg/L)		Potassium Diss. (mg/L)		Sodium Diss. (mg/L)	
										result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag
BRSW-3B	11-Oct-00		7.33	9		0.057		7.9				234		1	U	102		124		1	U			23		25		14		5	U	5	U
BRSW-22	28-Aug-09	323	7.98	17.75	1.5	0.05	328	8	156	5	U	211		1	UJ	90.4		90.4		5	U	1	U	82.2		37.2		15.3		1	U	1	
BRSW-22	12-Oct-04		7.01	6.9		0.04		7.9				316	J	10	U	80	J							81	J	59	J	23	J	1	J	1	J
BRSW-22	14-Jun-04		6.66	11.3		0.39		7.4				182	UJ	10	U	82	UJ							52		29		14		1	U	1	UJ
BRSW-22	26-May-04					1.23		7.2		5	U	189		10	U	68								89		25	J	14		5	U	5	U
BRSW-22	26-May-04		7.62	7.1		1.23		7.7				202		10	U	62								87		32	J	14		1	U	1	U
BRSW-22	28-Apr-04		6.45	2.1		0.51		7				229	UJ	10	U	46	UJ							110		31		16		1	U	1	U
BRSW-22	21-Oct-03		7.8	9.8		0.03		7.9				441		1.7	J	81		99		2	U			149		80		29		5	U	5	U
BRSW-22	25-Jun-03		7.7	12.5		0.3		8				151		1	U	78		95		2	U			56		29		13		5	U	5	U
BRSW-22	19-May-03		6.8	9.1		2.5		7.2				167		3.7		66		81		2	U			32		21		9.7		5	U	5	U
BRSW-22	28-Apr-03		6.04	3.5		1.2		6.4				226		13		40		49		2	U			149		31		19		5	U	5	U
BRSW-22	3-Oct-02		7.86	4.9		0.08		7.2				451		3.3		71		87		1	U			241		80		30		5	U	5	U
BRSW-22	11-Jul-02		7.15	16.8		0.56		7.1				228		6		75		92		1	U			89		39		17		5	U	5	U
BRSW-22	29-May-02		7.3	8		2.49		6.4				117		6		52		63		1	U			55		23		11		5	U	5	U
BRSW-22	6-May-02		6.83	3.7		0.46		6.2				565		8.6		26		32		1	U			331		74		38		5	U	5	U
BRSW-22	17-Oct-01		7.96	5		0.029		7.5				451		1.2		78		95		1	U			243		83		31		5	U	5	U
BRSW-22	26-Jun-01		8.04	10.7		0.47		7.3				191		4.8		74								78		28		14		2	U	1	U
BRSW-22	23-May-01		6.83	5.7		0.8		7.7				125		1	U	72								47		24		11		2	U	2	U
BRSW-22	22-May-01		7.3	10.1		0.67		7.7				131		1.2		68								56		24		12		2	U	2	U
BRSW-22	26-Apr-01		6.75	4.1		0.26		7.3				720		15		48								520		108		42		4.2		2	U
BRSW-22	12-Oct-00		6.94	2.1		0.034		7.8				732		1	U	89		109		1	U			373		87	"J4D, J4S"	31	"J4D, J4S"	5	U	5	U
BRSW-22	12-Oct-00		6.98	2.1		0.034		7.8				714		1	U	89		109		1	U			401		112		39		5	U	5	U
BRSW-22	19-Oct-99		8.31	5		0.041		7.2				279		1	U	83		83		1	U			114		48		19		5	U	5	U
BRSW-22	21-May-99		6.44			1.66		7.1		0		182		25		29								105		28		14		1	U	1	U
BRSW-22	29-Apr-99		6.67	3.1		0.322		6.4		0		461		19		16								288		60		32		2		1	
BRSW-22	22-Oct-98		6.55	4.4		0.037		7.8				279		1	U	79		96		1	U			144		50		21		5	U	5	
BRSW-22	5-May-98		7.85	8.3		0.464		7.6				180		1	U	58		71		1	U			80		29		13		2	U	2	U
BRSW-22	22-Oct-97		7.45	3.4		0.0781		7.4				651		1.7		81		81		1	U			385		98		44		2.1		3.5	
BRSW-22	27-May-97		7	6.6		2.55		7.7				106		2.1		58		71		1	U			32		21		9.2		3.2		2	U
BRSW-22	26-Feb-97		6.63	0.9		0		7.2		0		672		10	U	73								430		111		50		2		2	
BRSW-22	21-Oct-96		6.8	2.8		0.113		7.2				2484		5.5		52		52		1	U			1614		300		196		2	U	2.5	
BRSW-22	22-May-96		7.32	5.3		1.94		7.5				448		2.8	J4S	58		58		1	U			413	J4S	54		37		2.9	"UJ1, J4S,J 2"	1	U
BRSW-22	22-May-96		7.32	5.3		1.94		6.9		0		462		10	U	66								257		58		39		1	U	1	

Upper Blackfoot Mining Complex
Surface Water Analytical Results
TO 10 - Summer Field Work

Sample ID	Collection Date	Field Parameters: Specific Conductance (µmhos/cm)	pH (s.u.)	Temperature (°C)	Dissolved Oxygen (mg/L)	Discharge (cfs)	Physiochemical: Specific Conductance (µmhos/cm)	pH (s.u.)	Hardness (mg/L)	Acidity as $CaCO_3$ (mg/L)		Total Dissolved Solids (mg/L)		Total Suspended Solids (mg/L)		Common Anions: Alkalinity, Total as $CaCO_3$ (mg/L)		Bicarbonate as HCO_3 (mg/L)		Carbonate as CO_3 (mg/L)		Chloride (mg/L)		Sulfate (mg/L)		Common Cations: Calcium Diss. (mg/L)		Magnesium Diss. (mg/L)		Potassium Diss. (mg/L)		Sodium Diss. (mg/L)	
										result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag
BRSW-22	23-Oct-95		7.51	2.9		0.02		7.9				472		1	U	59		59		1	U			258		76		38		2	"U,U J4D"	2	U
BRSW-22	2-May-95		7	4.8		0.29		7.2		40		610		13	"J4S, J2"	24		50		1	U			403		81		47		2	U	2	U
BRSW-22	26-Oct-94		7.23	7.7		0.085		7		10		1606		106		24		50						1046		181		128		2.3		2	U
BRSW-22	18-May-94		6.96	5		1.31		7.6		1	U	373		10		50		50						212		68		43		2.3		1.3	
BRSW-22	26-Oct-93		6.43	3.5		0.24		6.71	484			726		20.7		75		75				0.5				95.4		61		0.77		1.36	
BRSW-22	26-Oct-93		6.43	3.5		0.24		7.4	477			694		19		76		76				2	U	920	J4	92		60		5	U	5	U
BRSW-22	26-Oct-93		6.43	3.5		0.24		7.3	510			698		20		75		75				2	U	521		102		62		5	U	5	U
BRSW-23	19-Nov-09	313	7.67	1.85	56.3	0.31	291	7.9	149	5	U	173	J	0.98	J	106		106		5	U	1	U	63.6		30		18		1	U	1.5	
BRSW-23	28-Aug-09	246	8.06	15.05	1.73	0.65	255	8.2	124	5	U	149		1	UJ	106		106		5	U	1	U	29.6		25.2		14.8		1	U	1.2	
BRSW-23	10-Oct-07		7.42					8.00	161			201		4		96		120		4	U	1		64						1	U	1	
BRSW-23	12-Oct-04		7.07	10.1		0.22		8				184	J	10	U	95	J							57	J	31	J	18	J	1	"U,J"	1	J
BRSW-23	14-Jun-04		7.13	9.8		3.72		7.9				150	UJ	10	U	84	UJ							47		23		14		1	U	1	U
BRSW-23	26-May-04		7.8	7		7.85		7.7				163		10	U	75								57		25	J	15		1	U	1	
BRSW-23	28-Apr-04		6.87	2.6		2.75		7.1				260	UJ	18		55	UJ							140		35		22		1	U	1	U
BRSW-23	21-Oct-03		7.8	10.8		0.3		7.8				185		106		94		115		2	U			59		33		19		5	U	5	U
BRSW-23	25-Jun-03		7.6	11.9		3		8				128		43		78		95		2	U			46		23		14		5	U	5	U
BRSW-23	19-May-03		6.7	11.3		16.6		7.5				137		2		72		88		2	U			19		18		10		5	U	5	U
BRSW-23	28-Apr-03		6.7	3.8		5.3		6.5				178		4.7		52		63		2	U			85		24		15		5	U	5	U
BRSW-23	3-Oct-02		7.6	8.6		0.25		7.3				219		1	U	93		113		1	U			87		37		20		5	U	5	U
BRSW-23	10-Jul-02		7.12	14		2.58		7.6				177		1	U	78		95		1	U			68		28		17		5	U	5	U
BRSW-23	29-May-02		6.29	9.8		10.02		6.9				126		4.6		58		71		1	U			45		20		12		5	U	5	U
BRSW-23	6-May-02		6.4	6.1		1.85		6.6				418		5.6		47		57		1	U			240		53		34		5	U	5	U
BRSW-23	17-Oct-01		7.9	7.7		0.23		7.8				199		1.2		93		113		1	U			87		36		21		5	U	5	U
BRSW-23	4-Oct-01	420	6.81	7.2		0.29																											
BRSW-23	26-Jun-01		8.03	10.9		3.6		7.3				161		1	U	78								53		23		14		2	U	1.3	
BRSW-23	22-May-01		7.63	10.1		4.2		7.8				162		1	U	60								64		23		14		2	U	2	U
BRSW-23	25-Apr-01		6.79	6.6		0.69		7.5				524		20		58								349		69		39		2	U	2	U
BRSW-23	25-Apr-01		6.79	6.6		0.74		7.5				514		19		56								357		69		38		2	U	2	U
BRSW-23	12-Oct-00		7.46	5.8		0.26		8				340		1	U	94		115		1	U			105		42	"J4D, J4S"	22	"J4D, J4S"	5	U	5	U
BRSW-23	11-Oct-00		7.46	7		0.29		8.1				238		1	U	97		118		1	U			110		41		21		5	U	5	U
BRSW-23	19-Oct-99					0.25		7.6				228		1	U	102		102		1	U			63		30		18		5	U	5	U
BRSW-23	19-Oct-99		8.24	9.6		0.25		7.8				201		1	U	95		95		1	U			57		31		19		5	U	5	U
BRSW-23	28-May-99		7.83	8.3		14.2		7.6				112		10	U	67								29		20		11		1	U	1	U

Upper Blackfoot Mining Complex
Surface Water Analytical Results
TO 10 - Summer Field Work

Sample ID	Collection Date	Field Parameters: Specific Conductance (µmhos/cm)	Field Parameters: pH (s.u.)	Field Parameters: Temperature (°C)	Field Parameters: Dissolved Oxygen (mg/L)	Field Parameters: Discharge (cfs)	Physiochemical: Specific Conductance (µmhos/cm)	Physiochemical: pH (s.u.)	Physiochemical: Hardness (mg/L)	Acidity as $CaCO_3$ (mg/L) result	Acidity flag	Total Dissolved Solids (mg/L) result	TDS flag	Total Suspended Solids (mg/L) result	TSS flag	Common Anions: Alkalinity, Total as $CaCO_3$ (mg/L) result	Alkalinity flag	Bicarbonate as HCO_3 (mg/L) result	Bicarbonate flag	Carbonate as CO_3 (mg/L) result	Carbonate flag	Chloride (mg/L) result	Chloride flag	Sulfate (mg/L) result	Sulfate flag	Common Cations: Calcium Diss. (mg/L) result	Calcium flag	Magnesium Diss. (mg/L) result	Magnesium flag	Potassium Diss. (mg/L) result	Potassium flag	Sodium Diss. (mg/L) result	Sodium flag
BRSW-23	29-Apr-99		6.9	3.2		1.8		6.8				406		10		41								249		54		37		1		1	
BRSW-23	22-Oct-98		7.24	10.3		0.305		7.5				198		1	U	97		118		1	U			71		33		20		5	U	5	U
BRSW-23	5-May-98		8.63	7.2		1.59		7.5				237		1	U	65		79		1	U			123		36		21		2	U	2	U
BRSW-23	20-Oct-97		7.94	9.4		0.388		7.9				278		1	U	94		94		1	U			118		39		23		2	U	2	U
BRSW-23	27-May-97		7.2	7.5		12.12		7.7				134		1	U	66		81		1	U			22		19		11		3		2	U
BRSW-23	26-Feb-97		5.44	5.6		0.17		7.7				235		10	U	111								97		41		24		1		2	
BRSW-23	21-Oct-96		6.8	6.2		0.359		7.4				723		1.2		84		84		1	U			435		94		61		2	U	2	U
BRSW-23	22-May-96		7.85	7.3		9.35		7.9				199		2	"U,U J4S"	63		63		1	U			103	J4S	25		17		3	"UJ1, J4S,J 2"	1	U
BRSW-23	23-Oct-95		7.62	6.7		.21		8				236		1	U	90		90		1	U			91		39		25		2	"U,U J4D"	2	U
BRSW-23	1-May-95		7.31	7.6		1.49		7.7				332		4.7	"J4S, J2"	58		58		1	U			169		47		30		2	U	2	U
BRSW-23	26-Oct-94		7.49	10.5		0.36		7.4				728		62		68								462		91		62		2.2		2	U
BRSW-23	18-May-94		7.12	6.4		5.98		8				170		1.6		70		70						61		35		22		2.7		1.3	
BRSW-23	26-Oct-93		6.57	7.3		1.76		7.6	209			270		2.6		82		82				2	U	127	J4			27		5	U	5	U
BRSW-38	19-Nov-09	358	7.26	1.52	62.1	.55	326	7.5	166	5	U	258	J	9.1		75.4		75.4		5	U	1	U	110		34.8		19.3		1	U	1.5	
BRSW-38	28-Aug-09	276	7.45	13.12	1.65	0.89	274	7.6	136	5	U	169		1	UJ	94.2		94.2		5	U	1	U	54.1		27.8		16.1		1	U	1.3	
BRSW-38	12-Oct-04		6.98	8.6		0.69		8				191	J	10	U	87	J							64	J	31	J	18	J	1	"U,J"	1	J
BRSW-38	14-Jun-04		7.08	8.8		6.25		7.8				143	UJ	10	U	78	UJ							40		23		13		1	U	1	UJ
BRSW-38	26-May-04		7.68	7.2		10.07		7.5				186		10	U	71								75		27	J	16		1	U	1	
BRSW-38	28-Apr-04		6.98	1.8		7.06		7.2				193	UJ	10	U	54	UJ							76		28		16		1	U	1	U
BRSW-38	21-Oct-03		7.8	9.7		0.5		8				183		1	"U,U J"	90		110		2	U			66		32		18		5	U	5	U
BRSW-38	25-Jun-03		7.6	9.5		3.6		8				144		1	U	76		93		2	U			45		23		13		5	U	5	U
BRSW-38	19-May-03		6.4	9.7		15.7		7.2				147		1	U	70		85		2	U			17		18		9.6		5	U	5	U
BRSW-38	28-Apr-03		6.7	3.9		5.9		6.4				187		4.8		50		61		2	U			94		26		16		5	U	5	U
BRSW-38	3-Oct-02		7.73	7.5		0.46		7.4				231		1	U	88		107		1	U			90		35		19		5	U	5	U
BRSW-38	9-Jul-02		7.42	14.9		2.73		7.3				164		1	U	74		90		1	U			68		28		17		5	U	5	U
BRSW-38	21-May-02		7.22	6.4		13.59		6.6				177		11		43		52		1	U			93		27		16		5	U	5	U
BRSW-38	3-May-02		7.37	9		2.7		6.3				430		11		39		48		1	U			265		60		36		5	U	5	U
BRSW-38	17-Oct-01		7.15	3.8		0.21		7.7				217		1		89		109		1	U			90		35		20		5	U	5	U
BRSW-38	16-Oct-01		8.07	8.6		0.31		7.7				202		1.2		84		102		1	U			80		35		20		5	U	5	U
BRSW-38	26-Jun-01		8.03	13.3		3.9																											
BRSW-38	26-Jun-01		8.01	9.6		4.9		7.1				155		1	U	74								65		25		15		2	U	1.1	

TABLE B-1
SURFACE WATER
ANALYTICAL SUMMARY

Upper Blackfoot Mining Complex
Surface Water Analytical Results
TO 10 - Summer Field Work

TerraGraphics Environmental Engineering, Inc.

Sample ID	Collection Date	Field Parameters					Physiochemical									Common Anions												Common Cations							
		Specific Conductance (µmhos/cm)	pH (s.u.)	Temperature (°C)	Dissolved Oxygen (mg/L)	Discharge (cfs)	Specific Conductance (µmhos/cm)	pH (s.u.)	Hardness (mg/L)	Acidity as $CaCO_3$ (mg/L)		Total Dissolved Solids (mg/L)		Total Suspended Solids (mg/L)		Alkalinity, Total as $CaCO_3$ (mg/L)		Bicarbonate as HCO_3 (mg/L)		Carbonate as CO_3 (mg/L)		Chloride (mg/L)		Sulfate (mg/L)		Calcium Diss. (mg/L)		Magnesium Diss. (mg/L)		Potassium Diss. (mg/L)		Sodium Diss. (mg/L)	
										result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag	result	flag
BRSW-38	22-May-01		6.72	6.5		4		7.6				170		1.1		62								78		25		15		2	U	2	U
BRSW-38	25-Apr-01		6.56	4.2		1.12		7.4				534		14		46								375		72		41		2	U	2	U
BRSW-38	25-Apr-01		6.16	7.6		1.61																											
BRSW-38	11-Oct-00		6.31	3.9		0.33		7.9				258		1	U	92		112		1	U			109		41		22		5	U	5	U
BRSW-38	19-Oct-99		8.36	4.4		0.34		7.8				220		1	U	96		96		1	U			70		31		18		5	U	5	U
BRSW-38	28-May-99		7.76	10.1		14.5		7.6				112		10	U	65								32		20		11		1	U	1	U
BRSW-38	28-Apr-99							6.9		0		443		12		37								274		55		36		1	U	1	
BRSW-38	28-Apr-99		7.07	3.7		3.1		6.9		0		441		13		36								276		57		37		1	U	1	
BRSW-48	20-Nov-09	3	7.38	2.07	57.9	0.37	318	7.6	161	5	U	204	J	2	J	93.5		93.5		10	U	1	U	88.5		32.8		19.2		1	U	1.3	
BRSW-48	28-Aug-09	255	7.82	15.52	1.68	0.95	265	8.1	126	5	U	151		1	UJ	102		102		5	U	1	U	37.4		25.5		15.3		1	U	1.2	
BRSW-48	17-Oct-01		7.89	5.5		0.19		7.8				213		2.3		94		115		1	U			81		37		21		5	U	5	U
BRSW-48	26-Jun-01		8.14	10.9		3.6		7.5				158		1	U	80								60		23		14		2	U	1	U
BRSW-48	22-May-01		7.11	8.7		4.1		7.8				160		1	U	63								65		24		15		2	U	2	U
BRSW-48	25-Apr-01		6.77	6.1		0.73		7.4				536		13		46								433		73		41		2	U	2	U
BRSW-48	11-Oct-00		7.36	6.4		0.22		8.1				247		1	U	98		120		1	U			108		39		21		5	U	5	U
BRSW-48	19-Oct-99		8.44	9.6		0.24		7.8				228		1	U	94		94		1	U			61		30		18		5	U	5	U
Surface Water Standards	**Acute**	--	--	--	**3.0 - 9.5**	--	--	**6.5-8.5**	--	--		--		--		--		--		--		--		--		--		--		--		--	
	Chronic	--	--	--	**3.0 - 9.5**	--	--	**6.5-8.5**	--	--		--		--		--		--		--		--		--		--		--		--		--	
	Human Health	--	--	--	**3.0 - 9.5**	--	--	**6.5-8.5**	--	--		--		--		--		--		--		--		--		--		--		--		--	

Notes:

Acute and Chronic levels are for aquatic life standards as listed in Circular DEQ-7, 2008.

Flag Qualifiers: J - estimated concentration above the adjusted method detection limit and below the adjusted reporting limit
U - the compound was analyzed for, but not detected
Quotation marks were flags included in historic data.

BRSW-22 was frozen during the November 2009 sampling event and a sample could not be obtained.

TABLE B-2
SURFACE WATER
METALS ANALYTICAL SUMMARY

TerraGraphics Environmental Engineering, Inc.

Upper Blackfoot Mining Complex
Surface Water Analytical Results
TO 10 - Summer Field Work

Sample ID	Collection Date	Aluminum (mg/L)				Arsenic (mg/L)				Cadmium (mg/L)				Copper (mg/L)				Iron (mg/L)				Lead (mg/L)				Manganese (mg/L)				Zinc (mg/L)			
		Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag
BRSW-1	19-Nov-09	0.004	U	0.008		0.00077		0.00077		0.00008	U	0.00008	U	0.0005	U	0.0005	U	0.05	U	0.05	U	0.0001	U	0.00011		0.001	J	0.0013		0.015		0.014	
BRSW-1	28-Aug-09	0.03	U	0.03	U	0.003	U	0.003	U	0.00008	U	0.00008	U	0.001	U	0.001	U	0.05	U	0.05	U	0.0005	UJ	0.0005	U	0.005	U	0.005	U	0.01	U	0.01	U
BRSW-1	23-Oct-98	0.05	U	0.05	U	0.002	U	0.002	U	0.001	U	0.001	U	0.005	U	0.005	U	0.05	U	0.05	U	0.003	U	0.003	U	0.01	U	0.01	U	0.01	U	0.016	
BRSW-1	5-May-98	0.05	U	0.05	U	0.002	U	0.002	U	0.001	U	0.001	U	0.005	U	0.005	U	0.03	U	0.03	U	0.003	U	0.003	U	0.01	U	0.01	U	0.01	U	0.01	U
BRSW-1	21-Oct-97	0.09	UJ1	0.05	U	0.002	U	0.002	U	0.001	U	0.001	U	0.005	U	0.005	U	0.05	U	0.05	U	0.003	U	0.003	U	0.01	U	0.01	U	0.026		0.022	
BRSW-1	27-May-97	0.05	U	0.05	U	0.002	U	0.002	U	0.001	U	0.001	U	0.005	U	0.005	U	0.03	U	0.03	U	0.003	U	0.003	U	0.01	U	0.01	U	0.01	U	0.01	
BRSW-1	26-Oct-93	0.1	U	0.1	"U, J4"	0.003	U	0.003	"U, J4"	0.001	U	0.001	U	0.01	"U, J4"	0.01	"U, J4"	0.1	"U, J4"	0.1	U	0.003	"U, J4"	0.003	U	0.015	U	0.015	U	0.02	"U, J4"	0.02	"U, J4"
BRSW-1	2-Jun-92	0.2	U	0.2	U	0.008	U	0.008	U	0.005	U	0.005	U	0.008	U	0.008	U	0.05	U	0.05	U	0.005	U	0.005	U	0.008	U	0.008	U	0.0083		0.008	U
BRSW-1	19-May-92	0.2	U	0.2	U	0.008	U	0.008	U	0.005	U	0.005	U	0.008	U	0.008	U	0.05	U	0.05	U	0.005	U	0.005	U	0.008	U	0.008	U	0.008		0.008	U
BRSW-1	5-May-92	0.2	U	0.2	U	0.008	U	0.008	U	0.005	U	0.005	U	0.008	U	0.008	U	0.05	U	0.05	U	0.005	U	0.005	U	0.008	U	0.008	U	0.02		0.018	
BRSW-1	16-Apr-92	0.2	U	0.2	U	0.008	U	0.008	U	0.005	U	0.005	U	0.008	U	0.008	U	0.05	U	0.05	U	0.005	U	0.005	U	0.008	U	0.008	U	0.013		0.015	
BRSW-1	13-Nov-91	0.2	U	0.2	U	0.02	U	0.02	U	0.008	U	0.008	U	0.008	U	0.008	U	0.025		0.025		0.01	U	0.01	U	0.008	U	0.008	U	0.015		0.015	
BRSW-1	13-Sep-91	0.2	U	0.2	U	0.02	U	0.02	U	0.008	U	0.008	U	0.008	U	0.008	U	0.02	U	0.033		0.01	U	0.01	U	0.008	U	0.008	U	0.008	U	0.008	U
BRSW-1	12-Aug-91	0.2	U	0.2	U	0.02	U	0.02	U	0.008	U	0.008	U	0.008	U	0.008	U	0.02	U	0.042		0.01	U	0.01	U	0.008	U	0.008	U	0.01	UJ1	0.01	UJ1
BRSW-2	19-Nov-09	0.03	U	0.091		0.003	U	0.0033		0.055		0.06		0.019		0.026		0.12		0.64		0.0016		0.029		35.4	J	31.6		23.1		19.8	
BRSW-2	28-Aug-09	0.03	U	0.083	J	0.0039		0.0075		0.00008	U	0.00039		0.0042		0.0098		0.051		1.5	J	0.0005	UJ	0.038		0.4		0.69		0.01	U	0.084	
BRSW-2	22-Oct-96	0.05	U	0.05	U	0.004		0.005		0.001	U	0.001	U	0.005	U	0.005	U	0.06		0.52	J4S	0.003	U	0.007		0.01	"U,U J4S"	0.011		0.01	U	0.01	U
BRSW-2	20-May-96	0.05	U	0.092	J4S	0.002		0.003		0.001	U	0.001	U	0.005	U	0.005	"U,U J4S"	0.05	U	0.05	U	0.003	U	0.004	J4S	0.01	U	0.012		0.01	U	0.012	
BRSW-2	23-Oct-95	0.05	U	0.08		0.004		0.005		0.001	"U,U J4S"	0.001	"U,UJ 4S"	0.005	U	0.006		0.1	J2	0.67	J2	0.004		0.025		0.01	U	0.076		0.013		0.031	
BRSW-2	1-May-95	0.05	U	0.05	U	0.002	U	0.002		0.001	U	0.001	U	0.005	U	0.005	U	0.03	"U,UJ 4S"	0.24		0.003	U	0.007	J2	0.01	U	0.029		0.015		0.17	
BRSW-2	26-Oct-94	0.05	U	0.05	U	0.002	"U,UJ 4D"	0.004		0.001	"U,UJ 2"	0.001	"U,UJ 2"	0.005	"U,U J2"	0.005	"U,U J2"	0.127	UJ1	0.485		0.002	U	0.014		0.01	"U,U J4S,U J2"	0.04	J2	0.01	UJ1	0.023	
BRSW-2	18-May-94	0.095		0.11						0.001	U	0.001	"U,UJ 2"	0.005	U	0.005		0.051	J4	0.055		0.002	U	0.002	"U,J4 "	0.008	"U,J4 "	0.008	U	0.012	"J4,J2 "	0.012	"J4, J2"
BRSW-2	26-Oct-93	0.1	U	0.1	"U, J4"	0.003	U	0.003	"U, J4"	0.001	"U, J4"	0.001	U	0.01	"U, J4"	0.01	"U, J4"	0.1	U	0.1	"U, J4"	0.003	"U,J4"	0.003	U	0.015	U	0.015	U	0.02	"U,J4 "	0.02	"U, J4"
BRSW-2	3-Jun-93	0.246		0.287						0.001	U	0.001	U	0.01	U	0.01	U	0.1	U	0.158		0.002	U	0.0092		0.015	U	0.044		0.05	U	0.05	U
BRSW-2	3-Jun-92	0.2	U	0.2	U	0.008	U	0.008	U	0.005	U	0.005	U	0.008	U	0.008	U	0.05	U	0.076		0.005	U	0.005	U	0.008	U	0.021		0.008	U	0.0092	
BRSW-2	19-May-92	0.2	U	0.2	U	0.008	U	0.008	U	0.005	U	0.005	U	0.012		0.008	U	0.159		0.166		0.005	U	0.0094		0.025		0.028		0.024		0.014	
BRSW-2	5-May-92	0.2	U	0.2	U	0.008	U	0.008	U	0.005	U	0.005	U	0.008	U	0.008	U	0.05	U	0.11		0.005	U	0.0066		0.008	U	0.025		0.011		0.016	
BRSW-2	17-Apr-92	0.2	U	0.2	U	0.008	U	0.008	U	0.005	U	0.005	U	0.008		0.01		0.195		0.58		0.005	U	0.033		0.028		0.096		0.032		0.044	
BRSW-2	13-Nov-91	0.2	U	0.2	U	0.02	U	0.02	U	0.008	U	0.008	U	0.008	U	0.008	U	0.11		0.36		0.01	U	0.012		0.068		0.073		0.01		0.033	
BRSW-2	13-Sep-91	0.2	U	0.2	U	0.02	U	0.02	U	0.008	U	0.008	U	0.019		0.019	UJ1	0.057		0.21		0.01	U	0.01	U	0.02		0.031		0.009		0.01	
BRSW-2	12-Aug-91	0.2	U	0.2	U	0.02	U	0.02	U	0.008	U	0.008	U	0.008	U	0.008		0.072		0.35		0.01	U	0.01	U	0.018		0.052		0.008	UJ1	0.01	UJ1
BRSW-3A	19-Nov-09	0.03	U	0.03	U	0.003	U	0.003	U	0.00086		0.0009		0.0013		0.0011		0.05	U	0.05	U	0.0005	U	0.0005	U	0.053	J	0.084		0.53		0.49	

TABLE B-2
SURFACE WATER
METALS ANALYTICAL SUMMARY

TerraGraphics Environmental Engineering, Inc.

Upper Blackfoot Mining Complex
Surface Water Analytical Results
TO 10 - Summer Field Work

Sample ID	Collection Date	Aluminum (mg/L)				Arsenic (mg/L)				Cadmium (mg/L)				Copper (mg/L)				Iron (mg/L)				Lead (mg/L)				Manganese (mg/L)				Zinc (mg/L)			
		Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag
BRSW-3A	28-Aug-09	0.03	U	0.03	U	0.003	U	0.003	U	0.00029		0.00027		0.0014		0.0021		0.05	U	0.057	J	0.0005	UJ	0.0005	U	0.033		0.033		0.1		0.074	
BRSW-3A	12-Oct-04	0.05	U	0.05	U	0.005	U	0.005	U	0.0002	J	0.0002	J	0.01	U	0.01	U	0.01	"U,J"	0.02	J	0.003	U	0.003		0.05		0.06		0.08		0.1	
BRSW-3A	14-Jun-04	0.05	U	0.08		0.005	U	0.005	U	0.0063		0.0065		0.02		0.02		0.01	U	0.04		0.003	U	0.004		0.82		0.95		1.22		1.24	
BRSW-3A	26-May-04	0.05	"U,J"	0.14	J	0.005	"U,J"	0.005	"U,J"	0.0087	J	0.0087	J	0.021	J	0.033	J	0.01	U	0.15		0.003	"U,J"	0.004		1.25	J	1.23	J	1.69	J	1.72	J
BRSW-3A	28-Apr-04	0.05	U	0.12		0.005	U	0.005	U	0.0067	J	0.007	J	0.01	U	0.02		0.01	"U,J"	0.1	J	0.003	U	0.003		0.95		1.05		1.85		2.03	
BRSW-3A	21-Oct-03	0.05	"U,UJ"	0.05	U	0.005	U	0.005	U	0.0001	U	0.0001	U	0.002	U	0.002	"U,UJ"	0.02	U	0.02	"U,UJ"	0.003	U	0.003		0.01	U	0.01	"U,UJ"	0.01	UJ	0.01	U
BRSW-3A	25-Jun-03	0.05	U	0.05	U	0.005	U	0.005	U	0.0002	UJ	0.0002		0.001	U	0.002	UJ	0.02	U	0.1		0.003	U	0.003		0.01	U	0.01	U	0.06		0.06	
BRSW-3A	19-May-03	0.05	U	0.05		0.005	U	0.005	U	0.003		0.003		0.009		0.02		0.02	U	0.1		0.003	U	0.005		0.3		0.4		0.6		0.6	
BRSW-3A	28-Apr-03	0.05	U	0.1		0.005	U	0.005	U	0.006		0.006		0.02		0.03		0.03	U	0.1		0.003	U	0.003		0.8		0.9		1.3		1.4	
BRSW-3A	3-Oct-02	0.05	U	0.05	U	0.005	U	0.005	U	0.00017		0.00019		0.002		0.002		0.037		0.044		0.003	U	0.003	U	0.083		0.097		0.08		0.082	
BRSW-3A	10-Jul-02	0.05	U	0.16		0.005	U	0.005	U	0.006		0.006		0.022		0.041		0.02	U	0.095		0.006		0.018		0.73		0.91		0.87		1	
BRSW-3A	29-May-02	0.05	U	0.11		0.005	U	0.005	U	0.0059		0.0057		0.016		0.023		0.02	U	0.095		0.002	U	0.003		0.64		0.68		1.1		1.1	
BRSW-3A	6-May-02	0.05	U	0.52		0.005	U	0.005	U	0.007		0.007		0.018		0.044		0.02	U	0.93		0.003	U	0.006		0.93		1.6		1.5		1.6	
BRSW-3A	17-Oct-01	0.05	U	0.05	U	0.005	U	0.005	U	0.0003		0.0003		0.001	U	0.001	J4S	0.075		0.082		0.003	U	0.004		0.59		0.59		0.11		0.12	
BRSW-3A	26-Jun-01	0.05	U	0.058		0.005	U	0.005	U	0.0054		0.0053		0.01		0.013		0.05	U	0.05	U	0.003	U	0.003	U	0.6		0.64		1.1		1.1	
BRSW-3A	22-May-01	0.05	U	0.076		0.005	U	0.005	U	0.006		0.006		0.013		0.02		0.05	U	0.05	U	0.003	U	0.051		0.6		0.6		1.3		1.3	
BRSW-3A	25-Apr-01	0.11		1.6		0.005	U	0.005	U	0.023		0.023		0.062		0.23		0.05	U	1.9		0.003	"U,UJ 4D"	0.013		3.6		3.6		3.9		4.2	
BRSW-3A	11-Oct-00	0.05	U	0.05	U	0.005	U	0.005	U	0.0002		0.0002		0.001		0.002		0.05	U	0.05	U	0.003	U	0.006		0.32		0.38		0.076		0.081	
BRSW-3B	19-Nov-20	0.03	U	0.03	U	0.003	U	0.003	U	0.0017		0.0016		0.001	U	0.0014		0.05	U	0.05	U	0.0005	U	0.0005	U	0.31	J	0.33		0.85		0.81	
BRSW-3B	28-Aug-09	0.03	U	0.03	U	0.003	U	0.003	U	0.00008	U	9.7E-05		0.001	U	0.0032		0.05	U	0.078	J	0.0005	UJ	0.0008		0.0071		0.016		0.039		0.033	
BRSW-3B	12-Oct-04	0.05	U	0.05	U	0.005	U	0.005	U	0.0001	"U,J"	0.0001	"U, J"	0.01	U	0.01	U	0.01	"U, J"	0.01	"U, J"	0.003	U	0.003		0.01	U	0.01	U	0.02		0.02	
BRSW-3B	14-Jun-04	0.07		0.17	J	0.005	U	0.005	U	0.018		0.0095		0.06		0.04		0.03		0.1	J	0.015		0.011		2.61		1.31		2.79		1.42	
BRSW-3B	26-May-04	0.05	"U,J"	0.34	J	0.005	"U,J"	0.005	"U,J"	0.0119	J	0.0127	J	0.044	J	0.066	J	0.01	U	0.13		0.003	"U, J"	0.009		1.69	J	2.22		1.94	J	2.11	J
BRSW-3B	28-Apr-04	0.05	U	0.42		0.005	U	0.005	U	0.0186		0.0211		0.04		0.09		0.01	"U, J"	0.25	J	0.003	U	0.012		2.2		2.49		4.37		4.42	
BRSW-3B	21-Oct-03	0.05	"U,UJ"	0.05	U	0.005	U	0.005	U	0.0002		0.0003		0.002	U	0.002	"U,UJ"	0.08		0.3	J	0.003	U	0.003		0.5		0.5		0.1		0.1	
BRSW-3B	25-Jun-03	0.05	U	0.05	U	0.005	U	0.005	U	0.0002	UJ	0.0002		0.001	U	0.002	UJ	0.02	U	0.02	U	0.003	U	0.003		0.03		0.03		0.05	UJ	0.05	UJ
BRSW-3B	19-May-03	0.05	U	0.09		0.005	U	0.005	U	0.005		0.005		0.02		0.03		0.02	U	0.05		0.005		0.009		0.6		0.6		0.9		0.9	
BRSW-3B	28-Apr-03	0.05	U	3.4		0.005	U	0.005	U	0.07		0.08		0.2		0.6		0.03	U	2.4		0.003		0.08		11		11		13		14	
BRSW-3B	3-Oct-02	0.05	U	0.057		0.005	U	0.005	U	0.00033		0.00038		0.002		0.003		0.053		0.1		0.003	U	0.003	U	0.21		0.23		0.13		0.14	
BRSW-3B	10-Jul-02	0.05	U	0.059		0.005	U	0.005	U	0.003		0.003		0.008		0.011		0.02	U	0.046		0.003	U	0.003	U	0.4		0.4		0.64		0.62	
BRSW-3B	29-May-02	0.05	U	0.45		0.005	U	0.005	U	0.016		0.016		0.038		0.088		0.02	U	0.6		0.003		0.016		1.7		1.8		2.5		2.6	
BRSW-3B	6-May-02	0.05	U	2.2		0.005	U	0.005	U	0.036		0.031		0.074		0.28		0.02	U	1.4		0.003	U	0.026		5.8		5.3		6.2		5.8	
BRSW-3B	17-Oct-01	0.05	U	0.05	U	0.005	U	0.005	U	0.0002	U	0.0002	U	0.001	U	0.001	"U,U J4S"	0.02	U	0.02	U	0.003	U	0.003	U	0.022		0.04		0.02		0.02	
BRSW-3B	26-Jun-01	0.05	U	0.092		0.005	U	0.005	U	0.0052		0.0048		0.018		0.023		0.05	U	0.05	U	0.003	U	0.005		0.54		0.51		0.8		0.79	
BRSW-3B	22-May-01	0.05	U	0.11		0.005	U	0.005	U	0.006		0.007		0.024		0.033		0.05	U	0.057		0.003	U	0.042		0.55		0.63		1.1		1.2	
BRSW-3B	25-Apr-01	0.31		3.6		0.005	U	0.005	U	0.049		0.051		0.22		0.57		0.32		5.8		0.003	"U,UJ 4D"	0.034		6.9		7.1		8.2		8.7	
BRSW-3B	11-Oct-00	0.05	U	0.05	U	0.005	U	0.005	U	0.0001	U	0.0001	U	0.001	U	0.001		0.05	U	0.05	U	0.003	U	0.004		0.026		0.036		0.024		0.029	

TABLE B-2
SURFACE WATER
METALS ANALYTICAL SUMMARY

TerraGraphics Environmental Engineering, Inc.

Upper Blackfoot Mining Complex
Surface Water Analytical Results
TO 10 - Summer Field Work

Sample ID	Collection Date	Aluminum (mg/L)				Arsenic (mg/L)				Cadmium (mg/L)				Copper (mg/L)				Iron (mg/L)				Lead (mg/L)				Manganese (mg/L)				Zinc (mg/L)			
		Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag
BRSW-22	28-Aug-09	0.03	U	0.03	U	0.003	U	0.003	U	0.009		0.0085		0.025		0.021		0.05	U	0.05	U	0.0094	J	0.0064		0.094		0.11		1.2		1.3	
BRSW-22	12-Oct-04	0.05	U	0.05	U	0.005	U	0.005	U	0.0139		0.0136		0.06		0.06		0.01	"U,J"	0.01	"U, J"	0.011		0.011		0.18		0.19		2.88		3.2	
BRSW-22	14-Jun-04	0.05	U	0.45		0.005	U	0.005	U	0.012		0.014		0.14		0.32		0.01	U	0.01	U	0.009		0.018		0.51		0.57		1.81		2.02	
BRSW-22	26-May-04	0.08	J	0.37	J	0.005	"U,J"	0.005	"U,J"	0.015	J	0.016	J	0.066	J	0.177	J	0.01	U	0.01	"U, J"	0.014	J	0.033		0.3	J	0.41	J	1.7	J	1.7	J
BRSW-22	26-May-04	0.08	J	0.41	J	0.005	"U,J"	0.005	"U,J"	0.0193	J	0.0197	J	0.152	J	0.265	J	0.01	U	0.03	J	0.018	J	0.036		0.64	J	0.75	J	2.95	J	3.6	J
BRSW-22	28-Apr-04	0.05	U	1.59		0.005	U	0.005	U	0.0294		0.0306		0.23		0.69		0.01	"U,J"	0.04	J	0.005		0.037		1.44		1.6		5.07		5.8	
BRSW-22	21-Oct-03	0.05	"U,UJ"	0.05	U	0.005	U	0.005	U	0.02		0.02		0.03		0.03		0.02	U	0.03	J	0.009		0.01		0.01		0.02	UJ	3.8		3.8	
BRSW-22	25-Jun-03	0.1		0.2		0.005	U	0.005	U	0.01		0.01		0.2		0.2		0.02	U	0.02	U	0.01		0.02		0.4		0.4		1.7		1.8	
BRSW-22	19-May-03	0.08		0.4		0.005	U	0.005	U	0.01		0.01		0.2		0.3		0.02	U	0.1		0.01		0.05		0.5		0.5		1.7		1.8	
BRSW-22	28-Apr-03	0.05	U	2.2		0.005	U	0.005	U	0.05		0.05		0.3		1.3		0.03	U	0.1		0.006		0.08		2.4		2.4		6.9		7.6	
BRSW-22	3-Oct-02	0.05	U	0.24		0.005	U	0.005	U	0.028		0.026		0.072		0.21		0.02	U	0.038		0.016		0.029		0.33		0.34		5.1		5.6	
BRSW-22	11-Jul-02	0.06		0.47		0.005	U	0.005	U	0.022		0.021		0.14		0.3		0.02	U	0.046		0.016		0.045		0.69		0.68		2.6		2.8	
BRSW-22	29-May-02	0.05	U	0.98		0.005	U	0.005	U	0.021		0.021		0.16		0.55		0.02	U	0.086		0.008		0.043		0.89		0.9		2.8		3.2	
BRSW-22	6-May-02	0.05	U	1.7		0.005	U	0.005	U	0.12		0.11		0.71		1.2		0.02	U	0.26		0.018		0.074		3.9		3.9		19		19	
BRSW-22	17-Oct-01	0.05	U	0.05	U	0.005	U	0.005	U	0.022		0.022		0.021		0.024	J4S	0.02	U	0.02	U	0.011		0.012		0.11		0.12		5.3		5.4	
BRSW-22	26-Jun-01	0.08		0.43		0.005	U	0.005	U	0.022		0.026		0.14		0.28		0.05	U	0.05	U	0.015		0.036		0.73		0.75		2.8		3	
BRSW-22	23-May-01	0.09	J4S	0.27	J4S	0.005	U	0.005	U	0.015		0.016		0.14		0.22		0.05	U	0.05	U	0.011		0.024	J4S	0.48		0.5		2.1	J4S	2.2	
BRSW-22	22-May-01	0.075		0.31		0.005	U	0.005	U	0.016		0.017		0.14		0.23		0.05	U	0.05	U	0.012		0.026		0.51		0.53		2.2		2.3	
BRSW-22	26-Apr-01	0.091	J4D	1.2		0.005	U	0.005	U	0.12		0.11		0.12		0.24		0.05	U	0.95	J4D	0.027		0.14		3.2		3.1		20		20	
BRSW-22	12-Oct-00	0.05	U	0.05	U	0.005	U	0.005	"U,UJ 2"	0.027		0.028		0.025		0.034		0.05	U	0.05	"U,U J2"	0.013		0.016	UJ1	0.22	J4D	0.27		5.8	"J4D, J4S"	6.3	
BRSW-22	12-Oct-00	0.05	U	0.05	U	0.005	U	0.005	"U,UJ 2"	0.028		0.028		0.025		0.035		0.05	U	0.05	"U,U J2"	0.014		0.016		0.28		0.27		7.3		6.3	
BRSW-22	19-Oct-99	0.05	U	0.05	U	0.002	U	0.002	U	0.014		0.014		0.021		0.024		0.05	U	0.05	U	0.012		0.015		0.099		0.097		3.6		3.6	
BRSW-22	21-May-99	0.05	U	2.33		0.002	U	0.002		0.0435		0.0406		0.251		1.02		0.01	U	0.94		0.011		0.214		1.59		1.61		6.21		5.68	
BRSW-22	29-Apr-99	0.05	U	3.78	J4S	0.002	U	0.002	U	0.125		0.128		1.91		3.15		0.01	U	0.11	J4S	0.048		0.123		4.46	J2	4.74	J2	19.6		19.8	
BRSW-22	22-Oct-98	0.05	U	0.05	U	0.002	U	0.002	U	0.02		0.019		0.064		0.061		0.05	U	0.13		0.016		0.017		0.2		0.19		4		4	
BRSW-22	5-May-98	0.05	U	0.076		0.002	U	0.002	U	0.02		0.018		0.047		0.071		0.03	U	0.072		0.023		0.036		0.44		0.44		3.3		3.3	
BRSW-22	22-Oct-97	0.087		0.05	U	0.002	U	0.002	U	0.088		0.087		0.078		0.088	J4S	0.05	U	0.05	U	0.033		0.037		4.8		4.7		14		14	
BRSW-22	27-May-97	0.05	U	0.3		0.002	U	0.002	U	0.013		0.012		0.11		0.19		0.03	U	0.066		0.018		0.043		0.33		0.34		2.1		2	
BRSW-22	26-Feb-97	0.1	U	0.1	U	0.005	U	0.005	U	0.038		0.037		0.03		0.05		0.03	U	0.37		0.09		0.14		0.69		0.64		13.3		12	
BRSW-22	21-Oct-96	0.05	U	0.05	U	0.002	U	0.002	U	0.16		0.15		0.1		0.17		0.1		0.84		0.003	U	0.055		43		40		73		67	
BRSW-22	22-May-96	0.05	U	0.36	J4S	0.002	U	0.002	U	0.029		0.025		0.11		0.19	J4S	0.05	U	0.47		0.007		0.041	J4S	6.9		6.7		11		12	
BRSW-22	22-May-96	0.03		0.24		0.002	U	0.002	U	0.027		0.027		0.113		0.27		0.03	U	0.44		0.006		0.032		6.88		6.72		12		12.7	
BRSW-22	23-Oct-95	0.05	U	0.07		0.002	U	0.002	U	0.035	J4S	0.033	J4S	0.048		0.063		0.03	U	0.25	J2	0.063		0.079		0.84		0.83		11		11	
BRSW-22	2-May-95	0.05	U	1.1		0.002	U	0.002	U	0.12		0.11		0.35		0.9		0.079	J4S	1.2		0.01		0.16		6.2		6.6		28		27	
BRSW-22	26-Oct-94	0.05	U	2.421		0.002	"U,UJ 4D"	0.013		0.086	J2	0.099	J2	0.025	J2	0.393	J2	3.301		14.74		0.002	U	0.868		17.59	"J4S, J2"	17.66	J2	33.53		39.2	
BRSW-22	18-May-94	0.1		0.56						0.029	J2	0.035	J2	0.049		0.48		0.044	J4	2.2		0.002	U	0.049	J4	3.6	J4	4		8.5	"J4, J2"	11	"J4, J2"
BRSW-22	26-Oct-93	0.031		0.133		0.001	U	0.003		0.0384		0.0354		0.0079		0.0818		0.837		7.05		0.003		0.053		10		9.09		15.7		16	

TABLE B-2
SURFACE WATER
METALS ANALYTICAL SUMMARY

Upper Blackfoot Mining Complex
Surface Water Analytical Results
TO 10 - Summer Field Work

TerraGraphics Environmental Engineering, Inc.

Sample ID	Collection Date	Aluminum (mg/L)				Arsenic (mg/L)				Cadmium (mg/L)				Copper (mg/L)				Iron (mg/L)				Lead (mg/L)				Manganese (mg/L)				Zinc (mg/L)			
		Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag
BRSW-22	26-Oct-93	0.1	U	0.13	J4	0.003	U	0.005	J4	0.028	J4	0.03		0.01	"U, J4"	0.082	J4	0.717	J4	6.717		0.003	"U,J4"	0.049		8.645		8.17		13.247	J4	14.142	J4
BRSW-22	26-Oct-93	0.1	U	0.241		0.003	U	0.004		0.026		0.031		0.01	U	0.08		0.937		6.733		0.003	U	0.047		7.858		7.962		12.3		14.04	
BRSW-23	19-Nov-09	0.03	U	0.03		0.003	U	0.003	U	0.002		0.002		0.0034		0.0051		0.05	U	0.21		0.001		0.0042		0.38	J	0.35		0.6		0.58	
BRSW-23	28-Aug-09	0.03	U	0.03	U	0.003	U	0.003	U	0.0011		0.0011		0.0026		0.0036		0.05	U	0.07	J	0.0015	J	0.0029		0.1		0.093		0.18		0.15	
BRSW-23	10-Oct-07			0.03	U			0.002	U			0.00328				0.014				0.7	J			0.0063				1.21				0.69	
BRSW-23	12-Oct-04	0.05	U	0.05	U	0.005	U	0.005	U	0.0018		0.0019	J	0.01	U	0.01	U	0.01	J	0.06	J	0.003	U	0.004		0.45		0.52		0.44		0.53	
BRSW-23	14-Jun-04	0.05	U	0.16	J	0.005	U	0.005	U	0.0047		0.0044		0.03		0.05		0.01	U	0.21	J	0.013		0.03		0.59		0.6		0.86		0.76	
BRSW-23	26-May-04	0.07	J	0.27	J	0.005	"U,J"	0.005	"U,J"	0.0069	J	0.0074	J	0.03	J	0.069	J	0.01		0.18		0.007	J	0.026		0.73	J	0.7	J	1.25	J	1.34	J
BRSW-23	28-Apr-04	0.05	U	1.52		0.005	U	0.005	U	0.0192		0.0195		0.09		0.6		0.01	"U,J"	1.04	J	0.006		0.146		1.56		1.59		3.9		4.1	
BRSW-23	21-Oct-03	0.05	"U,UJ"	0.1		0.005	U	0.005	U	0.002		0.004		0.003		0.08		0.02	U	1.5		0.003	U	0.1		0.6		1.1		0.4		0.9	
BRSW-23	25-Jun-03	0.05	U	0.1		0.005	U	0.005	U	0.003		0.004		0.02		0.05		0.02	U	0.3		0.009		0.02		0.4		0.7		0.6		0.8	
BRSW-23	19-May-03	0.05	U	0.2		0.005	U	0.005	U	0.003		0.004		0.03		0.09		0.02	U	0.6		0.007		0.1		0.2		0.4		0.5		0.6	
BRSW-23	28-Apr-03	0.05	U	0.7		0.005	U	0.005	U	0.02		0.02		0.09		0.3		0.03	U	0.3		0.005		0.04		1.4		1.4		2.4		2.7	
BRSW-23	3-Oct-02	0.05	U	0.05	U	0.005	U	0.005	U	0.005		0.005		0.008		0.015		0.02	U	0.084		0.003	U	0.01		0.87		0.91		1		1	
BRSW-23	10-Jul-02	0.05	U	0.11		0.005	U	0.005	U	0.006		0.006		0.033		0.045		0.02	U	0.046		0.011		0.021		0.64		0.63		0.91		0.92	
BRSW-23	29-May-02	0.05	U	0.34		0.005	U	0.005	U	0.0079		0.0079		0.06		0.15		0.02	U	0.16		0.009		0.032		0.58		0.62		1.2		1.3	
BRSW-23	6-May-02	0.05	U	1		0.005	U	0.005	U	0.04		0.039		0.088		0.3		0.02	U	0.66		0.003	U	0.058		2.9		3		7.5		7.4	
BRSW-23	17-Oct-01	0.05	U	0.05	U	0.005	U	0.005	U	0.0032		0.0031		0.003		0.004	J4S	0.02	U	0.045		0.003	U	0.006		0.52		0.52		0.74		0.74	
BRSW-23	4-Oct-01																																
BRSW-23	26-Jun-01	0.05	U	0.12		0.005	U	0.005	U	0.006		0.0066		0.033		0.053		0.05	U	0.05	U	0.011		0.022		0.45		0.46		0.94		0.99	
BRSW-23	22-May-01	0.053		0.17		0.005	U	0.005	U	0.007		0.007		0.043		0.072		0.05	U	0.074		0.014		0.028		0.6		0.62		1.2		1.2	
BRSW-23	25-Apr-01	0.14		2.2		0.005	U	0.005	U	0.067		0.067		0.078		0.36		0.07		2.3		0.012		0.15		3.9		4.3		11		13	
BRSW-23	25-Apr-01	0.075		2.1		0.005	U	0.005	U	0.067		0.067		0.067		0.35		0.2		2		0.006	J4D	0.16		3.9		3.9		11		12	
BRSW-23	12-Oct-00	0.05	U	0.05	U	0.005	U	0.005	"U,UJ2"	0.004	UJ1	0.004		0.004	UJ1	0.007		0.05	U	0.05	"U,UJ2"	0.003	U	0.006	UJ1	0.43	J4D	0.4		1.1	"J4D, J4S"	0.92	
BRSW-23	11-Oct-00	0.05	U	0.05	U	0.005	U	0.005	U	0.004		0.004		0.004		0.005		0.05	U	0.05	U	0.003	U	0.004		0.4		0.36		1		1.1	
BRSW-23	19-Oct-99	0.05	U	0.05	U	0.002	U	0.002	U	0.002		0.002		0.005	U	0.005	U	0.05	U	0.05	U	0.003	U	0.004		0.6		0.58		0.56		0.56	
BRSW-23	19-Oct-99	0.05	U	0.05	U	0.002	U	0.002	U	0.002		0.002		0.005	U	0.005	U	0.05	U	0.05	U	0.003	U	0.005		0.59		0.57		0.58		0.56	
BRSW-23	28-May-99	0.05	U	0.2		0.002	U	0.002	U	0.0045		0.0052		0.037		0.079		0.01	U	0.14		0.006		0.03		0.289		0.323		0.77		0.85	
BRSW-23	29-Apr-99	0.05	U	1.88	J4S	0.002	U	0.002	U	0.0497		0.0504		0.392		0.778		0.01	U	0.54	J4S	0.007		0.079		3.93	J2	3.91	J2	9.07		8	
BRSW-23	22-Oct-98	0.05	U	0.05	U	0.002	U	0.002	U	0.003		0.003		0.005		0.006		0.05	U	0.09		0.003	U	0.007		0.64		0.61		0.57		0.59	
BRSW-23	5-May-98	0.05	U	0.12		0.002	U	0.002	U	0.012		0.01		0.025		0.047		0.03	U	0.15		0.01		0.032		0.56		0.6		2.1		2.2	
BRSW-23	20-Oct-97	0.05	U	0.05	U	0.002	U	0.002	U	0.013		0.013		0.008		0.011		0.05	U	0.05	U	0.004		0.008		1.3		1.4		2		2	
BRSW-23	27-May-97	0.05	U	0.095		0.002	U	0.002	U	0.004		0.004		0.029		0.044		0.03	U	0.05		0.008		0.017		0.19		0.2		0.69		0.66	
BRSW-23	26-Feb-97	0.1	U	0.1	U	0.005	U	0.005	U	0.004		0.004		0.01	U	0.01	U	0.03	U	0.05		0.01		0.01		0.4		0.4		1.29		1.33	
BRSW-23	21-Oct-96	0.05	U	0.05	U	0.002	U	0.002	U	0.041		0.037		0.022		0.042		0.03	U	0.18		0.006		0.021		10		9.9		17		17	
BRSW-23	22-May-96	0.05	U	0.18	J4S	0.002	U	0.002	U	0.008		0.007		0.031		0.054	J4S	0.05	U	0.27		0.006		0.027	J4S	1.5		1.7		2.7		3	
BRSW-23	23-Oct-95	0.05	U	0.05		0.002	U	0.002	U	0.005	J4S	0.005	J4S	0.005	U	0.013		0.03	U	0.31	J2	0.006		0.024		0.9		0.87		1.4		1.3	
BRSW-23	1-May-95	0.05	U	0.42		0.002	U	0.002	U	0.035		0.033		0.067		0.21		0.03	"U,UJ 4S"	0.53		0.009		0.068		1.9		2		7.7		7.7	

TABLE B-2
SURFACE WATER
METALS ANALYTICAL SUMMARY

Upper Blackfoot Mining Complex
Surface Water Analytical Results
TO 10 - Summer Field Work

Sample ID	Collection Date	Aluminum (mg/L)				Arsenic (mg/L)				Cadmium (mg/L)				Copper (mg/L)				Iron (mg/L)				Lead (mg/L)				Manganese (mg/L)				Zinc (mg/L)			
		Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag
BRSW-23	26-Oct-94	0.05	U	0.957		0.002	"U,UJ4D"	0.008		0.036	J2	0.042	J2	0.007	J2	0.209	J2	0.11	UJ1	8.434		0.002	U	0.369		6.818	"J4S, J2"	6.745	J2	13.6		16.5	
BRSW-23	18-May-94	0.1		0.23						0.006	J2	0.007	J2	0.017		0.088		0.063	J4	0.49		0.002	U	0.016	J4	0.74	J4	0.84		1.6	"J4, J2"	2.1	"J4, J2"
BRSW-23	26-Oct-93	0.1	U	0.1	"U,J4"	0.003	U	0.003	"U, J4"	0.0049	J4	0.006		0.01	"U, J4"	0.017	J4	0.1	"U, J4"	1.095		0.003	"U, J4"	0.012		1.803		1.93		1.898	J4	2.632	J4
BRSW-38	19-Nov-09	0.13		0.27		0.003	U	0.003	U	0.012		0.0093		0.038		0.034		0.05	U	0.67		0.0013		0.02		2.3	J	1.9		2.3		1.9	
BRSW-38	28-Aug-09	0.03	U	0.03	U	0.003	U	0.003	U	0.0043		0.0041		0.0039		0.0054		0.05	U	0.17	J	0.0018	J	0.009		0.54		0.59		0.78		0.76	
BRSW-38	12-Oct-04	0.05	U	0.05	U	0.005	U	0.005	U	0.0044		0.0046		0.01	U	0.01	U	0.01	"U,J"	0.1	J	0.003	U	0.004		0.8		0.88		1.03		1.19	
BRSW-38	14-Jun-04	0.05	U	0.08		0.005	U	0.005	U	0.0044		0.0045		0.02		0.03		0.02		0.07		0.007		0.014		0.64		0.6		0.91		0.92	
BRSW-38	26-May-04	0.07	J	0.27	J	0.005	"U, J"	0.005	"U, J"	0.0084	J	0.0089	J	0.023	J	0.064	J	0.01		0.29		0.003	J	0.027		1.04	J	1.07	J	1.53	J	1.66	J
BRSW-38	28-Apr-04	0.06		0.53		0.005	U	0.005	U	0.0113		0.0113		0.05		0.2		0.03	J	0.43	J	0.006		0.049		1.24		1.39		2.62		2.95	
BRSW-38	21-Oct-03	0.05	"U,UJ"	0.05	U	0.005	U	0.005	U	0.004		0.004		0.003		0.004	J	0.02	U	0.04	J	0.003	U	0.003		0.5		0.5		0.8		0.8	
BRSW-38	25-Jun-03	0.05	U	0.05	U	0.005	U	0.005	U	0.004		0.004		0.02		0.02		0.02		0.07		0.006		0.01		0.5		0.5		0.8		0.8	
BRSW-38	19-May-03	0.05	U	0.07		0.005	U	0.005	U	0.003		0.003		0.02		0.04		0.02	U	0.07		0.006		0.02		0.2		0.2		0.5		0.5	
BRSW-38	28-Apr-03	0.05	U	0.6		0.005	U	0.005	U	0.02		0.02		0.07		0.3		0.03	U	0.3		0.004		0.04		1.7		1.7		2.8		3	
BRSW-38	3-Oct-02	0.057		0.05		0.005	U	0.005	U	0.0055		0.0054		0.007		0.01		0.02	U	0.089		0.003	U	0.004		0.96		1		1.1		1.1	
BRSW-38	9-Jul-02	0.05	U	0.077		0.005	U	0.005	U	0.006		0.006		0.023		0.037		0.02	U	0.098		0.008		0.02		0.7		0.68		0.98		0.96	
BRSW-38	21-May-02	0.05	U	1		0.005	U	0.005	U	0.02		0.022		0.056		0.3		0.02	"U,J"	0.88		0.004		0.081		1.4		1.8		3.2		3.6	
BRSW-38	3-May-02	0.05	U	0.88		0.005	U	0.005	U	0.0445		0.0444		0.034		0.23		0.01	U	1.3		0.003	U	0.089		3.7		3.7		8.2		8.5	
BRSW-38	17-Oct-01	0.05	U	0.05	U	0.005	U	0.005	U	0.0042		0.0053		0.003		0.004	J4S	0.021		0.046		0.003	U	0.005		0.63		0.67		1.3		1.3	
BRSW-38	16-Oct-01	0.05	U	0.058	J4D	0.005	U	0.005	U	0.0046		0.0042		0.004		0.005		0.02	U	0.066		0.003	U	0.004		0.55		0.54		0.98		0.99	
BRSW-38	26-Jun-01			0.13				0.005	U			0.0071				0.043				0.064				0.02				0.64				1.2	
BRSW-38	26-Jun-01	0.05	U	0.11		0.005	U	0.005	U	0.0071		0.0076		0.03		0.045		0.05	U	0.06		0.009		0.02		0.65		0.67		1.2		1.3	
BRSW-38	22-May-01	0.05	U	0.15		0.005	U	0.005	U	0.008		0.009		0.034		0.064		0.05	U	0.12		0.008		0.027		0.87		0.9		1.6		1.6	
BRSW-38	25-Apr-01	0.098		1		0.005	U	0.005	U	0.045		0.045		0.033		0.18		0.12		2.7		0.005	J4D	0.089		3.9		3.9		8.7		9.3	
BRSW-38	25-Apr-01			2.7				0.007				0.065				0.49				9.5				0.33				7.3				14	
BRSW-38	11-Oct-00	0.05	U	0.05	U	0.005	U	0.005	U	0.005		0.005		0.004		0.005		0.05	U	0.05	U	0.003	U	0.003	U	0.64		0.62		1.3		1.5	
BRSW-38	19-Oct-99	0.05	U	0.05	U	0.002	U	0.002	U	0.003		0.003		0.005	U	0.007		0.05	U	0.15		0.003	U	0.012		0.42		0.42		0.95		1	
BRSW-38	28-May-99	0.05	U	0.24		0.002	U	0.002	U	0.0047		0.0055		0.033		0.079		0.01	U	0.19		0.006		0.035		0.313		0.374		0.86		0.98	
BRSW-38	28-Apr-99	0.05	U	1.78		0.002	U	0.002	U	0.0515		0.0504		0.237		0.733		0.01	U	0.86		0.003		0.076		2.89		3.31		8.89		9.8	
BRSW-38	28-Apr-99	0.05	U	1.82		0.002	U	0.002	U	0.0504		0.0508		0.253		0.738		0.01	U	0.82		0.003		0.076		3	J2	3.12	J2	9.18		9.28	

TABLE B-2
SURFACE WATER
METALS ANALYTICAL SUMMARY

Upper Blackfoot Mining Complex
Surface Water Analytical Results
TO 10 - Summer Field Work

Sample ID	Collection Date	Aluminum (mg/L)				Arsenic (mg/L)				Cadmium (mg/L)				Copper (mg/L)				Iron (mg/L)				Lead (mg/L)				Manganese (mg/L)				Zinc (mg/L)			
		Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag	Dissolved	flag	Total	flag
BRSW-48	20-Nov-09	0.03	U	0.03	U	0.003	U	0.003	U	0.0045		0.005		0.0022		0.009		0.46		1.2		0.0005	U	0.023		2.2	J	2.2		1.1		1.1	
BRSW-48	28-Aug-09	0.03	U	0.03	U	0.003	U	0.003	U	0.0018		0.0018		0.0028		0.0049		0.05	U	0.25	J	0.0019	J	0.0094		0.58		0.62		0.26		0.22	
BRSW-48	17-Oct-01	0.05	U	0.05	U	0.005	U	0.005	U	0.0038		0.0037		0.003		0.004	J4S	0.02	U	0.027		0.003	U	0.005		0.64		0.66		0.9		0.93	
BRSW-48	26-Jun-01	0.05	U	0.13		0.005	U	0.005	U	0.0067		0.007		0.034		0.05		0.05	U	0.05	U	0.012		0.021		0.54		0.56		1		1.1	
BRSW-48	22-May-01	0.063		0.16		0.005	U	0.005	U	0.008		0.008		0.043		0.075		0.1		0.069		0.014		0.092		0.72		0.74		1.4		1.4	
BRSW-48	25-Apr-01	0.1		1.5		0.005	U	0.005	U	0.055		0.055		0.054		0.26		0.05	U	1.8		0.007	J4D	0.12		3.9		4		9.6		10	
BRSW-48	11-Oct-00	0.05	U	0.05	U	0.005	U	0.005	U	0.004		0.004		0.003		0.004		0.05	U	0.05	U	0.003	U	0.005		0.44		0.44		0.96		1	
BRSW-48	19-Oct-99	0.05	U	0.05	U	0.002	U	0.002	U	0.002		0.002		0.005	U	0.005	U	0.05	U	0.05	U	0.003	U	0.004		0.52		0.49		0.53		0.53	
Surface Water Standards	Acute	0.75				0.34				0.0052				0.00379				--				0.01398				--				0.037			
	Chronic	0.087				0.15				0.000097				0.00285				1.0				0.000545				--				0.037			
	Human Health	--				0.01				0.005				1.3				0.3 (aesthetic)				0.015				0.05 (aesthetic)				2.0			

Notes:
-- - indicates no standard
Acute and Chronic levels are for aquatic life standards as listed in Circular DEQ-7, 2008.
* - these aquatic life standards are hardness dependent. Levels shown are at 25 mg/L hardness.
Flag Qualifiers: J - estimated concentration above the adjusted method detection limit and below the adjusted reporting limit
U - the compound was analyzed for, but not detected
Quotation marks were flags included in historic data.
BRSW-22 was frozen during the November 2009 sampling event and a sample could not be obtained.

TABLE C-1
MIKE HORSE SOILS/TAILINGS
GEOCHEMICAL SUMMARY

Upper Blackfoot Mining Complex
Mike Horse Dam Analytical Results
TO 10 - Summer Field Work

TerraGraphics Environmental Engineering, Inc.

Sample ID	LabID	Aluminum SPLP (mg/L)	Arsenic SPLP (mg/L)	Cadmium SPLP (mg/L)	Copper SPLP (mg/L)	Iron SPLP (mg/L)	Lead SPLP (mg/L)	Manganese SPLP (mg/L)	Zinc SPLP (mg/L)	Aluminum (mg/kg)	Arsenic (mg/kg)	Cadmium (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Manganese (mg/kg)	Zinc (mg/kg)	pH Saturated Paste Std. Units
09-MHTP-1 9 1/2'	10112795008	0.23 J	0.005 U	0.012	0.005 U	0.57	0.053	4.5	0.11 U	7,150	166 J	20.5	1,280 J	66,200	4,030 J	4,600	3,570 J	6.7
09-MHTP-1 10'	10112795009	0.22 J	0.005 U	0.012	0.005 U	0.19	0 U	2.7	1.3	14,700	34.4 J	3.2	135 J	27,600	404 J	2,190	716 J	4.6
09-MHTP-1 16'	10112795010	0.31 J	0.005 U	0.0011	0.005 U	0.27	0 U	0.63	0 U	11,200	25.9 J	3.9	76 J	24,100	231 J	1,200	787 J	4.4
09-MHTP-2 4 1/2-5'	10112795011	0.11 J	0.005 U	0.016	0.074	0.11	0 U	1.5	2.1	9,790	30.3 J	1.8	70 J	22,300	57 J	903	346 J	3.7
09-MHTP-2 5 1/2'	10112795012	0.16 J	0.005 U	0.0057	0.005 U	0.13	0 U	0.74	0.76	8,720	28.3 J	1.3	48 J	20,700	49 J	604	312 J	4.3
09-MHTP-2 6'	10112795013	0.19 J	0.005 U	0.021	0.15	0.25	0 U	1.8	3.2	6,810	17.2 J	1.3	58 J	17,400	34 J	484	300 J	3.8
09-MHTP-3 7'	10112795014	0.1 U	0.005 U	0.012	0.005 U	0.047	0 U	21.4	1.5	8,990	96.5 J	4.6	253 J	54,900	587 J	2,770	1,260 J	6.5
09-MHTP-3 8'	10112793015	0.64	0.005 U	0.014	0.005 U	0.64	0.005	13.5	0.68	15,100 J	21.6 J	1.8	53 J	29,600	159	1,990	322	5.3
09-MHTP-3 8 1/2'	10112793016	0.1 U	0.005 U	0.02	0.005 U	0.042	0.002 U	10.2	1.2	13,900 J	22.2 J	2.4	55 J	27,300	144	2,170	277	4.7
09-MHTP-4 7 1/2'	10112793017	0.1 U	0.012	0.078	0.005 U	0.079	0.002 U	22.5	0.65	7,300 J	207 J	15.3	569 J	86,300	1,610	4,720	2,120	6.8
09-MHTP-4A 7 1/2'	10112793018	0.1 U	0.005 U	0.078	0.005 U	0.098	0.002 U	20.3	0.56	7,210 J	174 J	13	466 J	77,800	1,180	967	2,130	6.9
09-MHTP-4 8 1/2'	10112793019	0.1 U	0.006	0.016	0.005 U	0.033	0.002 U	14.7	0.15	4,870 J	382 J	29	1,020 J	148,000	3,550	8,470	4,880	7
09-MHTP-4 9'	10112793020	0.1 U	0.005 U	0.0005 U	0.005 U	0.1	0.002 U	1.1	0.01 U	9,950 J	50.3 J	3.6	135 J	35,900	595	2,310	1,270	7.4
09-MHTP-4, 9 1/2'	10116045001	0.1 U	0.009 U	0.0005 U	0.005 U	0.056	0.002 U	0.014 J	0.014 J	9,740	16.7	0.51 U	32	19,200	56	902	131	7.4
09-MHTP-5 51/2	10113726008	0.27 J	0.005 U	0.079	0.007	0.19	0.018	27.7	2.6	5,380	744 J	30.5	2,310	255,000 J	4,730	14,300 J	4,780 J	6.7
09-MHTP-5 6 1/2'	10112795001	0.25 J	0.005 U	0.084	0.005 U	0.16	0 U	30.4	11.2	29,000	36.9 J	22.4	125 J	30,300	310 J	5,130	3,060 J	4.6
09-MHTP-5 7'	10112795002	0.23 J	0.005 U	0.024	0.005 U	0.24	0 U	10.2	2.9	9,830	26 J	2.4	70 J	23,500	222 J	1,310	570 J	4.8
09-MHTP-6 5'	10112795003	0.11 J	0.02	0.29	0.005 U	0.24	0.2	15.8	1.2	2,560	389 J	38.2	1,520 J	149,000	2,700 J	10,800	4,230 J	6.4
09-MHTP-6 6'	10112795004	0.32 J	0.005 U	0.033	0.005	0.28	0 U	16	4	17,500	27.9 J	5.2	118 J	29,600	183 J	1,840	1,020 J	4.7
09-MHTP-6 6 1/2'	10112795005	0.1 U	0.005 U	0.04	0.005 U	0.026	0 U	19.7	3.7	17,100	53.6 J	4	215 J	37,200	300 J	1,850	1,030 J	5.5
09-MHTP-6, 7 1/2'	10116045002	0.1 U	0.009 U	0.023	0.005 U	0.03	0.002 U	15.1	1.3	14,100	43.4	4	113	29,700	269	1,460	603	6.8
09-MHTP-7 7 1/2'	10112795006	0.1 U	0.005 U	0.0076	0.024	0.029	0 U	3.4	0.94	10,900	41.3 J	1.5	131 J	26,800	348 J	1,570	463 J	4.5
09-MHTP-7 8 1/2'	10112795007	0.15 J	0.005 U	0.0077	0.036	0.058	0 U	3.6	1.2	11,100	26.8 J	1.4	99 J	24,500	244 J	1,510	351 J	4
09-MHTP-7 9'	10112793001	0.14	0.005 U	0.0013	0.005 U	0.061	0.002 U	1.4	0.2	9,670 J	13.1 J	0.91	42 J	18,200	31	1,370	192	4.9
09-MHTP-8 8 1/2'	10112793002	0.45	0.005 U	0.0005 U	0.005 U	0.3	0.002	0.26	0.017	12,500 J	29 J	2.3	102 J	24,800	446	6,930	567	5.4
09-MHTP-8 9 1/2'	10112793003	0.89	0.005 U	0.0005 U	0.005 U	0.63	0.005	0.11	0.021	20,900 J	29.5 J	2.7	134 J	38,300	385	2,780	549	5.4
09-MHTP-8 10'	10112793004	2.6	0.005 U	0.0005 U	0.008	2	0.021	0.078	0.058	12,100 J	25.1 J	1.3	86 J	21,800	290	1,620	369	5.6
09-MHTP-9 10'	10112793005	1.7	0.005 U	0.0005 U	0.008	1.6	0.024	0.087	0.042	6,490	141	9.9	343	65,400	771	2,990	1,810	6.7
09-MHTP-9 16'	10112793006	0.19	0.008	0.0005 U	0.012	1	0.054	1.2	0.037	4,470 J	458 J	31.8	1,330 J	165,000	3,040	5,890	4,260	6.2
09-MHTP-10 8'	10112793007	1.3	0.005 U	0.0005 U	0.009	1.8	0.078	0.13	0.071	4,590 J	196 J	9.4	346 J	58,100	1,040	2,080	2,100	7.1
09-MHTP-10 16'	10112793008	1.7	0.034	0.0013	0.24	2.8	1	0.77	0.19	34,400 J	3640 J	42	2,800 J	108,000	32,700	2,440	3,480	7.2
Regional Screening Level†										77,000	40	70	3,100	55,000	400	1,800	23,000	NA

† April 2009 Regional Screening Level for Chemical Contaminants at Superfund Sites (MDEQ)
Flag Qualifiers:
J - estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.
U - the compound was analyzed for, but not detected.

- Soil concentration exceeds the Regional Screening Level.

TABLE C-1
MIKE HORSE SOILS/TAILINGS
GEOCHEMICAL SUMMARY

Upper Blackfoot Mining Complex
Mike Horse Dam Analytical Results
TO 10 - Summer Field Work

TerraGraphics Environmental Engineering, Inc.

Sample ID	LabID	Sulfur HCl Extractable %(w/w)	Sulfur HNO_3 Extractable %(w/w)	Sulfur Hot Water Extractable %(w/w)	Sulfur Residual %(w/w)	Sulfur %(w/w)	Neutralization Potential (tons/1000)	Acid Potential (tons/1000)	Acid/Base Potential (tons/1000)	Lime Requirement (tons/1000)	SMP Lime Requirement (tons/1000)	SMP Buffer pH Std. Units	Sp.Conductance Saturated Paste (mmhos/cm)	Total Inorganic Carbon (mg/kg)
09-MHTP-1 9 1/2'	10112795008	0.56	2.9	1.2	0.03 J	4.7	56	104	-48	130	0	7.1	6.7 J	6450
09-MHTP-1 10'	10112795009	0.04 J	0.09	0.14	0 J	0.27	2.3	3.8	-1.5	12	6.1	6.1	4.8 J	1040
09-MHTP-1 16'	10112795010	0.03 J	0.15	0.28	0 J	0.45	3.8	5.2	-1.4	9.4	2.4	6.6	6.9 J	985 U
09-MHTP-2 4 1/2-5'	10112795011	0.04 J	0 J	0.11	0 J	0.15	0.5 U	1.1	-1.1	8	5.3	6.2	4 J	1000 UJ
09-MHTP-2 5 1/2'	10112795012	0.01 J	0 J	0.08	0 J	0.09	25	0.31	25	6.1	4.6	6.3	2.7 J	2340 J
09-MHTP-2 6'	10112795013	0.01 J	0 J	0.08	0 J	0.09	0.5 U	0.31	-0.31	4.2	3.1	6.5	4.2 J	252 UJ
09-MHTP-3 7'	10112795014	0.75	1.9	0.43	0 J	3.1	26	76	-50	96	0.3	6.9	8.8 J	5420 J
09-MHTP-3 8'	10112793015	0.064	0.59	0.51	0 J	1.2	5	20	-15	32	6.1	6.1	9.6 J	2000 UJ
09-MHTP-3 8 1/2'	10112793016	0.053	0.38	0.37	0.035 J	0.84	1	14	-13	25	6.1	6.1	8.6 J	1800 UJ
09-MHTP-4 7 1/2'	10112793017	0.81	7.9	1.5	0 J	10.3	97	267	-170	334	0	7.1	6.7 J	13180 J
09-MHTP-4A 7 1/2'	10112793018	0 J	9.4	2.3	0.11	11.6	79	298	-219	372	0	7.3	5.8 J	15240 J
09-MHTP-4 8 1/2'	10112793019	0.68	14.6	1.1	0.25	16.6	178	481	-303	601	0	7.4	7.5 J	43380 J
09-MHTP-4 9'	10112793020	0 J	2	0.52	0.019 J	2.8	31	63	-32	79	0	7.3	4.1 J	4440 J
09-MHTP-4, 9 1/2'	10116045001	0.037 U	0.077	0.35	0.037 U	0.44	5.3	2.8	2.4	3.6	0	7.2	4.3	489 U
09-MHTP-5 51/2	10113726008	0.037 U	13	1.8	0.082	14.5	98.8	409	-311	512	0	7.1	10.8	19260 J
09-MHTP-5 6 1/2'	10112795001	0.09	0.48	0.72	0 J	1.3	5.8	17	-11	29	6.1	6.1	14.3 J	23300
09-MHTP-5 7'	10112795002	0 J	0.04 J	0.32	0 J	0.37	1.7	1.3	0.38	2.9	1	6.8	7.9 J	2100
09-MHTP-6 5'	10112795003	0.06	12.4	1.1	0.13	13.7	186	394	-209	493	0	7.4	6 J	22900
09-MHTP-6 6'	10112795004	0.01 J	0.3	0.29	0 J	0.59	2.3	9.5	-7.1	15	2.4	6.6	9.4 J	3090
09-MHTP-6 6 1/2'	10112795005	0.22	1.2	0.48	0.01 J	1.9	12	42	-30	57	3.1	6.5	8.2 J	3520
09-MHTP-6, 7 1/2'	10116045002	0.08	1.5	0.78	0.037 U	2.4	19	50	-31	66	3.1	6.5	11	2270
09-MHTP-7 7 1/2'	10112795006	0.16	0.49	0.25	0 J	0.89	2.3	19	-17	26	1.8	6.6	4.1 J	3400
09-MHTP-7 8 1/2'	10112795007	0.04 J	0.07	0.1	0 J	0.21	1.7	3.1	-1.3	6.9	2.4	6.6	5.2 J	252 U
09-MHTP-7 9'	10112793001	0.021 J	0.028 J	0.058	0 J	0.11	0.5	1.4	-0.87	6.6	3.9	6.4	2.4 J	493 U
09-MHTP-8 8 1/2'	10112793002	0.033 J	0.024 J	0.034 J	0.0049 J	0.096	2.3	1.7	0.62	6	3.1	6.5	1.6 J	877
09-MHTP-8 9 1/2'	10112793003	0.015 J	0.0081 J	0.048 J	0 J	0.072	3.5	0.63	2.9	2	1	6.8	2.2 J	253 U
09-MHTP-8 10'	10112793004	0.015 J	0.018 J	0.071	0.0009 J	0.1	6	0.93	5.1	1.5	0.3	6.9	2.3 J	564
09-MHTP-9 10'	10112793005	0.042 J	3.7	0.18	0.11	4	12	120	-108	150	0	7.3	1.3	2590
09-MHTP-9 16'	10112793006	0.86	11.4	0.17	0.15	12.6	58	382	-324	478	0	7	1.5 J	3920 U
09-MHTP-10 8'	10112793007	0.59	7.9	0.12	0.2	8.8	58	268	-210	335	0	7.4	1.8 J	10400
09-MHTP-10 16'	10112793008	0.19	2.6	0 J	0.11	2.8	26	89	-63	111	0	7.3	0.88 J	4348 U
Regional Screening Level†		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Flag Qualifiers:
J - estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.
U - the compound was analyzed for, but not detected.

** Acid/Base Potential = NP - AP

Potentially Acid Generating:	NP:AP <1 and NNP < -20 tons/kton
Uncertain Acid Generation Potential:	NP:AP between 1 and 3 and/or NNP between -20 and +20 tons/kton
Unlikely to Generate Acid:	NP:AP >3 and NNP < +20 tons/kton

NP = Neutralization Potential
AP = Acidification Potential
NNP = Net Neutralization Potential = Acid/Base Potential

TABLE C-2
PAYMASTER SOILS
GEOCHEMICAL SUMMARY

Upper Blackfoot Mining Complex
Paymaster Soils Analytical Results
TO 10 - Summer Field Work

TerraGraphics Environmental Engineering, Inc.

Sample ID	LabID	Aluminum SPLP (mg/L)	Arsenic SPLP (mg/L)	Cadmium SPLP (mg/L)	Copper SPLP (mg/L)	Iron SPLP (mg/L)	Lead SPLP (mg/L)	Manganese SPLP (mg/L)	Zinc SPLP (mg/L)	Aluminum (mg/kg)	Arsenic (mg/kg)	As SSL (mg/kg)	Cadmium (mg/kg)	Cd SSL (mg/kg)	Copper (mg/kg)	Cu SSL (mg/kg)	Iron (mg/kg)	Fe SSL (mg/kg)	Lead (mg/kg)	Pb SSL (mg/kg)	Manganese (mg/kg)	Mn SSL (mg/kg)	Zinc (mg/kg)	Zn SSL (mg/kg)
09-PMTP-1 8'	10112793009	12.6	0.005 U	0.0005 U	0.15	16.2	0.18	0.19	0.2	39,700 J	26.2 J	524	2.8	280	1,030 J	89,267	106,000	19,630	938	782	888	2,337	855	85,500
09-PMTP-1 9'	10112793010	25.8	0.13	0.003	0.27	37.5	5.2	0.13	0.42	7,530 J	59.9 J	46	0.59	10	184 J	8,859	33,700	2,696	2,790	80	110	423	184	8,762
09-PMTP-2 3'	10112795018	13.2 J	0.005 U	0.023	0.44	17.8	0.29	8	0.77	27,400	25.9 J	518	78.3	170	1,670 J	49,341	81,400	13,719	778 J	402	28,300	1,769	2,730 J	70,909
09-PMBH-2, 5-10'	10116045003	27.3	0.043 J	0.013	0.39	75.1	0.15	3.6	1.3	22,400	8.6	20	6	23	416	13,867	99,700	3,983	219	219	2,480	344	1,100	16,923
09-PMBH-2, 6-8'	10116045004	17.9	0.034 J	0.012	0.31	51.7	0.14	4.2	1.2	45,300	21	62	16.4	68	980	41,097	219,000	12,708	320	343	3,150	375	2,940	49,000
09-PMTP-3 4'	10113726005	17.3 J	0.019	0.0026	0.091	21.3	0.42	0.23	0.069 U	38,900	26.1 J	137	0.8 J	15	239	34,143	62,600	8,817	1,160	414	593	1,289	199	57,681
09-PMTP-3 7'	10113726006	28.8 J	0.016	0.0024	0.15	22.7	0.28	0.36	0.088 U	55,500	23.2 J	145	0.89 J	19	387	33,540	86,900	11,485	1,020	546	588	817	227	51,591
09-PMTP-3 9'	10113726001	22.8 J	0.011	0.0018	0.11	19.5	0.2	0.26	0.1	33,200	14.3 J	130	0.68 J	19	258	30,491	63,400	9,754	607	455	379	729	141	28,200
09-PMTP-4 4'	10112793012	8.7	0.005 U	0.0005 U	0.13	21.7	1.2	0.043	0.035	10,400 J	21.5 J	430	0.085	9	473 J	47,300	81,500	11,267	2,140	268	63	733	57	32,571
09-PMTP-4 8-9'	10112793011	12.5	0.01	0.0005 U	0.14	17.5	0.97	0.028	0.12	19,200 J	66.6 J	666	0.23	23	948 J	88,029	106,000	18,171	8,100	1253	90	1,614	85	14,183
09-PMTP-5 5'	10112793014	11.1	0.005 U	0.0005 U	0.083	17.3	0.51	0.019	0.032	26,700 J	84.9 J	1698	0.13	13	543 J	85,048	103,000	17,861	2,950	868	117	3,079	80	49,688
09-PMTP-5 9-10'	10112793013	7	0.005 U	0.0005 U	0.055	8.7	0.44	0.027	0.027	33,600 J	22.3 J	446	0.12	12	532 J	125,745	107,000	36,897	1,390	474	238	4,407	102	75,556
09-PMTP-6 2'	10112795019	13.8 J	0.005	0.0005 U	0.13	18	0.52	0.16	0.09 U	22,700	24.2 J	448	0.61 J	61	415 J	41,500	70,400	11,733	719 J	207	433	1,353	107 J	23,778
09-PMTP-6 6'	10112795020	48.1 J	0.005 U	0.00052	0.73	36.8	0.31	0.71	0.13	58,000	10.5 J	210	0.67	64	1,250 J	22,260	89,900	7,329	152 J	74	1,130	796	116 J	17,846
09-PMTP-7 2'	10113726009	22.7 J	0.027	0.0038	0.21	35.1	0.33	0.44	0.17	27,600	40.3 J	149	1.1	14	476	29,467	73,400	6,274	1,300	591	442	502	293	34,471
09-PMTP-7 6'	10112795021	39.8 J	0.095	0.0042	0.74	90.7	2.5	0.071	1	9,510	98.3 J	103	1.7	20	1,420 J	24,946	89,800	2,970	2,200 J	132	58	411	551 J	11,020
09-PMTP-8 1 1/2'	10112795017	35.1 J	0.005 U	0.00064	0.23	39.5	0.082	0.94	0.37	26,000	10.9 J	218	1.2	94	383 J	21,648	75,000	5,696	105 J	192	1,180	628	463 J	25,027
09-PMTP-9, 2'	10116045005	13.5	0.019 J	0.0012	0.082	13.5	0.26	0.091	0.11 J	16,800	23.6	124	0.37 J	15	549	87,037	72,200	16,044	963	556	549	3,016	127	23,091
09-PMTP-9 8-9 1/2'	10112795015	98 J	0.058	0.0028	3.1	128	5.3	0.69	1.6	42,200	49.8 J	86	1.5	27	1,830 J	7,674	92,800	2,175	5,490 J	155	651	472	626 J	7,825
09-PMTP-9 17'	10112795016	12.5 J	0.16	0.0034	0.41	48.5	6.8	0.052	0.52	6,020	82.8 J	52	3.8	56	1,060 J	33,610	162,000	10,021	5,880 J	130	80	768	763 J	29,346
09-PMTP-10 1 1/2-2 1/2'	10113726007	55.3 J	0.035	0.0096	0.66	76	0.92	2.8	0.8	51,400	19.3 J	55	6.8	35	942	18,555	118,000	4,658	2,100	342	3,180	568	995	24,875
09-PMTP-10 3'	10113726004	29 J	0.014	0.0064	0.37	37.4	0.64	2.8	0.52	43,600	6.7 J	48	10.4	81	759	26,668	94,100	7,548	1,820	427	4,800 J	857	1,070	41,154
09-PMTP-11 9-10'	10113726003	18.1 J	0.071	0.007	0.83	58.8	0.019	0.77	0.73	28,500	116 J	163	2.2	16	2,380	37,277	211,000	10,765	12	95	1,590	1,032	2,330	63,836
09-PMTP-11 12-14'	10113726002	11.6 J	0.037	0.0082	0.43	44.8	0.042	1.6	0.74	11,000 J	20.5 J	55	8.3	51	758	22,916	67,600 J	4,527	78	279	2,020 J	631	1,200	32,432
Regional Screening Level†										77,000	40 *		70		3,100		55,000		400		1,800		23,000	

† April 2009 Regional Screening Level for Chemical Contaminants at Superfund Sites (MDEQ)
SSL = Soil Screening Level generated by SPLP formula.
Flag Qualifiers:
J - estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.
U - the compound was analyzed for, but not detected.
* - DEQ Action Level for Arsenic in surface soil (DEQ Remediation Division 2005).
- Soil concentration exceeds the Regional Screening Level.
- Soil concentration exceeds the calculated soil screening level (SSL).

SSL (mg/kg) = [HHS (mg/L)/SPLP result (mg/L)] x soil concentration (mg/kg) x 10
Where 10 is the dilution-attenuation factor. Highlighted SSLs are samples with concentrations that exceed the calculated SSL.

The synthetic precipitation leaching procedure (SPLP) analysis is used to estimate the potential for soil to leach metals to groundwater. The SPLP results (mg/L) are used in combination with the results of a soil sample analysis (mg/kg) from the same location to estimate the soil screening level (SSL). The SSL is the site-specific metals concentration in soil that is used to estimate if metals will leach to groundwater. If a soil sample contains metals at a greater concentration than the SSL, then unacceptable levels of metals leaching to groundwater would be expected. If metals concentrations in a soil sample were less than the SSL, then the leaching of metals to the groundwater would be at a rate that would be acceptable to meet groundwater quality standards.

TABLE C-2
PAYMASTER SOILS
GEOCHEMICAL SUMMARY

Upper Blackfoot Mining Complex
Paymaster Soils Analytical Results
TO 10 - Summer Field Work

Sample ID	LabID	pH Saturated Paste Std.	Sulfur HCl Extractable %(w/w)	Sulfur HNO_3 Extractable	Sulfur Hot Water Extractable	Sulfur Residual %(w/w)	Sulfur %(w/w)	Neutralization Potential (tons/1000)	Acid Potential (tons/1000)	Acid/Base Potential** (tons/1000)	Lime Requirement (tons/1000)	SMP Lime Requirement (tons/1000)	SMP Buffer pH Std. Units	Sp.Conductance Saturated Paste (mmhos/cm)	Total Inorganic Carbon
09-PMTP-1 8'	10112793009	6.7	0.016 J	0.0083 J	0.0072 J	0.0014 J	0.037 U	6.4	0.68	5.7	1.2	0.3	6.9	0.18 J	498 U
09-PMTP-1 9'	10112793010	6.6	0.14	0.08	0.11	0 J	0.33	13	5.9	6.8	7.3	0	7.2	0.31 J	251 U
09-PMTP-2 3'	10112795018	6	0.01 J	0.009 J	0 J	0 J	0.037 U	14	0.49	14	5.5	3.9	6.4	0.1 J	985 UJ
09-PMBH-2, 5-10'	10116045003	8.3	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	8.2	0.32	7.9	1.7	1	6.8	0.26	253 U
09-PMBH-2, 6-8'	10116045004	7.9	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	6.6	0.17	6.4	4.1	3.1	6.5	0.15	251 U
09-PMTP-3 4'	10113726005	7.2	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	4.9	0.23	4.8	3.2	2.4	6.6	0.14	550 J
09-PMTP-3 7'	10113726006	6.8	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	6.4	0.28	6.1	3.3	2.4	6.6	0.061	268 J
09-PMTP-3 9'	10113726001	7.2	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	6	0.21	5.7	2.5	1.8	6.7	0.16	1000 UJ
09-PMTP-4 4'	10112793012	6.4	0.022 J	0.025 J	0.0068 J	0 J	0.054	2.2	1.3	0.89	2.9	1	6.8	0.14 J	770 J
09-PMTP-4 8-9'	10112793011	6.8	0.016 J	0.029 J	0.028 J	0 J	0.073	1.5	1.3	0.23	2	0.3	6.9	0.2 J	487 UJ
09-PMTP-5 5'	10112793014	6	0.14	0.069	0.096	0 J	0.31	0.8	5.5	-4.7	13	4.6	6.3	0.58 J	590 J
09-PMTP-5 9-10'	10112793013	6	0.66	1.5	0.015 J	0.016 J	2.2	0.76	62	-62	83	4.6	6.3	0.12 J	494 UJ
09-PMTP-6 2'	10112795019	5.6	0.015 J	0.016 J	0 J	0 J	0.037 U	1.5	0.86	0.62	6	3.9	6.4	0.2 J	1000 UJ
09-PMTP-6 6'	10112795020	6.4	0.01 J	0.01 J	0 J	0 J	0.037 U	2.5	0.55	2	5.6	3.9	6.4	0.069 J	1000 UJ
09-PMTP-7 2'	10113726009	7.5	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	3.7	0.62	3.1	4.7	3.1	6.5	0.19	995 UJ
09-PMTP-7 6'	10112795021	6.3	0.08	0.01 J	0.01 J	0 J	0.1	0.5 U	2.23	-2.2	3.16	0.3	6.9	0.43 J	268 J
09-PMTP-8 1 1/2'	10112795017	6.5	0 J	0.01 J	0 J	0 J	0.037 U	7.2	0.47	6.7	2.8	1.8	6.7	0.53 J	2000 UJ
09-PMTP-9, 2'	10116045005	7.4	0.037 U	0.037 U	0.037 U	0.037 U	0.037 J	2.2	0.63	1.5	5.7	3.9	6.4	0.15	1480
09-PMTP-9 8-9 1/2'	10112795015	4.6	0.06	0.04 J	0 J	0 J	0.09	5.9	2.3	3.6	2.8	0	7	0.65 J	985 UJ
09-PMTP-9 17'	10112795016	6.6	0.19	0.11	0.1	0 J	0.4	1.5	7.9	-6.4	9.9	0	7.1	0.29 J	251 UJ
09-PMTP-10 1 1/2-2 1/2'	10113726007	7.5	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	6.9	0.7	6.2	3.9	2.4	6.6	0.2	1850 J
09-PMTP-10 3'	10113726004	7.3	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	8.4	0.41	8	0.88	0.3	6.9	0.14	1020 J
09-PMTP-11 9-10'	10113726003	7	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	14.1	0.46	13.6	0.95	0.3	6.9	0.073	862 J
09-PMTP-11 12-14'	10113726002	7.1	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	7.6	0.41	7.2	0.88	0.3	6.9	0.076	836 J
Regional Screening Level[†]		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Flag Qualifiers:
J - estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.
U - the compound was analyzed for, but not detected.

- Soil concentration exceeds the Regional Screening Level.
- Soil concentration exceeds the calculated soil screening level (SSL).

** Acid/Base Potential = NP - AP

Potentially Acid Generating:	NP:AP <1 and NNP < -20 tons/kton
Uncertain Acid Generation Potential:	NP:AP between 1 and 3 and/or NNP between -20 and +20 tons/kton
Unlikely to Generate Acid:	NP:AP >3 and NNP < +20 tons/kton

NP = Neutralization Potential
AP = Acidification Potental
NNP = Net Neutralization Potential = Acid/Base Potential

Upper Blackfoot Mining Complex
Shave Gulch Soils Analytical Results
TO 10 - Summer Field Work

TerraGraphics Environmental Engineering, Inc.

Sample ID	LabID	Aluminum SPLP (mg/L)	Arsenic SPLP (mg/L)	Cadmium SPLP (mg/L)	Copper SPLP (mg/L)	Iron SPLP (mg/L)	Lead SPLP (mg/L)	Manganese SPLP (mg/L)	Zinc SPLP (mg/L)	Aluminum (mg/kg)	Arsenic (mg/kg)	As SSL (mg/kg)	Cadmium (mg/kg)	Cd SSL (mg/kg)	Copper (mg/kg)	Cu SSL (mg/kg)	Iron (mg/kg)	Fe SSL (mg/kg)	Lead (mg/kg)	Pb SSL (mg/kg)	Manganese (mg/kg)	Mn SSL (mg/kg)	Zinc (mg/kg)	Zn SSL (mg/kg)
09-SGTP-1 11'	10113726010	32.7 J	0.052	0.0055	0.39	46.8	0.11	0.29	0.11	35,200	60.4 J	116	0.49 U	4	558	18,600	83,600	5,359	140	191	637	1,098	150	27,273
09-SGTP-1 12'	10113726011	29.5 J	0.085	0.0078	0.34	57.9	0.2	0.15	0.12	25,800	72.5 J	85	0.52 U	3	410	15,676	72,200	3,741	162	122	368	1,227	200	33,333
09-SGTP-2 3'	10113726012	39.9 J	0.031	0.0037	0.58	39.4	0.055	0.13	0.076 U	26,800	14.5 J	47	0.47 U	6	594	13,314	58,800	4,477	65.1	178	148	569	78.9	20,763
09-SGTP-2 5'	10113726013	40.2 J	0.035	0.004	0.57	43.1	0.061	0.12	0.1 U	26,700	12.2 J	35	0.47 U	6	561	12,795	48,200	3,355	51.2	126	154	642	61.4	12,280
09-SGTP-2 8'	10113726014	27 J	0.031	0.0034	0.39	37	0.085	0.048	0.11	9,800	10.6 J	34	0.42 U	6	278	9,267	26,000	2,108	85.3	151	31.1	324	38.7 J	7,036
09-SGTP-3 16'	10113726016	66.4 J	0.039	0.0056	0.69	59.6	0.11	0.46	0.16	64,500 J	30 J	77	0.46 U	4	1,270	23,928	152,000 J	7,651	117	160	753 J	818	180	22,500
09-SGTP-3 6'	10113726015	87.6 J	0.051	0.0076	0.96	82	0.12	0.57	0.2	65,300	24.6 J	48	0.53 U	3	1,170	15,844	147,000	5,378	80.9	101	657	576	168	16,800
09-SGTP-4 12'	10113726019	60.2 J	0.069	0.0074	0.67	69.2	0.77	0.85	0.31	29,500	38.7 J	56	1	7	739	14,339	99,100	4,296	667	130	1070	629	270	17,419
09-SGTP-4 2'	10113726017	25.6 J	0.048	0.0052	0.35	50.9	0.29	0.79	0.27	28,400	39.3 J	82	1.2	12	739	27,449	119,000	7,014	501	259	1420	899	330	24,444
09-SGTP-4 6'	10113726018	53.8 J	0.047	0.0058	0.43	56.9	0.35	0.82	0.27	24,100	14.2 J	30	0.66 J	6	281	8,495	50,200	2,647	193	83	866	528	178	13,185
09-SGTP-5 16'	10113729001	43 J	0.039	0.0051	0.4	48.3 J	0.15	0.69 J	0.29	17,800 J	15.3 J	39	0.96	9	238 J	7,735	37,300 J	2,317	161 J	161	1230 J	891	173 J	11,931
09-SGTP-5 9'	10113726020	82.2 J	0.099	0.012	1.2	117	0.37	1.2	0.46	38,300	48.6 J	49	0.81	3	841	9,111	98,500	2,526	367	149	1370	571	311	13,522
09-SGTP-6 2'	10113729002	41.4 J	0.035	0.0042	0.3	44.2 J	0.11	0.66 J	0.31	19,800 J	20.4 J	58	0.41 U	5	228 J	9,880	43,900 J	2,980	206 J	281	367 J	278	107 J	6,903
09-SGTP-6 6'	10113729003	71.3 J	0.063	0.0079	1	77.7 J	0.2	0.86 J	0.28	28,300 J	27.8 J	44	0.74 J	5	657 J	8,541	70,500 J	2,722	142 J	107	588 J	342	123 J	8,786
09-SGTP-7 12'	10113729005	101 J	0.059	0.0097	1.6	107 J	0.089	0.63 J	0.18	50,400 J	15 J	25	0.52 U	3	917 J	7,451	114,000 J	3,196	54.5 J	92	618 J	490	106 J	11,778
09-SGTP-7 8'	10113729004	89.5 J	0.098	0.012	0.82	118 J	0.18	1.1 J	0.49	22,100 J	21.7 J	22	0.49 U	2	197 J	3,123	34,800 J	885	73.3 J	61	322 J	146	100 J	4,082
09-SGTP-8 4'	10113729006	48.2 J	0.044	0.0054	0.29	43.4 J	0.25	0.71 J	0.36	11,700 J	9.6 J	22	0.53 J	5	86.5 J	3,878	20,500 J	1,417	65.7 J	39	483 J	340	111 J	6,167
09-SGTP-8 9'	10113729007	32.1 J	0.033	0.0054	0.37	36.1 J	0.15	1 J	0.34	12,400 J	12.6 J	38	1.3	12	164 J	5,762	21,800 J	1,812	66.9 J	67	804 J	402	187 J	11,000
09-SGTP-9 6'	10113729008	46.5 J	0.066	0.0083	0.77	80.7 J	0.24	0.46 J	0.18	18,000 J	20.1 J	30	0.47 U	3	402 J	6,787	57,200 J	2,126	107 J	67	270 J	293	87.5 J	9,722
09-SGTP-9 9'	10113729009	75 J	0.082	0.011	0.89	108 J	0.33	0.6 J	0.25	22,600 J	32.2 J	39	0.44 U	2	340 J	4,966	56,900 J	1,581	206 J	94	391 J	326	98.9 J	7,912
Regional Screening Level†										77,000	40 *		70		3,100		55,000		400		1,800		23,000	

† April 2009 Regional Screening Level for Chemical Contaminants at Superfund Sites (MDEQ)
SSL = Soil Screening Level generated by SPLP formula.
* - DEQ Action Level for Arsenic in surface soil (DEQ Remediation Division 2005).
Flag Qualifiers:
J - estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.
U - the compound was analyzed for, but not detected.
- Soil concentration exceeds the Regional Screening Level.

SSL (mg/kg) = [HHS (mg/L)/SPLP result (mg/L)] x soil concentration (mg/kg) x 10
Where 10 is the dilution-attenuation factor. Highlighted SSLs are samples with concentrations that exceed the calculated SSL.

The synthetic precipitation leaching procedure (SPLP) analysis is used to estimate the potential for soil to leach metals to groundwater. The SPLP results (mg/L) are used in combination with the results of a soil sample analysis (mg/kg) from the same location to estimate the soil screening level (SSL). The SSL is the site-specific metals concentration in soil that is used to estimate if metals will leach to groundwater. If a soil sample contains metals at a greater concentration than the SSL, then unacceptable levels of metals leaching to groundwater would be expected. If metals concentrations in a soil sample were less than the SSL, then the leaching of metals to the groundwater would be at a rate that would be acceptable to meet groundwater quality standards.

Upper Blackfoot Mining Complex
Shave Gulch Soils Analytical Results
TO 10 - Summer Field Work

Sample ID	LabID	pH Saturated Paste Std.	Sulfur HCl Extractable %(w/w)	Sulfur HNO_3 Extractable	Sulfur Hot Water Extractable	Sulfur Residual %(w/w)	Sulfur %(w/w)	Neutralization Potential (tons/1000)	Acid Potential (tons/1000	Acid/Base Potential** (tons/1000)	Lime Requirement (tons/1000)	SMP Lime Requirement (tons/1000)	SMP Buffer pH Std. Units	Sp.Conductance Saturated Paste (mmhos/cm)	Total Inorganic Carbon
09-SGTP-1 11'	10113726010	6.7	0.09	0.13	0.09	0.037 U	0.31	10.4	6.2	4.2	7.7	0	7	0.24	402 J
09-SGTP-1 12'	10113726011	7.2	0.037 U	0.17	0.17	0.037 U	0.35	9.2	5.5	3.7	6.9	0	7	0.18	539 J
09-SGTP-2 3'	10113726012	7.2	0.037 U	0.21	0.17	0.037 U	0.38	5.3	6.9	-1.5	8.6	0	7.1	0.13	254 U
09-SGTP-2 5'	10113726013	7.1	0.037 U	0.23	0.16	0.037 U	0.37	5.5	7.2	-1.7	9	0	7.2	0.084	253 U
09-SGTP-2 8'	10113726014	6.9	0.037 U	0.094	0.07	0.037 U	0.18	2.1	3.3	-1.2	4.2	0	7.2	0.081	252 U
09-SGTP-3 16'	10113726016	6.7	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	13	0.57	12.4	2	1	6.8	0.075	253 U
09-SGTP-3 6'	10113726015	7.1	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	13.3	0.73	12.6	0.91	0	7	0.17	255 U
09-SGTP-4 12'	10113726019	7	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	7.7	0.56	7.2	0.7	0	7	0.21	375 J
09-SGTP-4 2'	10113726017	7	0.037 U	0.037 U	0.037 U	0.037 U	0.053	3.9	0.9	3	2.4	1	6.8	0.14	3920 J
09-SGTP-4 6'	10113726018	6.7	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	5.6	0.59	5.1	0.74	0	7	0.11	314 J
09-SGTP-5 16'	10113729001	6.5	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	11.2	0.77	10.4	0.96	0	7	0.057 J	513 UJ
09-SGTP-5 9'	10113726020	6.9	0.037 U	0.037 U	0.037 U	0.037 U	0.039 J	6.9	0.91	6	1.5	0.3	6.8	0.12	1000 J
09-SGTP-6 2'	10113729002	6.9	0.037 U	0.037 U	0.037 U	0.037 U	0.039 J	5.8	0.8	5	1	0	7	0.14 J	498 UJ
09-SGTP-6 6'	10113729003	6.6	0.037 U	0.037 U	0.037 U	0.037 U	0.039 J	8.7	0.75	8	0.94	0	7.1	0.1 J	503 UJ
09-SGTP-7 12'	10113729005	7.3	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	6.3	0.56	5.8	0.7	0	7	0.11 J	490 UJ
09-SGTP-7 8'	10113729004	7.1	0.037 U	0.037 U	0.037 U	0.037 U	0.054	6.9	1.2	5.7	2.8	1	6.8	0.15 J	1260 J
09-SGTP-8 4'	10113729006	7.4	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	5.9	0.72	5.2	0.9	0	7	0.17 J	4350 UJ
09-SGTP-8 9'	10113729007	7.4	0.037 U	0.079	0.049 J	0.037 U	0.14	10.8	2.8	8	3.4	0	7.1	0.24 J	2780 UJ
09-SGTP-9 6'	10113729008	7.1	0.037 U	0.12	0.07	0.037 U	0.22	7.1	4.5	2.7	5.9	0.3	6.9	0.31 J	253 UJ
09-SGTP-9 9'	10113729009	7	0.037 U	0.12	0.08	0.037 U	0.21	9.8	4.1	5.8	5.1	0	7	0.13 J	255 UJ
Regional Screening Level†		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

** Acid/Base Potential = NP - AP

Flag Qualifiers:
J - estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.
U - the compound was analyzed for, but not detected.
- Soil concentration exceeds the Regional Screening Level.
- Soil concentration exceeds the calculated soil screening level (SSL)

Potentially Acid Generating:	NP:AP <1 and NNP < -20 tons/kton
Uncertain Acid Generation Potential:	NP:AP between 1 and 3 and/or NNP between -20 and +20 tons/kton
Unlikely to Generate Acid:	NP:AP >3 and NNP < +20 tons/kton

NP = Neutralization Potential
AP = Acidification Potental
NNP = Net Neutralization Potential = Acid/Base Potential

Table 1. Geotechnical Testing Summary
Paymaster and Shave Gulch Sites
Terragraphics

Sample I.D.	Sample Date	Sample Location	Sample Depth (ft)	ASTM D2488 General Material Description	ASTM D2488 USCS Classification Based on Lab Testing	ASTM D2216 Moisture Content As Received (%)	ASTM D4318 Liquid Limit	ASTM D4318 Plastic Limit	ASTM D4318 Plasticity Index	ASTM D4318 Atterberg Classification	ASTM D698 Maximum Dry Unit Weight (pcf)	ASTM D698 Optimum Water Content (%)	Initial Wet Unit Weight (pcf)	Initial Dry Unit Weight (pcf)	ASTM D854 Specific Gravity (-) #10	ASTM C127 Specific Gravity (+) 3/4"	ASTM D5084 Method C Permeability (cm/sec)	CU Triaxial with Pore Pressure ASTM D4767 Method A: Total Stress Angle of Internal Friction (deg.)	Total Stress Cohesion Intercept (psf)	Effective Stress Angle of Internal Friction (deg.)	Effective Stress Cohesion Intercept (psf)
09-PMBH-1	9/16/2009	Paymaster Site Borehole 1	0-2	Silty, Clayey Sand with Gravel	SC-SM	8.17	27	21	6	CL-ML					2.91						
09-PMBH-1	9/16/2009	Paymaster Site Borehole 1	4-5			10.49	32	23	9	CL											
09-PMBH-2	9/16/2009	Paymaster Site Borehole 2	0-2	Poorly Graded Sand with Silty Clay and Gravel	SP-SC	4.58	26	20	6	CL-ML					2.80						
09-PMBH-2	9/16/2009	Paymaster Site Borehole 2	4-6			12.84															
09-PMBH-2	9/16/2009	Paymaster Site Borehole 2	8-10			15.28															
09-PMBH-2	9/16/2009	Paymaster Site Borehole 2	14-14.5			22.14															
09-PMBH-4	9/22/2009	Paymster Site Borehole 4	2-4			4.45															
09-PMBH-5	9/21/2009	Paymaster Site Borehole 5	14-16	Sandy Lean Clay	CL	19.65	44	20	24	CL											
09-PMBH-5	9/21/2009	Paymaster Site Borehole 5	16-18	Clayey Sand	SC	29.80	49	28	21	CL											
09-PMBH-6	9/15/2009	Paymaster Site Borehole 6	2-4			13.96									3.07						
09-PMBH-7	9/16/2009	Paymaster Site Borehole 7	0-2			6.56	23	19	4	CL-ML					2.87						
09-PMBH-7	9/16/2009	Paymaster Site Borehole 7	4-6			16.26															
09-PMBH-7	9/16/2009	Paymaster Site Borehole 7	8-10	Silty Sand	SM	30.57	42	37	5	ML											
09-PMBH-7	9/16/2009	Paymaster Site Borehole 7	12-12.75			20.44															
09-PMBH-8	9/22/2009	Paymaster Site Borehole 8	4-6	Silty Sand with Gravel	SM	10.55	30	25	5	ML											
09-PMBH-8	9/22/2009	Paymaster Site Borehole 8	8-10			12.15															
09-PMBH-8	9/22/2009	Paymaster Site Borehole 8	12-14			8.75															
09-PMBH-9	9/18/2009	Paymaster Site Borehole 9	2-4			22.83	35	25	10	ML											
09-PMBH-9	9/18/2009	Paymaster Site Borehole 9	4-6			19.25															
09-PMBH-9	9/18/2009	Paymaster Site Borehole 9	6-6.5			18.79							141.4	119.1			7.0E-07				
09-PMBH-9	9/18/2009	Paymaster Site Borehole 9	6.5-7			14.52							129.8	113.4			5.4E-07				
09-PMBH-10	9/21/2009	Paymaster Site Borehole 10	6-8			16.99	32	17	15	CL			139.9	119.6			1.8E-07				
09-PMBH-10	9/21/2009	Paymaster Site Borehole 10	14-16			16.10	33	18	15	CL			138.6	119.4			8.9E-08				
09-SGBH-1	9/17/2009	Shave Gulch Site Borehole 1	0-2			10.18															
09-SGBH-1	9/17/2009	Shave Gulch Site Borehole 1	8-10	Clayey Sand with Gravel	SC	18.59	31	21	10	CL											
09-SGBH-1	9/17/2009	Shave Gulch Site Borehole 1	10-12			14.54															
09-SGBH-1	9/17/2009	Shave Gulch Site Borehole 1	14-16			9.32															
09-SGBH-1	9/17/2009	Shave Gulch Site Borehole 1	24-26			10.31															
09-SGBH-2	9/17/2009	Shave Gulch Site Borehole 2	0-2			7.18	22	17	5	CL-ML											
09-SGBH-2	9/17/2009	Shave Gulch Site Borehole 2	2-4			9.08									2.87						
09-SGBH-2	9/17/2009	Shave Gulch Site Borehole 2	6-8			5.34															
09-SGBH-2	9/17/2009	Shave Gulch Site Borehole 2	10-12			13.67															
09-SGBH-2	9/17/2009	Shave Gulch Site Borehole 2	14-16			10.29															
PMTP-4,PMTP-5, PMTP-6 @ 2-3' & PMTP-7 @ 2'(A)	9/11/2009	Paymaster Site Test Pits 4,5,6,7	2-3	Silty Gravel with Sand, GM (Visual Clasification)									132.9	117.8							
PMTP-4,PMTP-5, PMTP-6 @ 2-3' & PMTP-7 @ 2'(B)	9/11/2009	Paymaster Site Test Pits 4,5,6,7	2-3	Silty Gravel with Sand, GM (Visual Clasification)							132	9	132.4	117.3		2.53		19	322	38	0
PMTP-4,PMTP-5, PMTP-6 @ 2-3' & PMTP-7 @ 2'(C)	9/11/2009	Paymaster Site Test Pits 4,5,6,7	2-3	Silty Gravel with Sand, GM (Visual Clasification)									131.2	116.8							

Table 1. Geotechnical Testing Summary
Paymaster and Shave Gulch Sites
Terragraphics

Sample I.D.	Sample Date	Sample Location	Sample Depth (ft)	ASTM D2488 General Material Description	ASTM D2488 USCS Classification Based on Lab Testing	ASTM D2216 Moisture Content As Received (%)	ASTM D4318 Liquid Limit	ASTM D4318 Plastic Limit	ASTM D4318 Plasticity Index	ASTM D4318 Atterberg Classification	ASTM D698 Maximum Dry Unit Weight (pcf)	ASTM D698 Optimum Water Content (%)	Initial Wet Unit Weight (pcf)	Initial Dry Unit Weight (pcf)	ASTM D854 Specific Gravity (-) #10	ASTM C127 Specific Gravity (+) 3/4"	ASTM D5084 Method C Permeability (cm/sec)	CU Triaxial with Pore Pressure ASTM D4767 Method A: Total Stress Angle of Internal Friction (deg.)	Total Stress Cohesion Intercept (psf)	Effective Stress Angle of Internal Friction (deg.)	Effective Stress Cohesion Intercept (psf)
09-PMTP-1 @8' & 09-PMTP-11 9-10' (A)	9/10/09 & 9/14/09	Paymaster Site Test Pits 1, 11	8 & 9-10	Clayey Gravel w/Sand, GC (Visual Classification)									142.9	122.9							
09-PMTP-1 @8' & 09-PMTP-11 9-10' (B)	9/10/09 & 9/14/09	Paymaster Site Test Pits 1, 11	8 & 9-10	Clayey Gravel w/Sand, GC (Visual Classification)							134	13	142.8	122.2		2.81		29	1397	38	0
09-PMTP-1 @8' & 09-PMTP-11 9-10' (C)	9/10/09 & 9/14/09	Paymaster Site Test Pits 1, 11	8 & 9-10	Clayey Gravel w/Sand, GC (Visual Classification)									142.8	122.4							
09-PMTP-1 @8' & 09-PMTP-11 9-10' (D)	9/10/09 & 9/14/09	Paymaster Site Test Pits 1, 11	8 & 9-10	Clayey Gravel w/Sand, GC (Visual Classification)									140.8	120.1			1.1E-06				
09-PMTP-4 @4' & 09-PMTP-7 @6.0' (A)	9/11/2009	Paymaster Site Test Pits 4,7	4 & 6	Clayey Gravel w/Sand, GC (Visual Classification)									125.0	102.3							
09-PMTP-4 @4' & 09-PMTP-7 @6.0' (B)	9/11/2009	Paymaster Site Test Pits 4,7	4 & 6	Clayey Gravel w/Sand, GC (Visual Classification)							114	16	124.5	101.9				17	367	37	0
09-PMTP-4 @4' & 09-PMTP-7 @6.0' (C)	9/11/2009	Paymaster Site Test Pits 4,7	4 & 6	Clayey Gravel w/Sand, GC (Visual Classification)									124.7	101.6							
09-PMTP-9 @8-9.5' & 09-PMTP-10 @3-4' (A)	9/11/2009	Paymaster Site Test Pits 9, 10	8-9.5 & 3-4	Clayey Gravel w/Sand, GC (Visual Classification)									132.2	111.9							
09-PMTP-9 @8-9.5' & 09-PMTP-10 @3-4' (B)	9/11/2009	Paymaster Site Test Pits 9, 10	8-9.5 & 3-4	Clayey Gravel w/Sand, GC (Visual Classification)							122	16	132.3	112.8		2.31		4	3698	25	1442
09-PMTP-9 @8-9.5' & 09-PMTP-10 @3-4' (C)	9/11/2009	Paymaster Site Test Pits 9, 10	8-9.5 & 3-4	Clayey Gravel w/Sand, GC (Visual Classification)									132.4	112.8							
09-PMTP-9 @8-9.5' & 09-PMTP-10 @3-4' (D)	9/11/2009	Paymaster Site Test Pits 9, 10	8-9.5 & 3-4	Clayey Gravel w/Sand, GC (Visual Classification)									132.5	109.2							
09-SGTP-3,4,5,6 @ 2-3' composite(A)	9/15/2009	Paymaster Site Test Pits 3,4,5,6	2-3	Silty Gravel with Sand, GM (Visual Clasiffication)									131.7	115.0							
09-SGTP-3,4,5,6 @ 2-3' composite(B)	9/15/2009	Paymaster Site Test Pits 3,4,5,6	2-3	Silty Gravel with Sand, GM (Visual Clasiffication)							127	10	131.7	115.6		2.40		11	811	39	0
09-SGTP-3,4,5,6 @ 2-3' composite(C)	9/15/2009	Paymaster Site Test Pits 3,4,5,6	2-3	Silty Gravel with Sand, GM (Visual Clasiffication)									131.9	115.6							
09-SGTP-2,7,9 @2' composite	9/14/09-9/16/09	Shave Gulch Site Test Pits 2,7,9	@2	Silty Gravel with Sand, GM (Visual Classification)							128	8				2.28					
09-SGTP-1 @12' & 09-SGTP-2 @6'(A)	9/14/2009	Shave Gulch Site Test Pits 1,2	12 & 2	Clayey Gravel w/Sand, GC (Visual Classification)									130.8	114.0							
09-SGTP-1 @12' & 09-SGTP-2 @6'(B)	9/14/2009	Shave Gulch Site Test Pits 1,2	12 & 2	Clayey Gravel w/Sand, GC (Visual Classification)							131	10	130.5	113.4		2.55		33	274	38	0
09-SGTP-1 @12' & 09-SGTP-2 @6' (C)	9/14/2009	Shave Gulch Site Test Pits 1,2	12 & 2	Clayey Gravel w/Sand, GC (Visual Classification)									131.5	115.0							
09-SGTP-3 @6',SGTP-4 @6',SGTP-5 @9' (A)	9/15/2009	Shave Gulch Site Test Pits 3,4,5	6,6,&9	Clayey Gravel w/Sand, GC (Visual Classification)									135.9	124.2							
09-SGTP-3 @6',SGTP-4 @6',SGTP-5 @9' (B)	9/15/2009	Shave Gulch Site Test Pits 3,4,5	6,6,&9	Clayey Gravel w/Sand, GC (Visual Classification)							131	11	136.8	120.5		2.60		27	839	37	0
09-SGTP-3 @6',SGTP-4 @6',SGTP-5 @9' (C)	9/15/2009	Shave Gulch Site Test Pits 3,4,5	6,6,&9	Clayey Gravel w/Sand, GC (Visual Classification)									136.0	124.4							
09-SGTP-3 @6',SGTP-4 @6',SGTP-5 @9' (D)	9/15/2009	Shave Gulch Site Test Pits 3,4,5	6,6,&9	Clayey Gravel w/Sand, GC (Visual Classification)									133.9	117.8			1.2E-06				
09-SGTP-7 @12',SGTP-9 @9'(A)	9/15/09-9/16/09	Shave Gulch Test Pits 7, 9	12 & 9	Silty Gravel with Sand, GM (Visual Clasification)									136.6	119.9							
09-SGTP-7 @12',SGTP-9 @9'(B)	9/15/09-9/16/09	Shave Gulch Test Pits 7, 9	12 & 9	Silty Gravel with Sand, GM (Visual Clasification)							134	10	136.6	118.5		2.76		31	228	38	226
09-SGTP-7 @12',SGTP-9 @9'(C)	9/15/09-9/16/09	Shave Gulch Test Pits 7, 9	12 & 9	Silty Gravel with Sand, GM (Visual Clasification)									138.1	119.7							

Table 2. Particle Size Distribution Summary
Paymaster and Shave Gulch Sites
Terragraphics

Sample I.D.	Sample Date	Sample Location	Sample Depth (ft)	ASTM D2488 General Material Description	ASTM D2488 USCS Classification Based on Lab Testing	Particle Size Distribution ASTM D422 Passing 3" (%) Passing	Passing #4 (%) Passing	Passing #10 (%) Passing	Passing #200 (%) Passing	Passing 0.002 mm (%) Passing
09-PMBH-1	9/16/2009	Paymaster Site Borehole 1	0-2	Silty, Clayey Sand with Gravel	SC-SM	100	70.6	58.1	18.6	NA
09-PMBH-1	9/16/2009	Paymaster Site Borehole 1	4-5							
09-PMBH-2	9/16/2009	Paymaster Site Borehole 2	0-2	Poorly Graded Sand with Silty Clay and Gravel	SP-SC	100	57.7	42	11.9	NA
09-PMBH-2	9/16/2009	Paymaster Site Borehole 2	4-6			100	71.3	61.4	14.4	NA
09-PMBH-2	9/16/2009	Paymaster Site Borehole 2	8-10							
09-PMBH-2	9/16/2009	Paymaster Site Borehole 2	14-14.5							
09-PMBH-4	9/22/2009	Paymster Site Borehole 4	2-4							
09-PMBH-5	9/21/2009	Paymaster Site Borehole 5	14-16	Sandy Lean Clay	CL	100	98.9	95	52.3	22.2
09-PMBH-5	9/21/2009	Paymaster Site Borehole 5	16-18	Clayey Sand	SC	100	94.9	85.2	47	17.8
09-PMBH-6	9/15/2009	Paymaster Site Borehole 6	2-4			100	76.1	68	10	NA
09-PMBH-7	9/16/2009	Paymaster Site Borehole 7	0-2							
09-PMBH-7	9/16/2009	Paymaster Site Borehole 7	4-6							
09-PMBH-7	9/16/2009	Paymaster Site Borehole 7	8-10	Silty Sand	SM	100	90	79.4	18.2	NA
09-PMBH-7	9/16/2009	Paymaster Site Borehole 7	12-12.75							
09-PMBH-8	9/22/2009	Paymaster Site Borehole 8	4-6	Silty Sand with Gravel	SM	100	78.4	69	20.7	NA
09-PMBH-8	9/22/2009	Paymaster Site Borehole 8	8-10			100	73.8	67.6	17.2	NA
09-PMBH-8	9/22/2009	Paymaster Site Borehole 8	12-14							
09-PMBH-9	9/18/2009	Paymaster Site Borehole 9	2-4							

Table 2. Particle Size Distribution Summary
Paymaster and Shave Gulch Sites
Terragraphics

Sample I.D.	Sample Date	Sample Location	Sample Depth (ft)	ASTM D2488 General Material Description	ASTM D2488 USCS Classification Based on Lab Testing	Particle Size Distribution ASTM D422 Passing 3" (%) Passing	Passing #4 (%) Passing	Passing #10 (%) Passing	Passing #200 (%) Passing	Passing 0.002 mm (%) Passing
09-PMBH-9	9/18/2009	Paymaster Site Borehole 9	4-6			100	58.4	50	19.9	6.5
09-PMBH-9	9/18/2009	Paymaster Site Borehole 9	6-6.5							
09-PMBH-9	9/18/2009	Paymaster Site Borehole 9	6.5-7							
09-PMBH-10	9/21/2009	Paymaster Site Borehole 10	6-8							
09-PMBH-10	9/21/2009	Paymaster Site Borehole 10	14-16							
09-SGBH-1	9/17/2009	Shave Gulch Site Borehole 1	0-2							
09-SGBH-1	9/17/2009	Shave Gulch Site Borehole 1	8-10	Clayey Sand with Gravel	SC	100	71	54.1	38.9	9.7
09-SGBH-1	9/17/2009	Shave Gulch Site Borehole 1	10-12							
09-SGBH-1	9/17/2009	Shave Gulch Site Borehole 1	14-16							
09-SGBH-1	9/17/2009	Shave Gulch Site Borehole 1	24-26							
09-SGBH-2	9/17/2009	Shave Gulch Site Borehole 2	0-2							
09-SGBH-2	9/17/2009	Shave Gulch Site Borehole 2	2-4			100	58.1	47	24.9	7.1
09-SGBH-2	9/17/2009	Shave Gulch Site Borehole 2	6-8							
09-SGBH-2	9/17/2009	Shave Gulch Site Borehole 2	10-12							
09-SGBH-2	9/17/2009	Shave Gulch Site Borehole 2	14-16							