Mine Waste Characterization and Reposistory Evaluation
Various Mines in the Gold Creek Drainage
Lakeview Mining District
Idaho Panhandle National Forests
Bonner County, Idaho

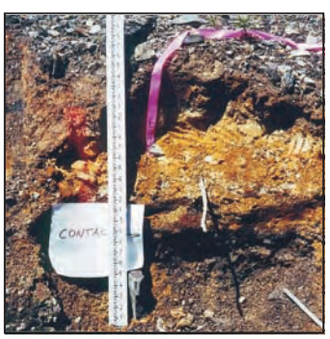
FINAL

Site Investigation and Characterization Report

Volume I

June 2002




USDA Forest Service
Region 1 and IPNF

MAXIM Technologies Inc®

SITE INVESTIGATION AND CHARACTERIZATION REPORT

MINE WASTE CHARACTERIZATION & REPOSITORY EVALUATION
VARIOUS MINES IN THE GOLD CREEK DRAINAGE
LAKEVIEW MINING DISTRICT
IDAHO PANHANDLE NATIONAL FORESTS
BONNER COUNTY, IDAHO

SITE INVESTIGATION AND CHARACTERIZATION REPORT

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VARIOUS MINES IN THE GOLD CREEK DRAINAGE
LAKEVIEW MINING DISTRICT
IDAHO PANHANDLE NATIONAL FORESTS
BONNER COUNTY, IDAHO

PREPARED FOR:

USDA Forest Service – Region 1
P.O. Box 7669
Missoula, Montana 59807

PREPARED BY:

Maxim Technologies, Inc.®
2436 Dixon Avenue
P.O. Box 2730
Missoula, Montana 59806

June 2002

EXECUTIVE SUMMARY

Maxim Technologies, Inc.® (Maxim) characterized six mine waste sites in the Gold Creek drainage, Idaho Panhandle National Forests, Lakeview Mining District, Bonner County, Idaho. The work was commissioned by the U.S. Department of Agriculture, Forest Service, Region 1 and completed under the terms and conditions of Contract No. 53-0343-0-0014, Delivery Order No. 42-0343-0-0309. The purpose of the investigation was to further characterize and to estimate volumes of various mine waste materials at the Conjecture Mine, New Rainbow Mine, Weber Mine, Keep Cool Mine, Idaho Lakeview Mine, and a portion of Chloride Gulch below the Idaho Lakeview Mine. Data generated during the characterization studies are intended to support mine waste remediation decisions for the Gold Creek drainage.

PROJECT OBJECTIVES

The Forest Service identified the six sites in the Lakeview Mining District as priority sites for mine waste characterization based on the potential for public health, safety, and/or environmental impacts associated with mine wastes. Additional information regarding the nature, extent, and magnitude of mine waste was necessary to facilitate and evaluate potential remedial actions. To that end, the Forest Service authorized a comprehensive mine waste characterization study with the following objectives:

- Document metals concentrations in mine wastes to characterize the extent and degree of contamination due to mining and processing operations.
- Determine the volume of mine wastes and areas of disturbance at the six sites.
- Prepare topographic base maps for each site showing pertinent natural and cultural features, sampling stations, and the approximate extent of mine waste material.

METHODS

Maxim completed the characterization study in November 2000 and June 2001 in general accordance with provisions contained in several planning documents including, a project work plan, a sampling and analysis plan (including a field sampling plan and quality assurance plan), and health and safety plan. More than 320 mine waste, sediment and soil samples were collected at the six sites using drilling methods, backhoes, and hand sampling tools. Over 150 of these samples were submitted to analytical laboratories for total and leachable metals analyses, acid/base account analysis, and physical properties testing.

Engineering surveys were completed at each site and maps showing mine waste locations, sampling stations, site features, and topography were generated. Distinct areas of mine waste were evident at most sites and were identified as such on maps. Approximate ($\pm$15 %) volumes of mine waste at each site were estimated.

Total and leachable metals data generated during this mine waste characterization study were compared to cleanup guidelines developed for recreational exposure at abandoned mine sites and to Idaho's chronic aquatic life standards, respectively. Analytical data from individual mine waste areas were assessed to determine which metals exceeded applicable guidelines and standards in both individual samples and in the average for samples in a given area. Using this approach, each of 19 identified mine waste areas at the sites can be treated uniquely should future selective or phased remedial actions be considered.

KEY FINDINGS

Table ES-1 summarizes key findings and identifies the six sites and the estimated volume of mine waste in the 19 waste areas. Also presented in the summary table are exceedences of total metals relative to cleanup guidelines, exceedences of leachable metals relative to aquatic standards, and total lime requirements.

Mine Waste Volumes

About 220,000 cubic yards of mine waste were mapped at 19 waste areas at the six sites. Largest mine waste volumes were found at the Conjecture Mine (82,250 cubic yards) and Weber Mine (76,450 cubic yards). The Keep Cool Mine and Idaho Lakeview Mine had similar total waste volumes (25,640 and 27,530 cubic yards, respectively). Included in the Idaho Lakeview Mine total is approximately 2,260 cubic yards of tailings. Waste rock found at the New Rainbow Mine was approximately 6,100 cubic yards and a discrete tailings deposit in Chloride Gulch is estimated at 1,000 cubic yards.

Total Metals

Cleanup guidelines were exceeded for five metals (antimony, arsenic, cadmium, lead, and manganese). Besides manganese, arsenic and lead guidelines were exceeded the most frequently. Antimony in excess of the cleanup guideline was only exceeded at samples from the Weber Mine. The cleanup guideline for cadmium was exceeded in samples from 10 of the 19 waste areas.

Of the 19 waste areas, nine areas exhibited average concentrations of arsenic, cadmium and lead in excess of cleanup guidelines. By far the greatest volume of these wastes is found at the Idaho Lakeview Mine.

TABLE ES-1
SUMMARY OF KEY FINDINGS
SITE INVESTIGATION AND CHARACTERIZATION
Various Mines in the Gold Creek Drainage, Idaho Panhandle National Forests

SITE	WASTE AREA	ESTIMATED VOLUME (cubic yards)	CLEANUP GUIDELINES FOR TOTAL METALS (mg/kg)										CHRONIC AQUATIC STANDARDS FOR LEACHABLE METALS (mg/L)						TOTAL LIME REQUIREMENT	
			Exceeded in One or More Samples					Exceeded in Average					Exceeded in One or More Samples						Maximum Value (t/1000t)	Average Value (t/1000t)
			Sb	As	Cd	Pb	Mn	Sb	As	Cd	Pb	Mn	As	Cd	Cu	Pb	Hg	Zn		
			293	700	19.5	1,100	665	293	700	19.5	1,100	665	0.19	0.00059	0.006	0.0011	0.000012	0.055		
CONJECTURE MINE	North Dump	55,240		X	X	X	X					X				X			39	4
	Southwest Waste Rock	8,880	X	X	X	X	X		X	X	X	X				X		X	254	161
	Mid-South Waste Rock	14,510					X						--	--	--	--	--	--	<1	<1
	Southeast Waste Rock	3,620		X	X	X	X		X	X	X	X		X	X	X		X	71	60
	SITE TOTAL	82,250							X		X	X							254	43
NEW RAINBOW MINE	Main Waste Rock Dump	6,100				X	X					X					X	X	<1	<1
	SITE TOTAL	6,100										X							<1	<1
WEBER MINE	Waste Rock-1	1,350		X		X	X		X		X	X	--	--	--	--	--	--	7	7
	Waste Rock-2	71,500	X	X		X	X	X			X	X		X		X	X	X	13	<1
	Waste Rock-3	3,600	X	X	X	X	X		X	X	X	X				X	X	X	25	9
	SITE TOTAL	76,450						X	X		X	X							25	<1
KEEP COOL MINE	Waste Area 1	1,610	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Waste Area 2	2,680				X	X				X	X						X	13	3
	Waste Area 3	4,500		X		X	X		X	X	X							X	137	137
	Waste Area 4	5,530				X	X			X	X	X	--	--	--	--	--	--	113	72
	Waste Area 5	2,860	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Waste Area 6	8,460		X		X	X				X	X		X	X	X	X	X	85	24
	SITE TOTAL	25,640									X	X							137	26
IDAHO LAKEVIEW MINE	South Waste Rock	24,460	X	X	X	X	X		X	X	X	X		X				X	171	50
	Mill Waste Rock	810		X	X	X	X		X	X	X	X						X	142	142
	Tailing Waste	2,260	X	X	X	X	X		X	X	X	X	X	X	X	X		X	141	53
	SITE TOTAL	27,530							X	X	X	X							171	51
CHLORIDE GULCH	Diffuse Buried Tailings	?		X	X	X	X		X	X	X	X	X	X	X	X	X	X	34	11
	Exposed Tailings Pile	1,000		X	X	X	X		X	X	X	X	--	--	--	--	--	--	15	15
	SITE TOTAL	1,000+							X	X	X	X							34	12

Notes:
Total metals cleanup standard based on recreational exposure (Tetra Tech 1996)
Chronic Aquatic Life Standard relative to hardness of 47 mg/L as CaCO3 (IDAPA 16.01.02.250)
Data presented are based on samples designated in the field as mine waste (waste rock or tailing)
Averages calculated using one-half the PQL for results less than the PQL
Includes data that are qualified with M, JF% and B

Key

--	Not sampled
	Not applicable
X	Exceedence of cleanup guideline for total metals
X	Exceedence of Idaho chronic aquatic life standards
45	Moderately high total lime requirement (30 to 100 t/1000t)
137	High total lime requirement (>100 t/1000t)

Leachable Metals

At least one of six leachable metals was detected in a sample at each site at concentrations in excess of Idaho's chronic aquatic life standards. In order of the number of exceedences, leachable concentrations of zinc (12 waste areas), lead (eight waste areas), and cadmium (six waste areas) were detected most frequently. Most leachable metals (five or more) were measured above standards in samples collected from Waste Area 6 at the Keep Cool Mine, Tailing Waste at the Idaho Lakeview Mine, and in Buried Tailings in Chloride Gulch.

Total Lime Requirements

Total lime requirements varied in samples from less than one-ton calcium carbonate equivalent per 1,000 tons of waste (1 t/1000t) to greater than 250 t/1000t. Average total lime requirement for mine waste sampled at the New Rainbow Mine and Weber Mine is less than 1 t/1000t. The most acidic mine waste areas (average of >130 t/1000t total lime requirement) are the Southwest Waste Rock area at the Conjecture Mine, Waste Area 3 at the Keep Cool Mine, and Mill Waste Rock at the Idaho Lakeview Mine. Site average total lime requirements were less than 30 t/1000t at all sites except the Conjecture Mine and the Idaho Lakeview Mine.

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1.0 INTRODUCTION

Maxim Technologies, Inc.® (Maxim) prepared this site characterization report for the U.S. Department of Agriculture, Forest Service, Region 1, under the terms and conditions of Contract No. 53-0343-0-0014, Delivery Order No. 42-0343-0-0309. Maxim developed a work plan for the project dated August 28, 2000, and a Sampling and Analysis Plan (SAP), Quality Assurance Project Plan (QAPP) and Health and Safety Plan (HASP) dated October 2000 (Maxim 2000) to guide the work. Site investigation and characterization work was completed by following the National Contingency Plan non-time-critical response action process and associated Environmental Protection Agency (EPA) guidance documents (EPA, 1993).

This document describes the results of field investigations performed for six sites in the Gold Creek drainage, Idaho Panhandle National Forests (IPNF), Lakeview Mining District, Bonner County, Idaho. The purpose of the investigations was to further characterize impacts associated with historic hard rock mining and to estimate volumes of mine waste materials at the six sites. Data presented in this report will be used to support mine waste remediation decisions in the Gold Creek drainage.

1.1 OBJECTIVES

Six sites in the Lakeview Mining District have been identified by the Forest Service as priority sites for mine waste characterization. Mine site names, along with an Idaho Geologic Survey (IGS) site number, are Conjecture Mine (SP-18), New Rainbow Mine (SP-24), Weber Mine (SP-25), Keep Cool Mine (SP-21), Idaho Lakeview Mine (SP-19), and a portion of Chloride Gulch below the Idaho Lakeview Mine (no site number). Potential environmental impacts from historic mine wastes present at these six sites may include increased sediment load to surface water, increased metal concentrations in surface water and groundwater, and health and safety risks to the public.

The following objectives were established for the investigative and characterization work:

- Document metals concentrations in mine wastes to characterize the extent and degree of contamination due to mining and processing operations.

- Determine the volume of mine wastes and areas of disturbance at the six sites.

- Prepare topographic base maps for each site showing pertinent natural and cultural features, sampling stations, and the approximate extent of mine waste material.

1.2 REPORT ORGANIZATION

This report is presented in two volumes. Volume I (this volume) contains the text, figures, and summaries of supporting data. This introductory section continues with a description of the six sites and a brief history of mining at the Conjecture, New Rainbow, Weber, Keep Cool, and Idaho Lakeview Mines. A narrative of the general geologic, hydrologic, and hydrogeologic features of the study area is also presented.

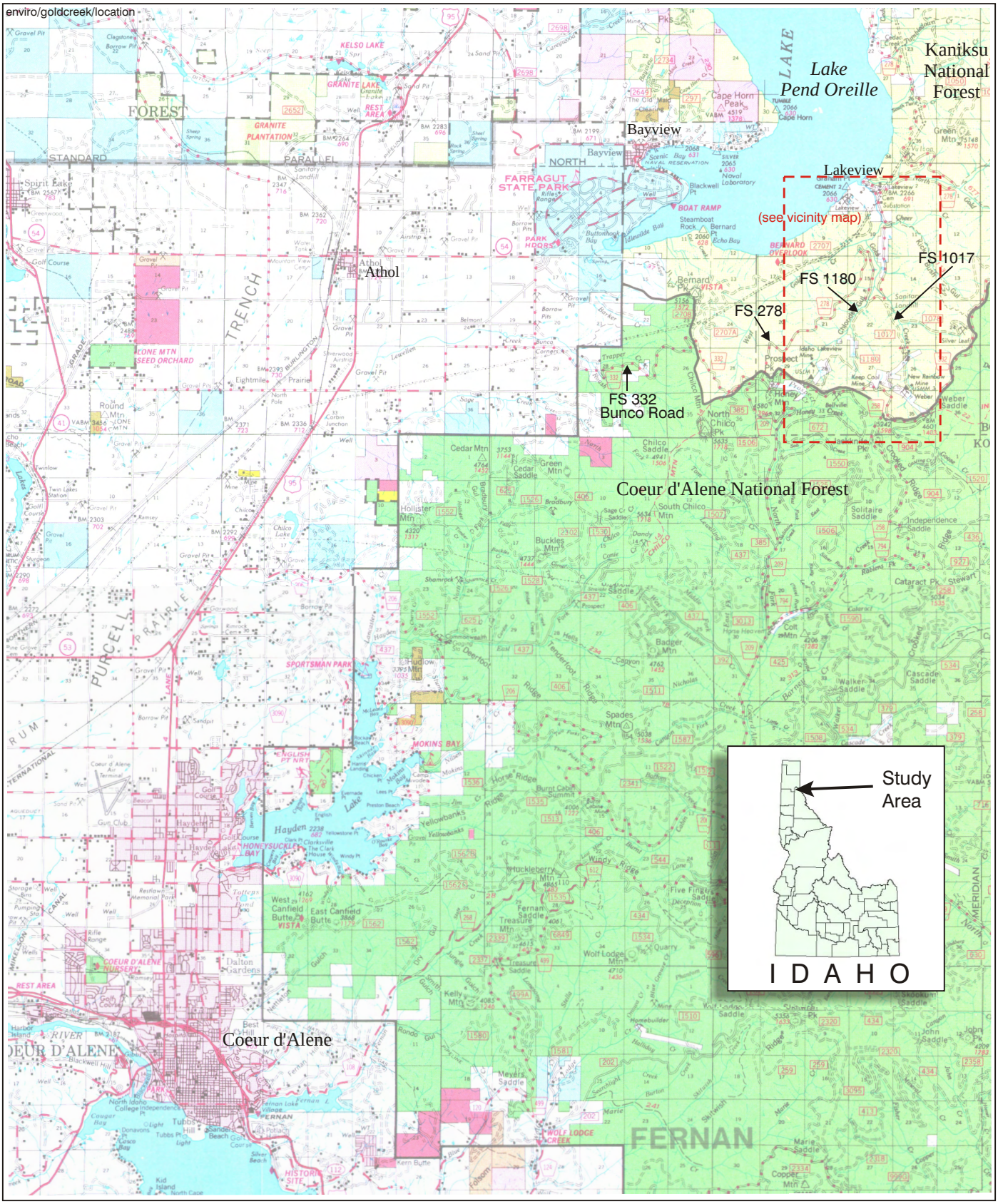
Sections 2.0, 3.0, and 4.0 of this report present investigative methods, results, and data quality assurance/quality control assessment, respectively. In our methods section (Section 2.0), we include a list of deviations from the SAP and offer our rationale of comparing metals data collected during the investigation to background data, cleanup guidelines for solid material, and applicable chronic aquatic life standards. Section 3.0 presents results, organized by site, related to mine waste distribution and thickness, chemical and physical characteristics of materials sampled, and estimates of mine waste volumes. An assessment of data quality assurance/quality control with respect to the QAPP is included as Section 4.0. A list of references cited in this report is presented in Section 5.0.

Supporting data for this report are contained in Appendices A through M. Tables of chemical and physical data are included in Appendix A and the complete project database is contained in Appendix B. Appendices C and D contain borehole and test pit logs, and selected photographs taken at each site, respectively. Appendix E contains plates in D-size format for each of the six sites. Volume II of this report contains data validation documentation in Appendices F through L. Copies of analytical laboratory and material testing reports arranged in chronological order are contained in Appendix M (Volume II).

1.3 SITE LOCATIONS AND DESCRIPTIONS

The Lakeview Mining District is located in the southern portion of Bonner County, approximately 10 miles east of Athol, Idaho. The district is bound by the southeastern end of Lake Pend Oreille and is accessed from the west by Bunco Road (Forest Service [FS] Road No. 332). The six sites are in the Idaho Panhandle National Forests (also known as the Kaniksu National Forest) and are all situated within the Gold Creek drainage (Figure 1). Table 1 presents a summary of general information for each of the six sites.

The Conjecture Mine is located 6 miles south of the town of Lakeview on Gold Creek (North ½, Section 26, T. 53 N., R. 1 W.). The site is accessible by spur roads from FS 1017 (Figure 2). The Conjecture was a large mine consisting of two shafts, two collapsed adits, several surface buildings, and two large waste dumps (Idaho Geologic Survey [IGS], 1997). The upper, or



From USFS Idaho Panhandle National Forests

MAXIM 2009168

Location Map, Gold Creek Drainage
Mine Waste Characterization and Repository Evaluation
Idaho Panhandle National Forests
Bonner County, Idaho
FIGURE 1

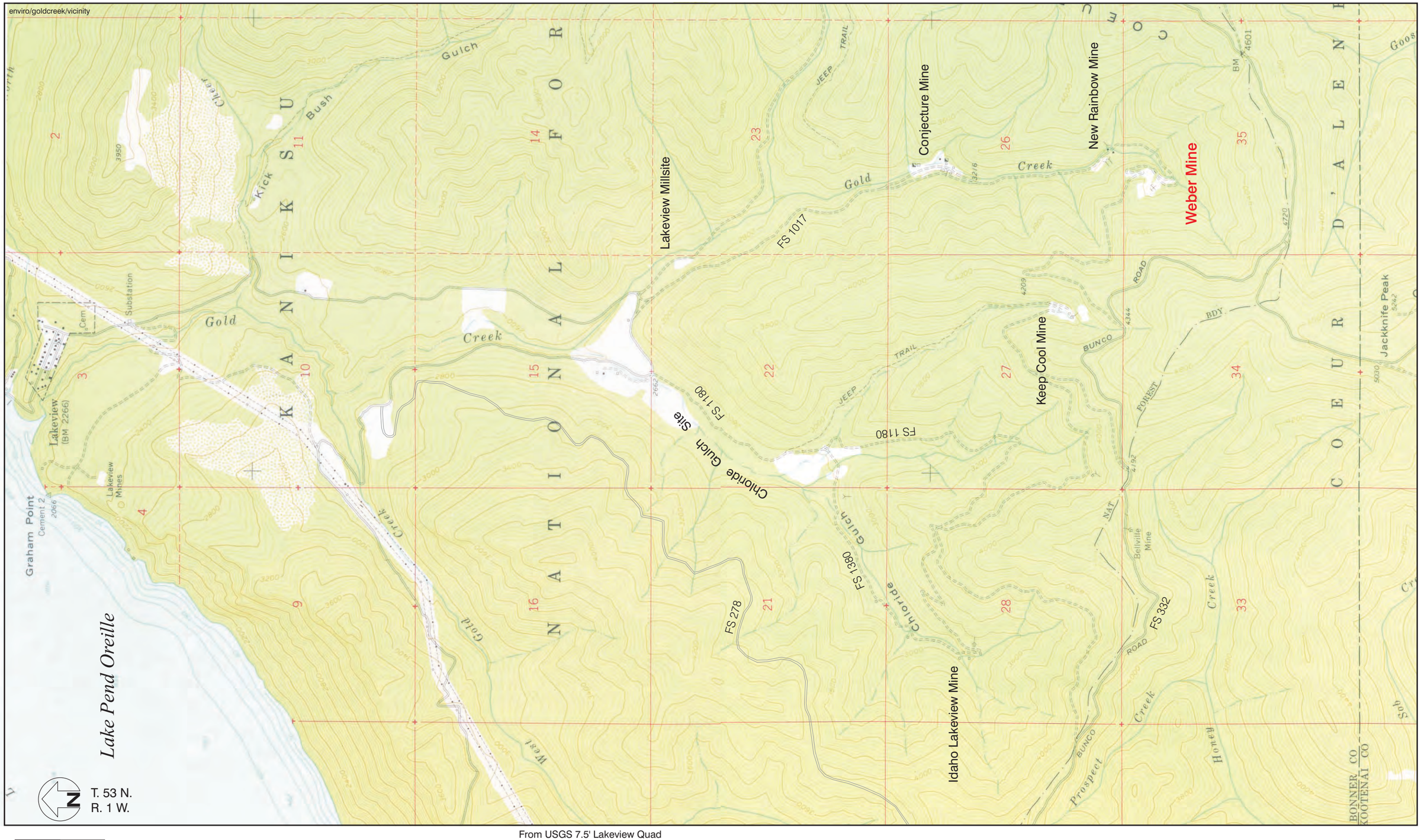
TABLE 1

SUMMARY OF SITE INFORMATION

MINE WASTE CHARACTERIZATION & REPOSITORY EVALUATION
VARIOUS MINES IN THE GOLD CREEK DRAINAGE, LAKEVIEW MINING DISTRICT
IDAHO PANHANDLE NATIONAL FOREST, BONNER COUNTY, IDAHO

SITE	LOCATION	ACCESS ROAD	OWNERSHIP	GEOLOGIC FEATURES	CULTURAL FEATURES	SHAFTS	ADITS	GENERAL MINE WASTE AREAS	SURFACE WATER
Conjecture Mine	N 1/2, Sec 26, T53N, R1W	FS Road 1017 Unimproved road on west side of site parallel to FS 1017	Patented Claims surrounded by National Forest	Lower Mm Wallace Fm	Two cabins, trailer, headframe, hoist building, various concrete foundations	Shaft 1, Collapsed Shaft 2	Adit 1, caved Adit 2, caved	South waste rock dump North waste rock dump South end dump east of Gold Creek, west of tributary Waste rock dumps below adits	Gold Creek, flowing Gold Creek tributaries, flowing Seepage from both adits
Idaho Lakeview Mine	NW 1/4, Sec 28, T53N, R1W	FS Roads 332 & 1180 FS Roads 278, 1180 & 1380	Patented Claims surrounded by National Forest	Middle Mm Wallace Fm Low to massive sulfide ore	Collapsed mill building, various collapsed buildings, outhouse, ore/waste rock car tracks and trestle, various concrete foundations		Adit 1, open Collapsed Adit, south end	Upper waste rock dump Millsite waste material Flotation tailing deposit Possible buried mill impoundment	Chloride Gulch Creek, flowing Seepage from Adit 1
New Rainbow Mine	S 1/2, Sec 26, T53N, R1W	FS Road 1017	National Forest	Lower Mm Wallace Fm	Collapsed building by Adits 1,2 Two collapsed shacks on south end		Adit 1,open (not found) Adit 2, caved (not found) Adit 3, caved	Waste rock dump	Seepage from collapsed adit Gold Creek, flowing
Weber Mine	NW 1/4, Sec 35, T53N, R1W	FS Road 1017	Patented Claims surrounded by National Forest	Lower Mm Wallace Fm Lamprophyre dikes, sulfides	Cabin			High upper waste rock dump Upper waste rock dump Lower waste rock dump Possible mill tailings near Gold Creek	Seep in bottom of open pit Gold Creek, flowing
Keep Cool Mine	SE 1/4, Sec 27, T53N, R1W	FS Road 1017	Patented Claims surrounded by National Forest	Lower Mm Wallace Fm Massive sulfide ore	Remains of old mill near Adit 1 Possible remains tailings impoundment Collapsed shaft by Adit 3 Logging debris ubiquitous Collapsed buildings	Possible shaft or adit	Adit 1, open Adit 2, caved Adit 3, caved Adit 4, caved (not found) Adit 5, caved (not found)	Possible jig tailings Waste rock Possible stream sediment	Seep 50 ft from Adit 1 Tributary to Chloride Gulch
Choride Gulch	Sec 21, 22 and 28, T53N, R1W	FS Roads 278 & 1180	National Forest	Chloride Gulch alluvium				Buried tailing deposits in flood plain Vegetated tailing deposit	Chloride Gulch Creek, flowing in places Tributaries from east and west

Notes:
Information sources: IGS, 1997, USFS RFP to Maxim dated 8/10/00, Site visit with USFS and Maxim on 10/11/00
NM - not measured
Blank cell indicates no information available or feature not present



From USGS 7.5' Lakeview Quad

Approx. 2000 Feet

MAXIM 2009168

Vicinity Map, Gold Creek Drainage
Mine Waste Characterization and Repository Evaluation
Idaho Panhandle National Forests
FIGURE 2

Southern, waste rock dumps consist of material from two collapsed adits and the caved No. 1 Shaft. The No. 1 Shaft is located on the west side of Gold Creek near the south end of the property. The two collapsed adits are located east of Gold Creek and a Gold Creek tributary. The lower, or northern, dump is primarily waste rock from the No. 2 Shaft. The No. 2 Shaft is reportedly over 2,000 feet deep (IGS, 1997) and is enclosed at the surface by a concrete headframe.

The New Rainbow Mine is about 5 miles south of Lakeview and 1 mile south of the Conjecture Mine (Figure 2). The New Rainbow Mine is located in the South ½, Section 26, T. 53 N., R. 1 W. on the west side of FS 1017. The mine accessed underground workings near and beneath the Weber open pit mine. Three collapsed adits, two collapsed buildings, and various debris are currently present on the site. A long and narrow waste rock dump is located above and parallel to FS 1017. The dump has been reworked into terrace-like features. A seep issues from an adit and infiltrates into the waste dump.

The Weber Mine consists of an "amphitheater-shaped" open pit facing southeast. The mine is located in the Northwest ¼, Section 35, T. 53 N., R. 1 W., approximately ¼-mile south of the New Rainbow Mine on FS 1017 (Figure 2). A seep discharges in the floor of the pit. In addition to the open pit, there are two primary waste rock dumps at the site. The upper dump extends from the north pit wall east to FS 1017. The lower dump extends eastward along the south end of the pit. The base of the lower dump extends to and impinges upon Gold Creek.

The Keep Cool Mine is about 5.5 miles south of Lakeview on the east branch of Chloride Gulch (Southeast ¼, Section 27, T. 53 N., R. 1 W.). The upper end of the site is adjacent to FS 1017 (Figure 2). Underground workings at the site were developed by five adits (IGS, 1997). The lowermost adit is open and generates a slight flow of water. The other four adits are either collapsed or partially collapsed. At the base of the site on the north end are building remains, which the IGS (1997) reports may have been a mill with associated jig tails.

The Idaho Lakeview Mine is located in Chloride Gulch, about 5 miles south of Lakeview (Northwest ¼, Section 28, T. 53 N., R. 1 W.). The site is accessible by FS 1180 and FS 1380 (Figure 2), with the exception of two road washouts, or by FS 332. The mine consists of one adit, a waste dump, a partially collapsed mill, various collapsed buildings, and a tailing deposit on the north side of the site. The waste dump is located on the south side of the property and consists of material excavated from the open adit, which is on the east side of the waste dump. Seepage from the adit drains to Chloride Gulch Creek, which is located immediately west of the waste dump. The tailing disposal area is on the north end of the site and the northernmost end is bisected by Chloride Gulch Creek.

The Chloride Gulch site extends from the northern end of the Idaho Lakeview Mine for approximately 2 miles to about 1,000 feet downstream of the intersection of FS 1180 and FS 278 (Figure 2). FS 1180 is generally parallel to the site. Numerous tributaries (e.g., East Fork of Chloride Gulch and Keep Cool Mine Gulch) join Chloride Gulch along the reach investigated. Chloride Gulch is heavily vegetated and flows only intermittently in the lower 1 mile of the area studied.

1.4 MINING HISTORY

The first claims in the Lakeview district were staked on September 27, 1888 on quartz outcrops that are now part of the Weber Mine (Sampson, 1928 *in* Kun, 1974). The first carload of ore was shipped from the area to Great Falls, Montana, in January 1889. From 1901 to 1981, the mines discussed in this report produced a total of 170,996 tons of ore. This material yielded 3,694 ounces of gold, 1,203,779 ounces of silver, 33,672 pounds of copper, 1,276,320 pounds of lead, and 213,285 pounds of zinc.

In 1992, the FS and the IGS entered an agreement to inventory abandoned and inactive mines on or affecting Forest Service lands in Idaho. The work included conducting site inspections of 22 mining properties in the Lakeview Mining District in 1996 (including the five mine sites discussed herein) and developing the history of selected mines in the district. The following mining history discussion is based entirely on information reported in IGS (1997 and 2000) and Kun (1974).

1.4.1 CONJECTURE MINE

The Conjecture Mine was discovered in 1894 in a slate shale and quartzite host rock (IGS, 2000). Two main veins formed in shear zones were targeted for mining (the Conjecture Vein and the Weber Vein). Typical ore from the mine included galena, sphalerite and pyrite (IGS, 2000). In 1953, IGS (2000) reports that a 60-tons-per-day (tpd) flotation mill was constructed at the site. The duration of milling is not apparent, but by 1962 plans to reactivate a 100-tpd mill at the site were reported in IGS (2000). A further description of the history of the Conjecture Mine is presented below.

Kun (1974) described the history of the Conjecture Mine as follows:

> *Located in 1894, the Spider and Graham adits produced high grade ore until the early 1920's, when the inclined shaft [No. 1] was started. The incline replaced a vertical shaft that had been damaged by fire (Sampson, 1928). Lakeview Silver Mines Co. operated the mine intermittently from the 1920's until early 1951 when the mine and adjacent patented claims were purchased by D.E. Majer and L.H. Funnel, who formed Conjecture Mines, Inc. The company mined ore from four levels using the inclined shaft until 1956 when Federal Resources Corporation leased the property in order to undertake an exploration program. By 1963, Federal Resources had finished a 2,000 ft. shaft [No. 2],*

> *about 500 ft. northeast from the incline (P1.4 [omitted]), and had driven over 13,000 ft. of drifts from four levels. The results of the exploration work were not satisfactory to Federal Resources and property was returned to Conjecture Mines, Inc. in 1965. In 1967, Duval Corporation leased all the property and conducted surface exploration including soil sampling and detailed mapping. Duval Corporation also initiated underground exploration by partially de-watering the vertical shaft and by core drilling from the surface to a depth in excess of 4,000 feet. The property was once again returned to Conjecture Mines in 1970.*

IGS (1997) added the following:

> *There was little activity at the property from 1970 until 1978, when the Sunshine Mining Company renewed an exploration agreement with Conjecture Mines. In 1980, Conjecture Mines, under an operating agreement with Minerals Management, Inc., evaluated the silver-lead potential of the mine. Conjecture thought about sinking an inclined shaft at the property in 1981, but this was not done. There was no further activity until 1995, when Royal Silver Mines, Inc., obtained a lease on the Conjecture and announced plans for an aggressive exploration program, if funds were available.*

Total production from the Conjecture Mine was 12,663 tons of ore yielding 111 ounces of gold, 81,333 ounces of silver, 13,825 pounds of copper, 90,983 pounds of lead, and 53,778 pounds of zinc (IGS, 1997).

1.4.2 NEW RAINBOW MINE

IGS (1997, pg. 75) described the history of the New Rainbow Mine as follows:

> *Kun (1974) notes that the Weber Mine (which was the first discovery in the Lakeview District), was originally developed by four underground levels before the Weber open pit was started in the 1940s. After World War II, the underground workings were leased by the New Rainbow Mining Company and became known as the New Rainbow Mine…*
>
> *…Serious operations began in the second half of 1949 when the Lakeview Lease operated the Weber Mine (under the lease, it was known as the New Rainbow Mine) as an underground operation. The New Rainbow Mining Company continued shipping ore from the underground workings until 1956. The ore was either shipped directly to smelters or processed at the Idaho Lakeview Mill as there was no mill at the New Rainbow. Like the ore from the Weber pit, the underground ore was very siliceous and was used as a flux for smelting copper at the Tacoma smelter.*

Most of the production from the New Rainbow Mine has been reported with that of the Weber Mine open pit. Production from the New Rainbow Mine reported separately includes 8,227 ounces of silver and 10,171 pounds of lead from 115 tons of ore.

1.4.3 WEBER MINE

According to IGS (1997, pg. 58):

> *The first shipment of ore from the Weber Mine recorded by the U.S. Geological Survey/U.S. Bureau of Mines was in 1916. The next mention was in 1922, when the Lakeview Mining and Milling Company shipped several cars of rich silver ore from the underground mine. One car of silver concentrates was shipped in 1934. It was processed in a 15-tpd flotation mill at the site…*
>
> *…In 1954, the Austin Meyer Corporation began shipping ore from the Weber open pit, which was developed above the No. 3 level of the underground workings. Mining from the open pit continued until 1965. The surface ore was shipped to the Tacoma smelter, where the charge for treating the ore was low because the high-silica content of the material made it desirable as a flux for copper smelting.*
>
> *In 1980, Shoshone Silver Mining Company milled 600 tons of ore from the open pit at the Weber. The company had signed operating agreements with Lakeview Consolidated Silver Mines, Inc., on several properties in the Lakeview district. Their new mill was centrally located to the district's mines. By 1983, full operations were underway processing oxidized ore from open pits at the Weber Mine (leased from Sunshine Mining Company and Lakeview Consolidated Silver Mines, Inc.) By October, the company had sold 10,757 ounces of silver to Sunshine for refining. Development and mill improvement continued until 1985, by which time a 10,000-ton ore stockpile had been accumulated. By 1987, the company had a 100% interest in the Weber. Shoshone Silver ceased all operations in the district in 1992, waiting for better metal prices. Since then, there has been no activity at the mine or mill.*

The Weber Mine produced 3,455 ounces of gold, 875,356 ounces of silver, 6,596 pounds of copper, 756,603 pounds of lead, and 41,409 pounds of zinc from 127,011 tons of ore (IGS 1997).

1.4.4 KEEP COOL MINE

IGS (1997, pg. 65) described the history of the Keep Cool Mine as follows:

> *In 1928, the underground workings at the Keep Cool Mine included five adits (Savage, 1967). In 1937, the lower (No. 5) level was used as the main haulage level, and ore from the mine was processed in the adjacent mill and shipped by truck to Bunker Hill smelter (Kotschevar, 1938). That year, the mine, operated by the Silver Leaf Mines Corporation, accounted for the entire output of the Lakeview district. The company also built a 50-tpd flotation plant in 1937, which only operated until 1938.*
>
> *Plans were announced to reopen the mine in 1942, using funds from a Reconstruction Finance Corporation loan. The ore was to be processed in the Idaho Lakeview mill 4½ miles away. The Idaho Lakeview mill was being rehabilitated as recommended by the Knapp Refractory Ore Process Company.*
>
> *About 200 tons of ore were mined in 1943. There is no further mention of the property until 1950, when there was some production until 1954.*

In 1957, the Federal Uranium Corporation acquired control of the adjoining Keep Cool and Hewer mines and made preliminary plans to work them from a shaft of the Conjecture property. As noted, most of Federal's efforts were concentrated at the Conjecture Mine, and there was little work done at the Keep Cool. Kun (1974) notes that the No. 5 level at the Keep Cool was reopened in 1967 by the Sunshine Mining Co., who had leased the property.

In 1980, Shoshone Silver Mining Company milled 600 tons of ore from the Keep Cool and the Weber open pit. The company had operating agreements with Lakeview Consolidated Silver Mines, Inc., on several properties in the area. However, in 1981, the company closed its operations in the Lakeview district because of declining metal prices.

In 1983, full operations were again under way at Shoshone Silver's mill and mines. Oxidized ore from the open pit at the Weber and from the Keep Cool (leased from Sunshine Mining Company and Lakeview Consolidated Silver Mines, Inc.) was processed at a carbon-in-pulp leaching plant. BY 1987, Shohone Silver had a 98 percent interest in the Keep Cool group and a 100 percent interest in the Weber and Weil (Drumheller) group. In 1990 the company drove about 350 feet of new drift at the Keep Cool and was stockpiling lead/silver ore, waiting for more favorable prices. In 1991, a 2- to 3-man crew drove 200 feet of exploration drift at the mine, after which all operations ceased.

According to the U.S. Bureau of Mines, production from the Keep Cool Mine was 474 ounces of gold, 35,180 ounces of silver, 29,250 pounds of copper, 479,739 pounds of lead, and 616,127 pounds of zinc from 10,415 tons of ore and 230 tons of reprocessed tailings. Most of the production occurred from 1937 to 1954.

1.4.5 IDAHO LAKEVIEW MINE

According to IGS (1997, pg. 47):

The first mention of the Venezuela Mine (also called the Hewer or Idaho Lakeview Mine) by the U.S. Geological Survey/U.S. Bureau of Mines was in 1905 when it was part of the mineral holdings of the Ponderay Smelting Company. Several shipments of ore were made in 1916. Test lots of ore were shipped from the mine by the Hewer Mining Company in 1923. The following year, several hundred tons of silver-lead ore (the silver was the most valuable constituent) were treated in a 100-ton flotation mill, which was moved from the Loon Lake Mine in Washington. In 1928, the Idaho Lakeview Mines Company purchased the Hewer Mine, installed a new hoist, and enlarged the shaft with the intent of sinking it to a depth of 1,200 feet. Development work continued until 1929, but the mill was idle.

Closed by the depression, the Hewer property was reopened in 1935 by the Revlis Company, and several thousand tons of silver ore were treated by flotation-concentration. The mine closed the following year. Mining resumed and was more or less continuous from 1940 to 1950, reaching a peak of 2,000 tons in 1946.

There was little more activity until 1955, when some ore from the Weber Mine was milled on the property. In 1957, Federal Uranium Corporation acquired operating control of the Keep Cool and Hewer mines and made preliminary plans to work them from a shaft on the conjecture property. However, most of Federal's work was concentrated on the Conjecture Mine, and the company dropped its program in 1964.

In 1980, Shoshone Silver Mining Company reopened the Idaho Lakeview Mine and planned completing 700 feet of new tunnel. The company had built a 100 ton-per-day mill about one mile south of the Conjecture Mine to process ore from the Lakeview and other properties in the district. About 200 feet of old tunnel were rehabilitated in 1982.

In 1984, the company planned to do surface work on the Weil group of claims that lie on an extension of the Hewer Vein. A 500-foot-long tunnel was driven at the Idaho Lakeview in 1987 to look for a mineralized target found by drilling. Some trenching was done in 1988 before all operations ceased at the property due to low silver prices.

1.5 GEOLOGY

The IGS (1997) presents a summary of the geologic framework of the Lakeview Mining District. In 1967, Peter Kun mapped the geology in the district and reported his findings in the Idaho Bureau of Mines and Geology Pamphlet 156 (Kun, 1974). Three general rock groups are represented in the district:

- Precambrian-age metasedimentary rocks of the Belt Supergroup,
- Cambrian-age metasedimentary rocks, including the Gold Creek Quartzite, Rennie Shale and Lakeview Limestone, and
- Cretaceous-age igneous rocks including granodiorite plutons associated with the Idaho batholith.

The host rocks for most of the ore bodies mined in the Lakeview District are the Middle and Lower Members of the Belt Supergroup Wallace Formation (IGS, 1997). The Wallace Formation is a greenish-gray argillite. Kun (1974) describes the ore as galena-carbonate-quartz fillings and replacements along shear zones. Other minerals present in the ores include pyrite, sphalerite, tetrahedrite, and aresenopyrite. The ore shoots were enclosed in quartz and breccia in three major fracture systems (Kun, 1974). The IGS (1997) reports that the Wallace Formation is informally know as the Belt carbonate and that the high carbonate content of the host rock has a neutralizing effect on acid water flowing from the mine sites.

Other geologic features in the district include Pleistocene-age glacial lake, outwash, and till deposits. Kun (1974) mapped these deposits primarily in the floor of Chloride Gulch and the lower reaches of Gold Creek. More recent deposits covering the bedrock units include talus, stream alluvium, and landslides (IGS, 1997).

1.6 HYDROLOGIC AND HYDROGEOLOGIC SETTING

The study area is located within the drainage of Gold Creek, which discharges into Lake Pend Oreille (Figure 2). Several perennial tributaries of the main stem of Gold Creek enter Gold

Creek proximal to the Conjecture Mine, New Rainbow Mine, and Weber Mine. Chloride Gulch is mapped as an intermittent stream and joins the main stem of Gold Creek near the junction of FS Roads 278 and 1180 (Figure 2). The Idaho Lakeview Mine sits in the headwaters of Chloride Gulch and the Keep Cool Mine is located in the headwaters of a tributary to Chloride Gulch. Kun (1974) mapped faults parallel and near the axes of Chloride Gulch and Gold Creek above their confluence. Based on Kun's observations, these north-trending valleys are likely associated with tectonics.

Surface water quality was investigated by the IGS in 1996. All background samples from major tributaries to Gold Creek exhibited metals concentrations below the EPA's primary and secondary Maximum contaminant limits (MCLs) and the acute and chronic aquatic life standards (IGS, 1997). The IGS concluded that all drainages were stable and probably not receiving any metals from natural values in rock of the Wallace Formation.

Groundwater occurrence and flow in the Gold Creek drainage has not been studied. Due to the steep, narrow, bedrock valleys, alluvial aquifers are likely thin, discontinuous and confined to the valley bottoms. The metasedimentary rocks in the study area are faulted and fractured (IGS, 1997) and groundwater occurrence and flow are likely controlled by the orientation and interconnectedness of fracture systems. Bedrock aquifers apparently sustain baseflow in Gold Creek and are an important contributor to other surface water flows in the study area.

2.0 METHODS

Maxim completed field studies during two sampling and surveying events at the project site. The initial event was conducted during November 2-9, 2000 when field work was performed at the Conjecture Mine, New Rainbow Mine, Weber Mine, Idaho Lakeview Mine, and in Chloride Gulch. By November 9, 2000, snow blanketed the sites and limited/prevented site access. Maxim re-mobilized to the study area in June 2001 and completed the remaining data collection activities. The project SAP (Maxim, 2000) provides a detailed description of the methods used to complete the investigation. The following subsections discuss several changes made to the SAP, and briefly describe material sampling, laboratory and field testing, and surveying and mapping methods. We conclude this section with a discussion of our approach in comparing data collected during this investigation to applicable cleanup guidelines and standards.

2.1 CHANGES TO THE SAP

During the 2000 and 2001 field investigations, several changes were made to the procedures described in the SAP (Maxim, 2000). These changes, consisting of deviations from and/or refinements to the plan, fit into several categories, including: general investigative methods, sample labeling, and the rationale used to select chemical/physical analyses. Specific changes to and/or deviations from the SAP are listed below.

GENERAL INVESTIGATIVE METHODS

- A "white board" to identify sampling sites was not always used while photographing sampling sites due to poor natural light conditions.

- Field scientists had difficulty distinguishing the subtle contact between mine waste material and native soils in both test pits and borehole split spoon samples. Consequently, additional samples were obtained near the presumed contact at many sampling locations.

- Drill-through casing advance techniques were used to construct boreholes rather than hollow stem auger techniques. This change increased penetration rates and allowed better utilization of drilling time.

- Water was added while drilling boreholes to cool the bit.

- Sample recovery in split-spoon samplers was less than expected. On the second day of drilling, field personnel changed from 1-½-inch diameter split spoons to 3-inch diameter split spoons to increase sample recovery.

- Two native material samples were not always collected at sampling sites due to equipment limitations.

- A polymer-based drilling additive ("FSF-2000") was used while drilling the corehole at the Weber Mine to cool the bit and promote circulation.

- A decontaminated stainless steel hand auger was used to collect tailing samples at the Idaho Lakeview Mine in June 2001.

- Elevation data for the Conjecture Mine were related to a survey completed by Pioneer Technical Services, Inc. (Pioneer, 1999).

- Elevation data for the Idaho Lakeview Mine and Chloride Gulch sites were related to elevations for benchmarks established by the Forest Service.

- Elevations for the New Rainbow Mine, Weber Mine, and Keep Cool Mine are based on a local datum.

- Because milling/processing operations are occurring at the Lakeview Mill site (Northeast ¼, Section 22, T. 53 N., R. 1 W.), the site was not investigated by Maxim.

- More samples than proposed in the SAP were collected for laboratory analysis from the Conjecture Mine, Weber Mine and Idaho Lakeview Mine to characterize the sites. Fewer samples than anticipated were necessary to characterize the Chloride Gulch site.

LABELING

- Field duplicates were labeled "Duplicate 1", "Duplicate 2", etc. instead of with a (D) suffix as described in the SAP.

- Labels for samples collected in Chloride Gulch used a "CG" prefix rather than "MA" prefix.

- A global positioning system (GPS) unit was used to survey the location of and spot elevations for FS 1180 in Chloride Gulch.

- The surface water sample collected at the base of the Weber open pit was labeled "FS-WE-SEEP(SW)" not "FS-WE-101(SW)".

- The corehole at the Weber Mine was labeled "FS-WE-COREHOLE".

- The labels for samples FS-WE-21 through -24 were labeled in inches, not feet.

- The following sample site numbers were not used:

    - Conjecture Mine, FS-CM-19 and FS-CM-XRF-4
    - Weber Mine, FS-WE-17 through -20
    - Keep Cool Mine, FS-KC-13 through -19
    - Chloride Gulch, FS-CG-17

- Hand samples were first collected at sample site FS-CM-24. A backhoe was then used to collect samples at the same location and labeled FS-CM-28.

- Elevation data for sample sites FS-CM-5, -11, -12, and -13 at the Conjecture Mine were not collected.

- Streambed and/or streambank samples in the gulch below the Keep Cool Mine were labeled FS-KCG-1 through -4.

- The sample of waste rock from the former mill area at the Idaho Lakeview Mine was labeled as tailings ("T") instead of waste ("W").

RATIONALE FOR ANALYSIS SELECTION

- Chemical analyses including pH and electrical conductivity, sulfur fractionalization, neutralization potential, acid/base accounting, SMP lime requirements, and total metals were selected for samples that were considered representative of various waste areas at each site.

- Total metals were analyzed by EPA Method 6010B using an inductively coupled plasma (ICP) instrument. An ICP makes three measurements of every sample and reports the average. ICP software calculates the relative standard deviation (RSD) between the three measurements. Due to a high RSD (>20 percent) for arsenic in five samples from Sample Digestion Group 20001101192, the five samples were reanalyzed by EPA Method 7062 (hydride generation, atomic absorption [AA]).

- Mercury and leachable metals analyses were selected for a representative subset of waste rock and tailing samples.

- Physical properties tests including grain size distribution (coarse sieve analysis), hydrometer analysis (fine fraction), and Atterberg Limits were performed on representative samples (waste rock and/or tailings) from all sites except the New Rainbow Mine.

2.2 MATERIAL SAMPLING

Four types of solid materials were sampled during site characterization: mine waste rock, tailings, streambed sediments, and native soil material. Waste rock, tailings, and native material were distinguished by field geologists based on lithology, mineralogy, and texture. In cases where textural and mineralogical differences between waste rock and native material were subtle, color was used as the distinguishing characteristic. For streambed/streambank samples, the upper 6 inches of material was sampled.

2.2.1 SOIL BORING ADVANCEMENT

Maxim contracted with Ruen Drilling Company (Ruen) of Clark Fork, Idaho to drill boreholes at the mine sites. Soil borings were advanced from a mobile track-mounted drilling platform using casing advance techniques. This technique involved advancing a drill bit through a rotating 8-inch diameter casing. When necessary, water was used to flush the borehole of cuttings and cool the bit. Boring locations were chosen based on those proposed in the SAP, field observations, and site conditions. Maximum soil boring depths were determined based on lithologic observations (thickness of mine waste) by the on-site geologist. Material characteristics (color, lithology, texture, moisture, etc.) in each boring were logged by a Maxim field geologist and recorded on soil boring logs. Borehole locations were marked with labeled 4-foot wood lathes and recorded on a site field map.

Material samples were collected using a decontaminated stainless steel split-spoon sampler. Soil samples were containerized in one-gallon polyethylene bags, sealed, and labeled according to the sample designation and labeling procedures described in the SAP (Maxim, 2000). Samples for mercury analysis were containerized in 8-ounce jars, sealed, and preserved with ice. All material samples were shipped to Northern Analytical Laboratories, Inc. in Billings, Montana using chain-of-custody protocol.

2.2.2 EXPLORATORY TEST PITS

Two types of excavators were used to construct test pits. For the November 2000 work, Maxim contracted with Ruen to use a rubber-tired, articulating backhoe. This equipment was sufficient to access relatively level sampling sites via existing roadways. Due to the steep terrain and limited road access at the most mine sites, Maxim contracted with Davison Ranch of Deer Park, Washington to provide a “Superhoe” (spiderhoe) for the June 2001 work. The

Superhoe allowed Maxim to construct test pits in areas that were inaccessible by conventional backhoe.

Test pits were generally excavated to an initial depth of 4 feet. Samples were then collected from the walls of the pit using a decontaminated stainless steel spade. From 4 feet to total depth, samples were collected by extracting soil from the backhoe bucket with the spade. To avoid cross-contamination from the backhoe bucket, samples were collected from the center of the bucket.

Test pits locations were noted in field logbooks, and notes were made on the physical characteristics of materials encountered in the test pits. Materials observed and sampled in the test pits were divided on the basis of material type, including apparent waste and native materials. When possible, samples were collected from each distinct material type from the sides of the test pits. A log was prepared for each test pit and photographs were taken of most test pit locations.

Samples for chemical analyses were containerized in 1-gallon polyethylene bags and 8-ounce jars (if selected for mercury analysis), sealed, and labeled according to the sample designation and labeling procedures described in the SAP (Maxim, 2000). All mercury samples were preserved with ice. At test pits selected for physical property tests, a larger volume of sample was collected in woven plastic sacks. After samples were collected, the test pits were backfilled with excavated material and the surface was regraded. Each test pit location was marked with a labeled, 4-foot wood lathe for the survey crew.

2.2.3 HAND SAMPLES

In areas inaccessible by heavy equipment, samples were collected using a decontaminated stainless steel spade. These areas included steep portions of waste dumps, heavily vegetated areas, and locations in the gulch below the Keep Cool Mine and in Chloride Gulch. A shovel was used in many instances to excavate to a depth of approximately 2-feet prior to collecting samples. A decontaminated stainless steel auger was used to obtain samples of tailing material at the Idaho Lakeview Mine and in Chloride Gulch. Sampling procedures (including containerizing, labeling, photographing, and staking) were identical to those described above.

2.3 LABORATORY AND FIELD TESTING

Physical testing was performed by Maxim's materials laboratory in Missoula, Montana and at Northern Analytical Laboratories, Inc. in Billings, Montana. Physical tests included texture, grain size distribution (sieve analyses and hydrometer tests), and Atterberg limits. Procedures for these tests followed the ASTM methods listed in the SAP (Maxim, 2000).

Samples were analyzed for chemical parameters at Northern Analytical Laboratories, Inc. Chemical analyses included: total metals, leachable metals (Synthetic Precipitation Leaching Procedure), saturated paste pH, sulfur fractionation, neutralization potential, acid/base accounting, and SMP lime requirement. All analytical methods followed the EPA procedures listed in the SAP (Maxim, 2000).

Two samples of rock core from the corehole at the Weber Mine were submitted to SVL Laboratories in Kellogg, Idaho. These samples were analyzed for acid/base accounting.

Field analyses for five metals (iron, copper, zinc, arsenic, and lead) were performed on several samples collected at the Conjecture Mine on June 13, 2001. Analyses were performed by Bureau of Land Management (BLM) staff from Coeur d'Alene, Idaho using a portable, analytical-grade x-ray fluorescence (XRF) analyzer. Field analysis using the XRF was performed to measure metal concentrations in potential hot spots (waste materials exhibiting a red-brown to yellow-brown color) and evaluate whether these materials exhibited higher metal concentrations than gray-colored waste rock. Another purpose of performing field tests with the XRF was to compare XRF results with analytical laboratory results. XRF analysis was completed on near surface samples collected from the northernmost waste rock dump, from the waste rock dump on the southeast side of the site, and from several boreholes and test pits. Each sample was analyzed by direct measurement through heavy-duty plastic sample bags.

2.4 SURVEYING AND MAPPING

Maxim contracted Eli & Associates, Inc. (Eli) of Missoula, Montana to complete topographic surveys of the six sites. Survey work was completed in both November 2000 and June 2001 while Maxim was conducting field studies. Local control points were established in the field by setting ½-inch steel bars at appropriate locations outside disturbed areas and by using marked Forest Service survey boundaries and benchmarks, when available. Maxim staked and flagged all sampling locations and flagged the approximate edge of waste material based on visual observations at the mine sites. Eli also surveyed other site features identified by Maxim, including adits, shafts, structures, and roads.

For the Chloride Gulch site, several methods were used to locate sampling stations and develop a site map showing tailings distribution. Maxim complete an initial reconnaissance of the approximately 2-mile length of Chloride Gulch from the junction of roads FS 1180 and FS 278 to the Idaho Lakeview Mine on November 2, 5, and 8, 2000. Field crews walked the creek bottom and used a hip chain to identify locations of sampling stations FS-CG-01 through FS-CG-15. After reviewing these data, it became clear that the inherent errors associated with this mapping technique would not be accurate.

In June 2001, Maxim directed Eli to use GPS equipment to survey FS 1180 from its confluence with FS 278 southward to the Idaho Lakeview Mine. GPS was also used to locate the 23 sampling stations in Chloride Gulch and to mark various tributaries. Conventional survey techniques were used to generate topographic profiles transverse to Chloride Gulch at seven stations. The profiles were extended approximately 50 feet on each side of the stream channel. At a discrete, heavily vegetated tailing deposit in Chloride Gulch adjacent to sampling station FS-CG-14, Maxim scientists measured the dimensions of the deposit with a tape and used shovels and a hand auger to determine waste thickness. These measurements were transferred to the site map.

Survey data were processed by a professional land surveyor and Eli prepared maps for each site. Topographic maps with contour intervals of either 1 or 2 feet were generated for the five mine sites. For the Chloride Gulch site, topographic contours were not generated, but spot elevations were measured along roads FS 1180 and 1380. Hard copy and electronic files from Eli were transmitted to Maxim and used to prepare site maps in AutoCAD 2000 format. Key data, including ground surface elevation and estimated mine waste thickness, were posted adjacent to sampling stations on each site map.

Maxim used digital site maps and Eagle Point™ Civil Engineering (Eagle Point) software (Eagle Point™ Software Corporation, 2000) to estimate volumes of mine waste materials at each site. Surface topography measured by Eli, lateral limits of waste material observed by Maxim field staff (and surveyed by Eli), and observed depths of waste material were used to model volumes of mine waste. Triangulated irregular networks (TINs) were constructed in Eagle Point for the surface of the waste dumps and the underlying natural topography. The TINs created for each of the two surfaces were then overlaid and the in-place volume of material calculated between the TINs.

Cross sections through waste deposits (waste dumps and tailing piles) generated by Eagle Point were used as a visual check to volume calculations. At several sites, waste thickness data were insufficient to model volume. In these instances, Maxim multiplied the surface area of the mine waste by an estimated average waste thickness to calculate mine waste volumes.

2.5 METALS DATA COMPARISON

Total metals data for waste rock, tailing, sediment, and native soils collected during this investigation were compared to available background metals data and cleanup guidelines developed for abandoned mine sites (Table 2). Background metals data in rock samples and soil samples for the Wallace Formation of the Belt Supergroup are reported in IGS (1997). Risk-based cleanup guidelines for abandoned mine sites developed for the Montana Department of

Environmental Quality by Tetra Tech, Inc. (1996) were used. The cleanup guidelines are based on the following:

- Recreational exposure,
- Soil-related exposure assumed to be half of the total potential exposure for each metal, and
- A carcinogenic risk of five in 10,000 ($5x10^{-4}$).

The recreational guidelines should not be interpreted as cleanup action levels. Cleanup action levels could only be determined through a site-specific risk assessment, which is outside the scope of a non-time-critical removal action process.

Average and ranges of concentration for leachable metals for the various sites were compared to chronic aquatic life standards for metals listed in the Idaho Administrative Procedures Act (IDAPA 16.01.02.250, 2000). The standards were corrected, as required, to a hardness as calcium carbonate of 47 milligrams per liter. This value is the average hardness measured in nine water samples collected in the study area by Pioneer in August 1998 (Pioneer 1999). The comparison of leachable metals concentrations to chronic aquatic life standards is being used to estimate the potential for groundwater or surface water quality impacts from metals leaching from mine waste. Applicable Idaho aquatic standards are listed in Table 2.

TABLE 2
BACKGROUND, CLEANUP GUIDELINES AND AQUATIC STANDARDS FOR METALS

ELEMENT	BACKGROUND METALS DATA(1)		CLEANUP GUIDELINE(2) (mg/kg)	CHRONIC AQUATIC LIFE STANDARD(3) (mg/L)
	Rock (mg/kg)	Soil (mg/kg)		
Aluminum	--	--	--	--
Antimony	1.1	1.1	293	--
Arsenic	--	--	700	0.19
Cadmium	0.5	0.5	19.5	0.00059*
Chromium	23.8	32	735,000	0.011*+
Copper	11	29	27,100	0.006*
Iron	24,000	37,000	--	--
Lead	23	45	1,100	0.0011*
Manganese	360	1,377	665	--
Mercury	0.04	0.13	220	0.000012
Nickel	11	24	14,650	0.083*
Selenium	--	--	--	0.005
Silver	0.3	0.6	--	--
Zinc	41	115	220,000	0.055*

Notes:
1. Data for the Wallace Formation of the Belt Supergroup reported in IGS (1997)
2. From Tetra Tech (1996)
3. From IDAPA 16.01.02.250 (2000)

mg/kg – milligrams per kilogram
mg/L – milligrams per liter
\+ Chromium VI
* Based on 47 mg/L hardness as $CaCO_3$
-- Not available

3.0 RESULTS

Results of the investigation and characterization work are presented in this section. Discussions related to mine waste distribution and thickness, chemical and physical characteristics of materials sampled at each site, and estimates of mine waste volumes are presented in separate subsections for each site. In each subsection, a sample inventory table summarizes pertinent information about each sample collected for this investigation. A reduced format (11"x17") topographic site map is also presented for each site.

Tables of chemical and physical data are included in Appendix A. Tables A1, A2, and A3 provide mean total metals, mean leachable metals, and mean acid base accounting, respectively, for each mine site. Other tables in Appendix A present summary statistics by site for total metals, leachable metals, and acid base accounting. Average results presented in the summary statistics tables contained in Appendix A were calculated using one-half the detection limit for values reported as less than detection. Appendix B contains the project database with analytical and material testing results for each sample analyzed. Table B6 (Appendix B) provides a cross reference of laboratory numbers and sample designations.

Supporting data for this report are included in Appendices C through E (Volume I), and F through M (Volume II). Appendices C and D contain borehole and test pit logs, and selected photographs taken at each site, respectively. Appendix E contains large format topographic maps (D-size) for each of the six sites. Data validation information is presented in Appendices F through L. Laboratory reports are arranged in chronological order in Appendix M.

3.1 CONJECTURE MINE

Mine waste at the Conjecture Mine is located in four general areas as follows (Figure 3):

- A large waste rock dump bisected by Gold Creek on the north end of the site (North Dump), which is presumed to be waste from the development of Shaft #2.

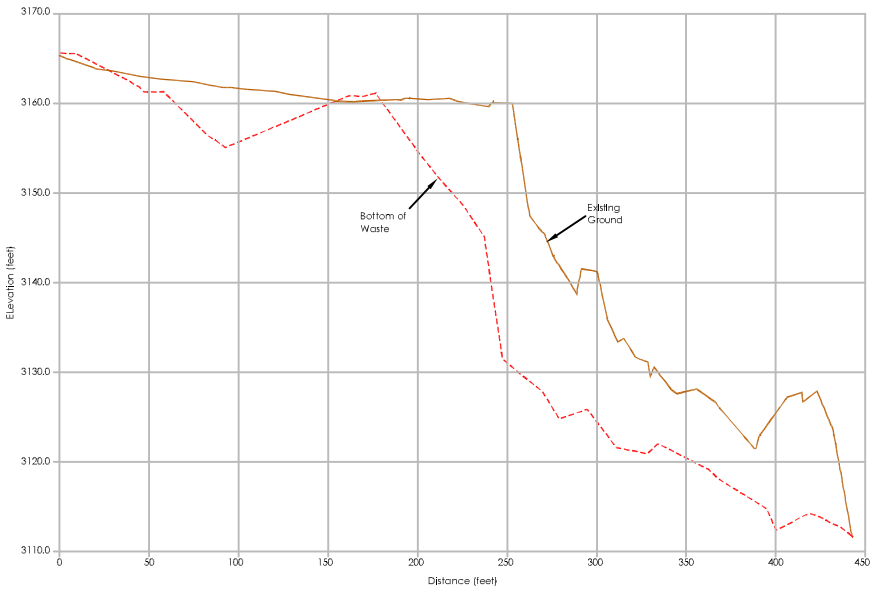
- A waste rock dump on the southwest side of the site near Shaft #1 (Southwest Waste Rock), west of Gold Creek.

- Waste rock on the south side of the site between Gold Creek and a Gold Creek tributary (Mid-South Waste Rock).

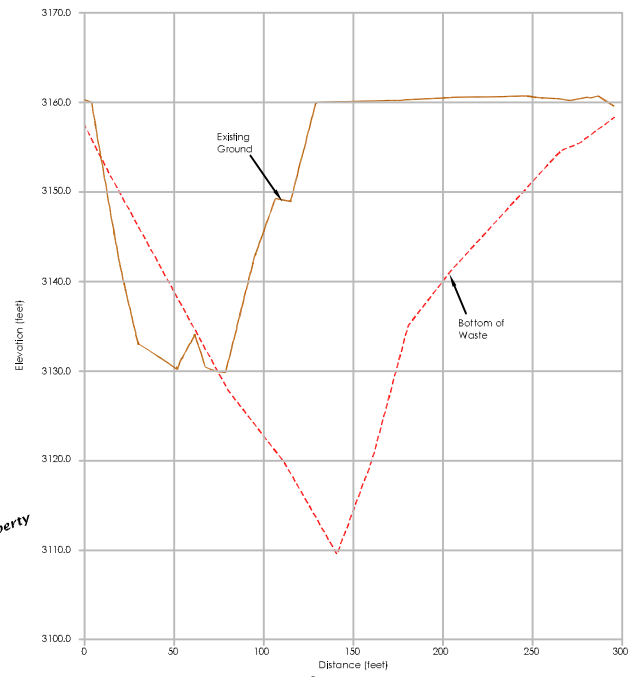
- A waste rock dump on the southeast portion of the site below the two collapsed adits east of the Gold Creek tributary (Southeast Waste Rock).

CONJECTURE MINE - NORTH DUMP
Prismoidal Volume Results

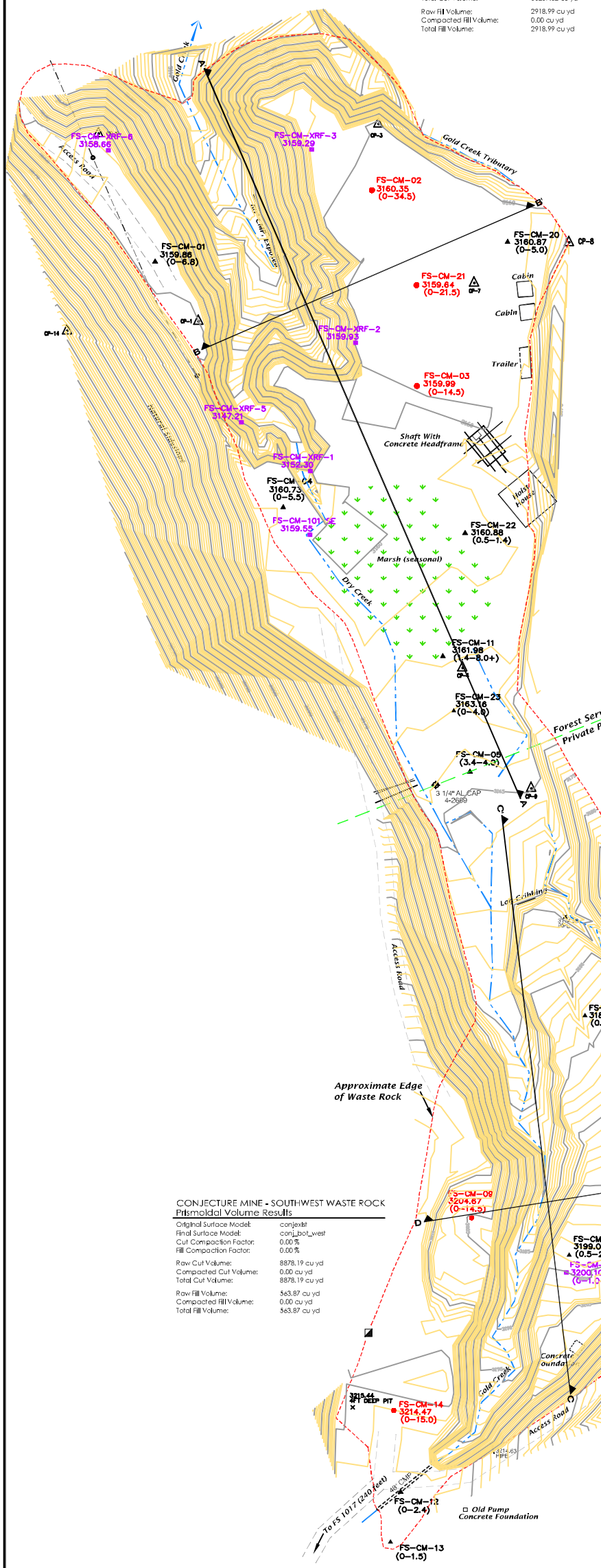
Original Surface Model:	conjexist
Final Surface Model:	conj_nwaste_bot_new
Cut Compaction Factor:	0.00 %
Fill Compaction Factor:	0.00 %
Raw Cut Volume:	55239.62 cu yd
Compacted Cut Volume:	0.00 cu yd
Total Cut Volume:	55239.62 cu yd
Raw Fill Volume:	2918.99 cu yd
Compacted Fill Volume:	0.00 cu yd
Total Fill Volume:	2918.99 cu yd



Section A-A'
Horizontal Scale: 1" = 50 Feet
Vertical Scale: 1" = 10 Feet



Section B-B'
Horizontal Scale: 1" = 50 Feet
Vertical Scale: 1" = 10 Feet



CONJECTURE MINE - SOUTHWEST WASTE ROCK
Prismoidal Volume Results

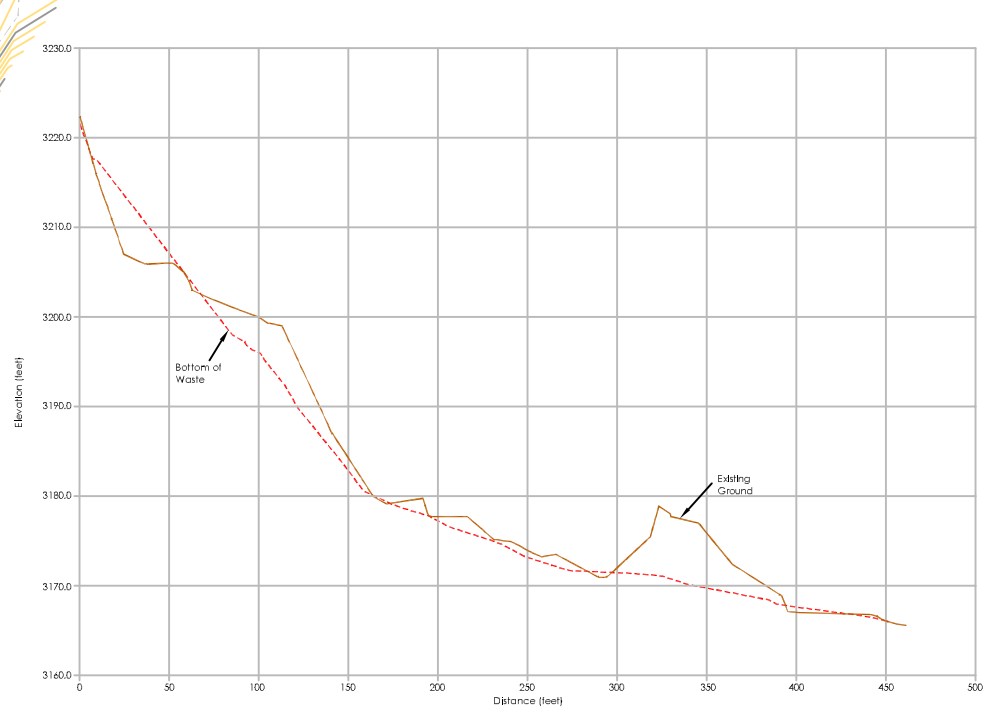
Original Surface Model:	conjexist
Final Surface Model:	conj_bot_west
Cut Compaction Factor:	0.00 %
Fill Compaction Factor:	0.00 %
Raw Cut Volume:	8878.19 cu yd
Compacted Cut Volume:	0.00 cu yd
Total Cut Volume:	8878.19 cu yd
Raw Fill Volume:	563.87 cu yd
Compacted Fill Volume:	0.00 cu yd
Total Fill Volume:	563.87 cu yd

CONJECTURE MINE - SOUTHEAST WASTE ROCK
Prismoidal Volume Results

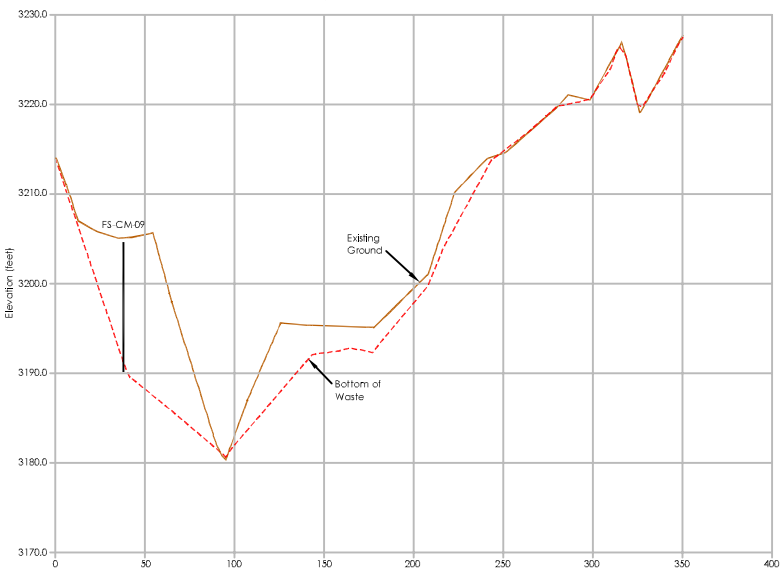
Original Surface Model:	conjexist
Final Surface Model:	conj_east_bot
Cut Compaction Factor:	0.00 %
Fill Compaction Factor:	0.00 %
Raw Cut Volume:	3616.36 cu yd
Compacted Cut Volume:	0.00 cu yd
Total Cut Volume:	3616.36 cu yd
Raw Fill Volume:	491.77 cu yd
Compacted Fill Volume:	0.00 cu yd
Total Fill Volume:	491.77 cu yd

CONJECTURE MINE - MID-SOUTH WASTE ROCK
Prismoidal Volume Results

Original Surface Model:	conjexist
Final Surface Model:	conj_mid_bot
Cut Compaction Factor:	0.00 %
Fill Compaction Factor:	0.00 %
Raw Cut Volume:	14507.50 cu yd
Compacted Cut Volume:	0.00 cu yd
Total Cut Volume:	14507.50 cu yd
Raw Fill Volume:	1041.70 cu yd
Compacted Fill Volume:	0.00 cu yd
Total Fill Volume:	1041.70 cu yd



Section C-C'
Horizontal Scale: 1" = 50 Feet
Vertical Scale: 1" = 10 Feet



Section D-D'
Horizontal Scale: 1" = 50 Feet
Vertical Scale: 1" = 10 Feet

NOTE: THERE ARE TWO PIPES RUNNING THOUGHT THE SITE A 4" AND A 2" CAST IRON

LEGEND

- Hand Sample Location
- Drill Hole Sample Location
- Test Pit Sample Location
- USFS Aluminum Cap
- Caved/Collapsed Adit
- Caved/Collapsed Shaft
- Open Shaft
- Seep
- Creek

FS-IL-03 — Sample Number
3165.32 — Ground Surface Elevation At Sample Point (feet)
(0 – 7.0+) — Waste Rock Interval (feet below ground surface)
Ell & Associates Control Point

NOTE: Survey performed by Ell & Associates Inc., November 2000 and June 2001, Contour Interval - 1 Feet

Topography north of USFS Boundary determined by Pioneer Technical Services, Inc. In 1996.

N

0 Feet 100

REV	DATE	DESCRIPTION	DRN BY	APP BY

Date: August 2001	Project Title: Mine Waste Characterization and Repository Evaluation Kanisku National Forest Bonner County, Idaho
Project #: 2009168	
File: environmental\goldcreek\cadpro\conject.dwg	
Sheet: 1 of 1	Sheet Title: Site Plan Conjecture Mine FIGURE 3

MAXIM TECHNOLOGIES INC

Table 3 summarizes samples collected at the Conjecture Mine site. A total of 35 locations at the site were sampled by drilling 5 boreholes, constructing 18 backhoe test pits, and hand sampling 12 locations. Logs of boreholes and test pits are contained in Appendix C and photographs showing representative sampling locations are included in Appendix D.

3.1.1 WASTE DISTRIBUTION, CHARACTER AND THICKNESS

Waste rock at the Conjecture Mine is widely distributed at the site. Figure 3 shows areal limits of waste observed in November 2000 and June 2001. The waste rock is generally angular, gray-blue to gray-green argillaceous rock. The material ranges in size from gravel to pebble, with varying amounts of cobbles and coarse sand. Where waste rock has weathered, red-brown to yellow-brown iron oxide staining is present on rock surfaces and in layers exposed in test pits (FS-CM-22, Appendix D). This staining is particularly observable in Gold Creek's head cut into the North Dump. Wood debris and metal pipe was occasionally encountered in waste rock deposits (e.g., FS-CM-15 and FS-CM-21, Figure 3, Appendix C). Native materials encountered beneath waste rock were typically brown, and consisted of alluvial sand, gravel, and silt.

Several potential waste rock "hot spots" (identified by a red-brown to yellow-brown coloration) were observed at the North Dump. Potential hot spots were evident in the upper 2-feet of waste rock exposed in the Gold Creek cut banks. These hot spots were also occasionally observed on the ground surface of the North Dump. The Gold Creek head cut into the North Dump (up to 13 vertical feet) exhibited red to orange colored waste rock that may represent deposition of oxidized waste rock eroded from overlying layers.

The observed thickness of waste rock is posted in parentheses next to sampling locations on Figure 3. Waste rock thickness is also shown in Table 3 and on borehole and test pit logs contained in Appendix C. Maximum waste rock thickness observed at the four waste areas is:

- North Dump, 34.5 feet in FS-CM-22.
- Southwest Waste Rock, 15 feet in FS-CM-14.
- Mid-South Waste Rock, 8 feet in FS-CM 17.
- Southeast Waste Rock, >2 feet in FS-CM-07.

TABLE 3
SAMPLING SUMMARY
CONJECTURE MINE
NOVEMBER 2000 AND JUNE 2001

Method	Sample Site	Location	Total Depth	Sample Name	Sample Interval	Lithology	Waste Rock	Tailings	Cover Soil	Native	Sediment	Waste Interval	Chemical Anal*	Mercury	Sieve Analysis	Hydro-meter	SPLP	Archived	Comments
BH	FS-CM-01	NW side of north waste dump	9.0	FS-CM-01-0-6.8(W)	0-6.8	Gray sandy gravel with iron staining	X					0-6.8	X	X			X		
				FS-CM-01-6.8-9(N)	6.8-9	Brown gravelly sand				X			X						Pit wall caved, sample may be mixed
DR	FS-CM-02	NE portion of north waste rock dump.	37.0	FS-CM-02-10-12,20-22(W)	10-12,20-22	Gray-blue angular gravel in brown silty coarse sand	X					0-34.5	X	X			X		
				FS-CM-02-34-34.5(W)	34-34.5	Gray-blue angular gravel in brown coarse sand	X						X						
				FS-CM-02-34.5-35(N)	34.5-35	Brown silty gravel with clay				X			X						
				FS-CM-02-35-37(N)	35-37	Brown silty gravel with clay				X			X						
DR	FS-CM-03	North waste rock dump; Approx. 50' NW of concrete structure.	24.0	FS-CM-03-4.5-6,9.5-11(W)	4.5-6,9.5-11	Gray-blue angular gravel in brown silty coarse sand	X					0-14.5	X	X			X		
				FS-CM-03-14.5-16(N)	14.5-16	Angular gravel with silt				X			X						
				FS-CM-03-18-19.5(N)	18-19.5	Angular gravel with silt				X			X						
				FS-CM-03-20-21,22.5-24(N)	20-21	Angular gravel with silt				X			X						Intervals 20-21 and 22.5-24 were composited due to sample recovery
					22.5-24	Gray soft sticky clay and silt													
BH	FS-CM-04	West side lower waste dump,	6.5	FS-CM-04-0-0.5(N)	0-0.5	Brown fine sand capped by moss			X			0-5.5	X	X					
		20' from hillside		FS-CM-04-0.5-1.2(W)	0.5-1.2	Yellow-brown sandy gravel	X						X						
				FS-CM-04-1.2-5.5(W)	1.2-5.5	Gray gravel with yellow banding	X						X	X			X		
				FS-CM-04-5.5-6.5(N)	5.5-6.5	Gray gravel with large flaggy cobbles				X			X						
BH	FS-CM-05	Center of valley, south of buildings	6.0	FS-CM-05-0-0.5(N)	0-0.5	Brown coarse sand and gravel			X			3.4-4.0	X						
				FS-CM-05-3.4(W)	3.4	0.6' thick gray coarse band	X						X	X					
HS	FS-CM-06	Below and north of caved adit #1	2.0	FS-CM-06-0-1.3(W)	0-1.3	Gray gravel and sand	X					0-2.0+	X	X			X		Blind Field Duplicate, #2
HS	FS-CM-07	Below and south of caved adit #2	2.0	FS-CM-07-0-2(W)	0-2	Gray gravel and sand	X					0-2.0+	X	X			X		Blind Field Duplicate, #1
HS	FS-CM-08	On flat area below and between FS-CM-06 and FS-CM-07	1.0	FS-CM-08-0-0.8(N)	0-0.8	Brown coarse sand and gravel			X			0-1.0+						X	
				FS-CM-08-0.8-1.0(W)	0.8-1.0	Gray gravel and sand	X						X	X					
DR	FS-CM-09	SW corner of south waste rock dump.	25.5	FS-CM-09-0-2(W)	0-2.0	Very angular gravel with silty sand	X					0-14.5			X	X			
				FS-CM-09-4.5-6(W)	4.5-6	Very angular gravel with silty sand	X						X	X					
				FS-CM-09-9.5-11(W)	9.5-11	Very angular gravel with brown silty sand	X						X	X			X		
				FS-CM-09-14.5-16(N)	14.5-16	As above with very weathered rock frags.				X			X						
				FS-CM-09-19.5-21(N)	19.5-21	Very angular gravel with weathered rock fragments				X			X						
				NA	24.5	Split spoon refusal/ No sample													Drill refusal at 24.5 feet
BH	FS-CM-10	East side of upper waste dump	9.0	FS-CM-10-0-7(N)	0-7	Brown gravel with silt and clay			X			0	X	X			X	NA	
BH	FS-CM-11	Center of valley, north of USFS boundary	8.0	FS-CM-11-0-1.4(N)	0-1.4	Red-brown silty, clayey fercrete			X			1.4-8.0+						X	
				FS-CM-11-1.4-8.0(W)	1.4-8.0	Gray sandy gravel	X						X	X			X		
BH	FS-CM-12	6' west of 'stump' on south side of site	5.0	FS-CM-12-0-2.4(W)	0-2.4	Mixed brown and grey gravelly sand	X					0-2.4	X	X					
				FS-CM-12-2.4-5(N)	2.4-5	Brown sandy silty gravel				X			X						metal culvert hit at 5.0'
BH	FS-CM-13	37' south of 'stump' between creek and hillside	7.4	FS-CM-13-0-1.5(W)	0-1.5	Red-brown gravelly sand with some gray rocks	X					0-1.5	X	X					
				FS-CM-13-1.5-5(N)	1.5-5.0	Brown sandy silty gravel				X			X						
				FS-CM-13-5-7.4(N)	5.0-7.4	Yellow-brown sandy gravel, cobbles				X			X						
HS	FS-CM-101	sed sample from center of dry channel	2.0	FS-CM-101-0-2.0(SE)	0-2.0	Red-brown sand, medium to fine gravel pavement					X	NA	X	X					
HS	Conjecture	FS-CM-XRF-1	2	FS-CM-XRF-HS-1-0-2(W)	0 - 2	Orange red sandy gravel	X					NA	X						
HS	Conjecture	FS-CM-XRF-2	2	FS-CM-XRF-HS-2-0-2(W)	0 - 2	Orange red sandy gravel	X					NA						X	
HS	Conjecture	FS-CM-XRF-3	2	FS-CM-XRF-HS-3-0-2(W)	0 - 2	Yellow orange to red orange sand and gravel	X					NA						X	
HS	Conjecture	FS-CM-XRF-5	2	FS-CM-XRF-HS-5-0-2(N)	0 - 2	Brown sandy gravel				X		NA						X	
HS	Conjecture	FS-CM-XRF-6	0	FS-CM-XRF-HS-6-0-2(W)	0 - 2	Red-orange sand and gravel.	X					NA						X	
			2	FS-CM-XRF-HS-6-2(W)	2	Blue gray sand and gravel.	X						X						
			9	FS-CM-XRF-HS-6-9(W)	9	Grey sand and gravel	X						X						
DR	FS-CM-14	S. dump near FS-CM-09	18.5	FS-CM-14-5-6.5(W)	5 - 6.5	Gravel & sand;orange to red	X					0 - 15						X	
				FS-CM-14-10-11.5(W)	10 - 11.5	Gravel & sand; yellow orange	X											X	
				FS-CM-14-13-14.5(W)	13 - 14.5	Silt & gravel; red brown silt	X											X	
				FS-CM-14-15-16.5(N)	15 - 16.5	Gravel/Cobbles; lg rock fragments & gravel w/ some brown silt				X								X	
				FS-CM-14-17-18.5(N)	17 - 18.5	Sand, gravel & silt; brown				X								X	
BH	FS-CM-15	On lower bench near log cribbing	14	FS-CM-15-0.5-2.5(W)	0.5 - 2.5	Cover soil, lg grey angular gravel & sand	X					0.5-2.5	X	X					
				FS-CM-15-2.5-4(N)	2.5 - 4.0	Sand & gravel; brown with some wood debris				X			X						
				FS-CM-15-6-7(N)	6 - 7	Wood debris, brown, finer grained				X								X	

TABLE 3
SAMPLING SUMMARY
CONJECTURE MINE
NOVEMBER 2000 AND JUNE 2001
Page 2 of 2

Method	Sample Site	Location	Total Depth	Sample Name	Sample Interval	Lithology	Waste Rock	Tailings	Cover Soil	Native	Sediment	Waste Interval	Chemical Anal*	Mercury	Sieve Analysis	Hydrometer	SPLP	Archived	Comments
BH	FS-CM-16	Near Gold Creek/tributary merging	11	FS-CM-16-0-1.5(W)	0 - 1.5	Gravel & sand, gray & brown sand & angular gravel	X					0-3						X	
				FS-CM-16-1.5-3(W)	1.5 - 3.0	Gravel & sand; brown sand & angular gray gravel	X											X	
				FS-CM-16-3-5(N)	3.0 - 5.0	Same as above, but with larger fine grained component				X								X	
BH	FS-CM-17	30 feet southeast of creek	12	FS-CM-17	NA	Brown to gray gravel, iron staining, boulders and angular rock						0.5-8							No samples collected.
BH	FS-CM-18	Heavily forested area near tributary	10	FS-CM-18-1-4(N)	1.0 - 4.0	Gravel, sand, silt. Brown & loamy w/ boulders up to 3'. No waste rock.				X		0						X	
BH	FS-CM-20	50'N of cabins	8	FS-CM-20-0-0.6(W)	0 -0.6	Gravel, Gray gravel w/ some clay & roots	X					0-5						X	
				FS-CM-20-0.6-4(W)	0.6 - 4	Gravel, gray & orange angular gravel up to 1' diameter	X								X	X			
				FS-CM-20-6-8(N)	6 - 8	Gravel & sand; brown loamy sand & gravel with some silt.				X								X	
DR	FS-CM-21	N. dump near FS-CM-02	24.5	FS-CM-21-5-6.5(W)	5 - 6.5	Gravel; blue-green & purple with angular argilitic gravel. Minimal fines.	X					0 - 21.5						X	
				FS-CM-21-10-11.5(W)	10 - 11.5	Gravel as above with wood debris.	X											X	
				FS-CM-21-15-16.5(W)	15 - 16.5	Gravel as above with wood debris.	X											X	
				FS-CM-21-20-21.5(W)	20 - 21.5	Gravel & silt; dk gray silt w/ occ. angular gravel & org. debris	X						X	X					
				FS-CM-21-21.5-23(N)	21.5 - 23	Brown silty w/ angular gravel from pea size to 3/4". Lg rock fragments.				X			X						
				FS-CM-21-23-24.5(N)	23 - 24.5	Brown silty w/ angular gravel from pea size to 3/4". Lg rock fragments.				X								X	
BH	FS-CM-22	50'W of brick structure	4	FS-CM-22-0-0.5(N)	0 - 0.5	Topsoil, dk brown sandy soil capped w/ grass.			X			0.5-1.4						X	
				FS-CM-22-0.5-1(W)	0.5-1	Gravel & sand; orange & yellow gravel & sand.	X											X	
				FS-CM-22-2.3(N)	2.3	Gravel & sand; gray gravel & sand.				X								X	
				FS-CM-22-3.2(N)	3.2	Gravel & sand, brown gravel & sand w/ greater no. of fines than above				X								X	
BH	FS-CM-23	Middle of site near USFS boundary	12	FS-CM-23-0-3.2(W)	0 - 3.2	Gravel & sand; brown coarse gravel & sand. Gravel angular up to 6" diam.	X					0-4						X	
				FS-CM-23-3.5(W)	3.5	Same as above w/ slightly larger fine grained component.	X								X	X			
				FS-CM-23-3.2-4(W)	3.2 - 4	Same as above, but gray in color.	X											X	
				FS-CM-23-12(N)	12	Gravel & sand; brown coarse gravel &sand w/ boulders up to 2' diam.				X								X	
HS	FS-CM-24	On slope above CM-06	2	FS-CM-24-0-2(W)	0 - 2	Red-orange gravelly sand	X					0-0.1						X	
HS	FS-CM-25	On road between CM-07 & CM-24	2	FS-CM-25-0.2(W)	0 - 2	Red-orange gravelly sand	X					0-0.3						X	
BH	FS-CM-25	W. side of CM-07 mound	4	FS-CM-25-2(N)	2	Native brown gravel & sand beneath a very thin layer of waste (3").				X		0-0.3						X	
HS	FS-CM-26	On road between CM-07 & CM-25	2	FS-CM-26-0-2(W)	0 - 2	Red-orange gravelly sand	X					0-2+						X	
BH	FS-CM-27	45 feet north of FS-CM-23	11	FS-CM-27	NA	Gray gravel in sand, yellow horizon at two feet, pipes and wood debris at 10 feet						2-11+							No samples collected.
BH	FS-CM-28	Hill above FS-CM-06	4	FS-CM-28-1-3(N)	1 - 3	Loamy native bwn sandy silt & gravel capped by <1" of orange sand & silt				X		0-<0.1						X	
BH	FS-CM-29	Near toe of mound	4	FS-CM-29-0-2(W)	0 - 2	Gravel & sand; orange & yellow waste gravel & sand.	X					0-2	X						
				FS-CM-29-2-3(N)	2 - 3	Native brown loamy soil, sand, gravel & silt				X			X						Duplicate sample taken.

Notes:
Depth in feet below ground surface
DR - Drill rig
BH - Backhoe
HS - Hand sample
Sample site number FS-CM-19 not used

* - Chemical Analyses includes pH/EC, S-Fract., N-Poten., A/B Acct., SMP, and T. Metals
NA - Not applicable
Duplicate identified in comments column

3.1.2 CHEMICAL TEST RESULTS

Analytical laboratory data for samples from the Conjecture Mine are presented in various tables in Appendices A and B. Summary statistics (minimum, maximum and average values for waste rock, sediment and native samples) for total metals, leachable metals and acid base accounting are presented in Tables A4, A5, and A6 (Appendix A). Results for individual samples for the same parameters are presented in Tables B1, B2, and B3 (Appendix B). Table B5 (Appendix B) presents XRF data collected on June 13, 2001. Key findings from analysis of total metals, leachable metals, and acid base accounting are presented below.

Total Metals

Average concentrations for the 24 waste rock samples and the sediment sample exceeded cleanup guidelines (Table 2) for three metals: arsenic (700 milligrams per kilogram, [mg/kg]), lead (1,100 mg/kg), and manganese (665 mg/kg). Average arsenic concentrations for waste rock and sediment were 1,090 mg/kg and 1,680 mg/kg, respectively. Average lead concentrations were 1,286 mg/kg and 1,910 mg/kg for waste rock and sediment, respectively. The manganese cleanup guideline was exceeded for average manganese in waste rock, sediment, and native material samples (1,865 mg/kg, 1,400 mg/kg, and 2,056 mg/kg, respectively). In comparison, background manganese concentrations for soil on the Wallace Formation is 1,377 mg/kg (Table 2).

A sample collected on the south end of the site (FS-CM-10-0-7(N), Figure 3) probably best represents background conditions at the Conjecture Mine. Field staff designated the sample as native material. Several total metals measured on this sample (Table B1, Appendix B) correlate with background metal data for soil from the Wallace Formation (Table 2). These include copper, iron, and manganese. The concentration of total arsenic in sample FS-CM-10-0-7(N) was low (80 mg/kg) relative to other samples obtained from the site and may represent an approximate background concentration.

Maxim reviewed total metals data for samples collected from each of the four waste areas in an attempt to evaluate which areas exhibited arsenic and/or lead concentrations in excess of cleanup guidelines. Results of the review for the four waste areas are as follows:

- North Dump – Samples collected at two sampling sites exceeded the arsenic guideline (FS-CM-05 and FS-CM-101 SE) and samples from three sites exceeded the lead guideline (FS-CM-05, FS-CM-101 SE, and FS-CM XRF-HS-1). Each of these samples was obtained from the upper 2 feet of the waste deposit.

- Southwest Waste Rock – Four samples collected in the interval of 4.5 feet to 19 feet below ground surface from borehole FS-CM-09 all exceeded arsenic and lead cleanup guidelines. Near surface (upper 2 feet) samples from sites FS-CM-12 and -13 at the southern end of the site also exceeded cleanup guidelines for arsenic and lead.

- Mid-South Waste Rock – None of the samples from the two sites submitted for laboratory analysis exhibited arsenic or lead above cleanup guidelines.

- Southeast Waste Rock – Three samples collected from 0 to 2 feet below ground surface exceeded arsenic and lead cleanup guidelines (FS-CM-06, -07 and -29).

At nine locations at the Conjecture Mine, samples of waste rock and material that field staff considered "native" were submitted for laboratory analysis. Typically, native material was distinguished from overlying waste rock based on often subtle differences in lithology, grain size and/or color. At six of the sampling locations (FS-CM-01, -02, -12, -13, -21 and -29; Figure 3), metals concentrations in native samples were generally less than in overlying waste rock and less than cleanup guidelines except for manganese (Table B1). This suggests that field staff made appropriate judgments regarding the thickness of waste rock based on field observations.

At sample sites FS-CM-03, -09, and -15 (Figure 3), however, samples designated native exhibited concentrations of several metals that exceeded those in overlying waste materials. In particular, the sample from borehole FS-CM-09 at 19.5 to 21 feet exhibited the highest lead concentration of any sample analyzed at the Conjecture Mine (9,220 mg/kg) and a relatively high total arsenic concentration (2,240 mg/kg). At FS-CM-09, field staff considered the waste rock interval ended at 14.5 feet below ground surface based on slight textural differences in split spoon samples. The borehole was advanced to a point of drilling refusal at 24.5 feet (possibly bedrock). Although total metals data suggest that waste rock may have extended to a depth of 24.5 at borehole FS-CM-09 in the Southwest Waste Rock area, the field-determined waste rock interval of 0 to 14.5 feet is used on maps, logs, laboratory reports, and data tables.

Evaluation of Total Metals Measured by XRF and the Laboratory

Total metals concentrations measured by the BLM with an XRF analyzer are presented in Table B5 (Appendix B). Over 60 XRF tests were performed on waste rock samples from 21 locations in the north half of the Conjecture Mine site. Analytical laboratory data available for seven of the samples are also listed in Table B5. XRF tests were performed on samples with apparent iron oxide staining (potential hot spots) as well as samples of gray and brown waste rock. In several instances, red/orange colored waste rock generally exhibited higher lead and arsenic values with the XRF (e.g., samples FS-XRF-7, FS-XRF-8, FS-B1-14, FS-B2-12).

Field XRF data was compared with laboratory data by calculating relative percent difference (RPD) by dividing the difference between the two reported values for a given parameter by the average of the two parameters. Based on data in Table B5, it appears that XRF analysis overestimated copper and zinc (negative RPDs) and underestimated arsenic, iron, and lead (positive RPDs). At higher concentrations (greater than 700 to 1,000 parts per million [ppm]), RPDs are within normal error for soils (plus or minus 35 percent). Of the five elements tests, iron values measured with the XRF and the laboratory exhibited the lowest average RPD (-6 percent). Iron concentrations were relatively high in the samples and the best correlation between field XRF and laboratory measurements was observed.

Leachable Metals

Leachable metals analyses were performed on eight waste samples and one native sample. Five samples were obtained from the North Dump, two samples from the Southeast Waste Rock area, one sample from the Southwest Waste Rock area, and one sample from the southern end of the site (FS-CM-10) outside of the area mapped as waste rock. Average concentrations of leachable metals are shown in Table A5. Table B2 presents date for individual samples.

Leachable concentrations of most metals were below the laboratory's practical quantitation limit (PQL), including chromium. In comparing leachable metals results with Idaho's chronic aquatic life standards (Table 2), it should be noted that the PQL for chromium (0.02 mg/L) exceeds the standard (0.011 mg/L).

One sample from the Southeast Waste Rock area (FS-CM-07-0-2(W)) exceeded the chronic aquatic life standards for cadmium (16 times higher), copper (28 times higher) and zinc (50 times higher). Leachable metals concentrations for all other samples were below the standards with the exception of four samples:

- Sample FS-CM-07-0-2(W) exhibited an estimated leachable lead concentration of 1.53 mg/L. The data is qualified as estimated because the RPD for this sample and its duplicate exceeded the precision requirement of 35 percent established in the QAPP (Maxim 2000).

- Zinc concentrations for samples FS-CM-09-9.5-11(W)[0.17 mg/L] and FS-CM-10-0-7(N)[0.12 mg/l] exceeded the standard of 0.055 mg/L but are qualified as estimated because zinc was present in the SPLP extraction blank or the preparation blank.

- Sample FS-CM-02-10-12,20-22(W) exhibited a leachable zinc concentration of 0.02 mg/L.

Acid Base Accounting

Acid base accounting analyses were performed on 26 waste samples, one sediment sample and 16 native material samples obtained at the Conjecture Mine. Table A6 presents summary statistics for these sample types and Table B3 presents data for individual samples.

Table A6 shows various differences in the three types of material sampled at the site. Acid potential ranged from a maximum of 231 tons of calcium carbonate equivalent per 1000 t/1000t for a waste sample collected from borehole FS-CM-09 (Southwest Waste Rock area) to zero in many of the native samples. Average acid potential for waste rock, sediment and native samples was approximately 52 t/1000t, 22 t/1000, and 20 t/1000t, respectively. Average neutralization potential was highest for waste rock (22 t/100t) and lowest for the sediment sample (6 t/1000t). Saturated paste electrical conductivity ranged from a high of 5.36 mmhos/cm for a waste rock sample to a low of 0.24 mmhos/cm for a native material sample. This suggests average waste rock exhibits a high ionic activity. Waste and sediment samples exhibited slightly acid saturated paste pH (6.27 standard units [s.u.] and 6.40 s.u., respectively). The average saturated paste pH for the 17 native samples was 5.77 s.u.

Average total lime requirements for waste rock, sediment, and native materials were approximately 45 t/1000t, 27 t/1000t, and 20 t/1000t, respectively. These data suggest that average lime requirements for waste rock and sediment are moderately high, whereas total lime requirements for native material are moderate.

Review of Table B3 indicates that, in general, samples collected from the Southwest Waste Rock area (FS-CM-09) and the Southeast Waste rock area (FS-CM-29) exhibited the lowest saturated paste pH values, the highest acid potential, and greatest total lime requirements at the site.

3.1.3 Physical Test Results

Table B4 presents a summary of grain size analyses performed on three waste rock samples. Greater than 50 percent of each sample was medium gravel (>10 millimeters [mm]). The samples are well graded (poorly sorted) and exhibit less than approximately 2 to 8 percent silt and clay size material.

3.1.4 Estimated Volume of Mine Waste Material

The estimated areal extent of mine waste at the Conjecture Mine is shown on Figure 3. The approximate edge of waste rock was determined by visual observations of apparent mining-related disturbance relative to the natural landscape, and by observing the character of materials exposed by test pits and boreholes.

Mine waste volumes in the four areas of the site were determined by first importing surface topography into Eagle Point software. Lower (native) topographic surfaces were generated in Eagle Point as TINs with waste thickness data obtained from boreholes and test pits. Zero mine waste boundaries were established at the approximate edge of mine waste shown on Figure 3. The exposed Gold Creek channel that bisects the North Dump and the portion of the Gold Creek channel that separates the Southwest Waste Rock and Mid-South Waste Rock areas were considered to be original topographic surfaces based on the presence of tree stumps adjacent to the channel. The slopes of the natural ground surface adjacent to the edges of mine waste were also considered and often used to help generate a native surface in the waste areas.

In generating an estimated waste volume for the Southwest Waste Rock area, we considered chemical data from borehole FS-CM-09 that suggests that waste rock may extend to a depth of 24.5 feet at this location. Eagle Point was first run assuming a waste rock depth of 14.5 feet at FS-CM-09, resulting in a waste volume of approximately 8,880 cubic yards. A second model, assuming a waste rock thickness of 24.5 feet at FS-CM-09, resulted in an estimated volume of 12,200 cubic yards. The volume assuming a thicker waste rock package at the Southwest Waste Rock area is within approximately 15 percent of the volume calculated assuming a thinner waste rock package. As an error tolerance of $\pm$ 15 percent is expected for waste volume estimates, the 14.5-foot waste thickness at FS-CM-09 for the Southwest Waste Rock area was used.

Figure 3 presents cross sections that extend through the four waste areas showing ground surface and the estimated base of waste modeled using Eagle Point. Note that some sections show the natural ground surface above the waste surface. These result from the approximation of the native surface by the model and are reported as “fills” in the volume summary tables shown on Figure 3. As these fills are artifacts of the model, they were ignored in the total volume estimate. Approximate ($\pm$ 15 percent) volumes of mine waste for the four areas are:

Location	Volume (cubic yards)
North Dump	55,240
Southwest Waste Rock	8,880
Mid-South Waste Rock	14,510
Southeast Waste Rock	3,620
Total	**82,250**

Field observations, analytical data, and XRF data were assessed in an attempt to estimate the areal extent, thickness, and volume of potential hot spots in waste rock at the North Dump. Waste rock identified as hot spots is exposed in the upper 2 feet of the cut bank created by Gold Creek in the North Dump. Hot spots in waste rock are also present at various locations on

the planar surface of the North Dump north of FS-CM-23. It is possible that the hot spots in waste rock were deposited as a final, approximately 2-foot thick lift on the North Dump. If these assumptions are valid, the volume of hot spots in waste rock is approximately 6,500 cubic yards, or approximately 8 percent of the total estimated waste volume at the Conjecture Mine.

3.2 NEW RAINBOW MINE

The New Rainbow Mine was investigated in November 2000. Vegetation covers most of the site, including several benches cut in the waste rock material (Appendix D). Figure 4 is a topographic map of the site and shows pertinent features, sampling locations, and the approximate edge of waste rock. Access to the site by vehicles is limited to an unimproved road on the east end of the site. One test pit and one borehole were installed at the west end of the mine access road. Two hand samples were obtained on the western portion of the site (Figure 4). Table 4 summarizes samples collected.

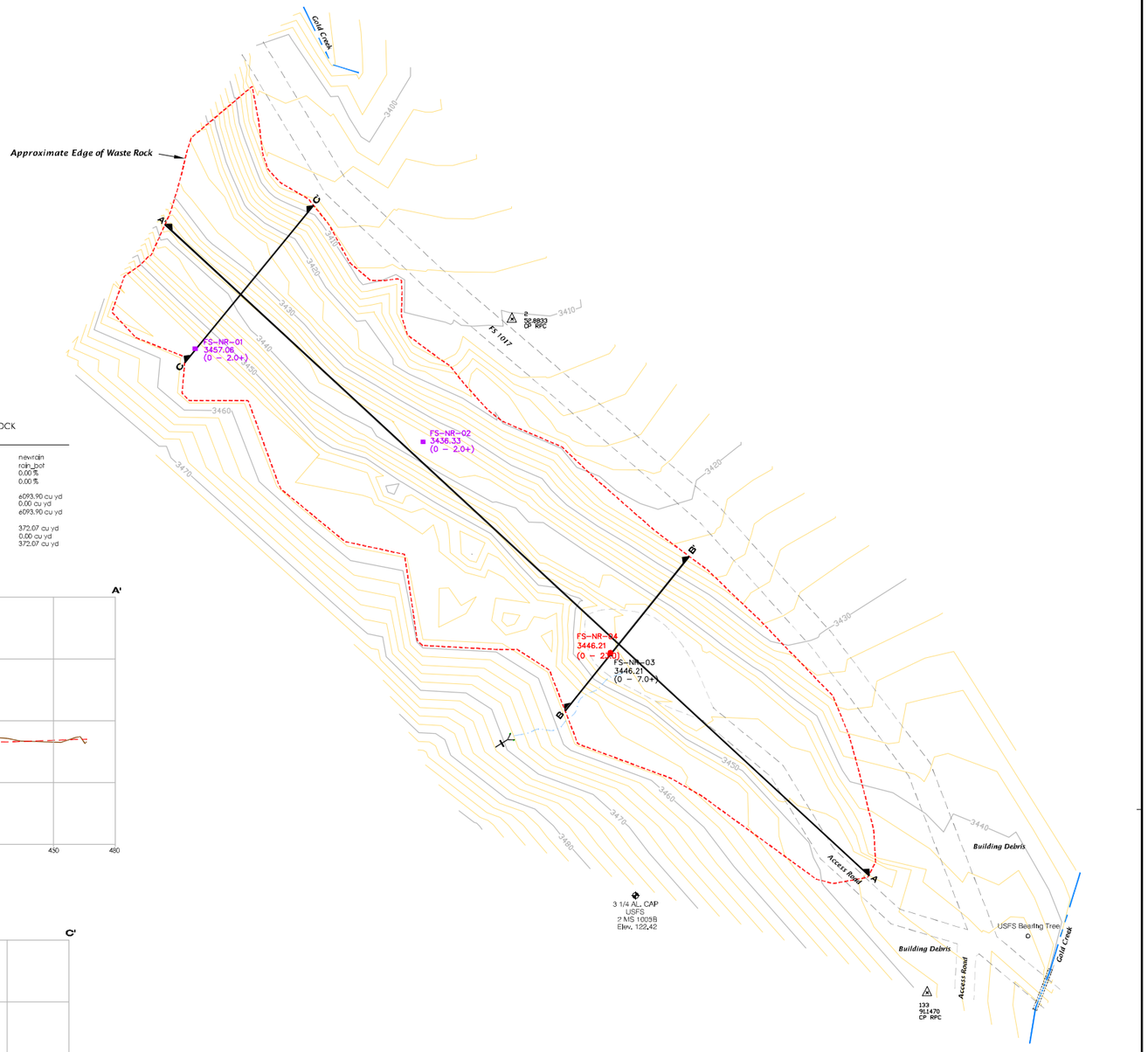
3.2.1 WASTE DISTRIBUTION, CHARACTER AND THICKNESS

Waste rock is distributed over an area of approximately 920 feet (northeast/southwest) by 220 feet (northeast/southwest), parallel to and west of FS 1017 (Figure 4). The waste material was observed and noted on logs as red to gray, sandy gravel (Appendix C). Gravel and cobble-sized materials were blocky and unconsolidated. Apparent native soil was encountered in borehole FS-NR-04 and consisted of brown silt to clayey silt.

Figure 4 shows approximate waste rock thickness observed during the investigation. Waste rock thickness exceeded the total depths of hand samples FS-NR-01 and -02 (>2.0 feet), and test pit sample FS-NR-03 (>7.0 feet). At borehole FS-NR-04 (Figure 4) waste rock thickness was observed to be 23 feet.

3.2.2 CHEMICAL TEST RESULTS

Seven material samples were submitted for chemical analyses. Summary statistics for total metals, SPLP metals and acid base accounting are presented in Tables A7, A8, and A9, respectively (Appendix A). Results for individual samples are included in Tables B1, B2, and B3 (Appendix B). Of the seven samples, four were waste rock, two were native material beneath waste rock, and one sample was cover soil.



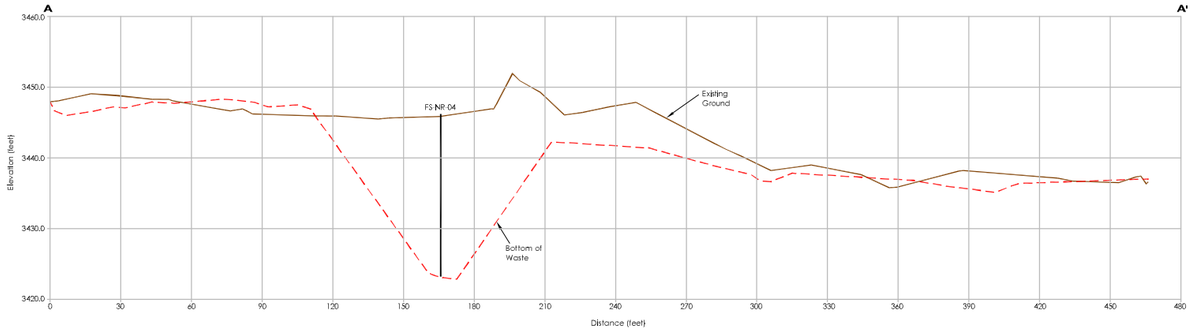
N

0 Feet 60

NEW RAINBOW MINE - WASTE ROCK

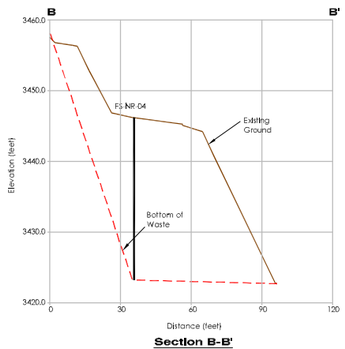
Prismoidal Volume Results

Original Surface Model:	newcain
Final Surface Model:	rain_bot
Cut Compaction Factor:	0.00 %
Fill Compaction Factor:	0.00 %
Raw Cut Volume:	6093.90 cu yd
Compacted Cut Volume:	0.00 cu yd
Total Cut Volume:	6093.90 cu yd
Raw Fill Volume:	372.07 cu yd
Compacted Fill Volume:	0.00 cu yd
Total Fill Volume:	372.07 cu yd

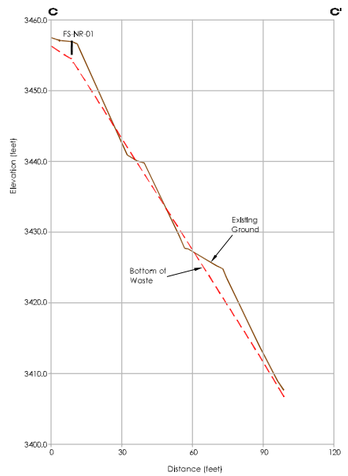


Section A-A'

Horizontal Scale: 1" = 30 Feet
Vertical Scale: 1" = 10 Feet



Section B-B'



Section C-C'

LEGEND

- Hand Sample Location
- Drill Hole Sample Location
- Test Pit Sample Location
- USFS Aluminum Cap
- Caved/Collapsed Adit
- Seep
- Creek

FS-IL-03 Sample Number
3446.21 Ground Surface Elevation At Sample Point (feet)
(0 – 7.0+) Waste Rock Interval (feet below ground surface)

Ell & Associates Control Point

NOTE: Survey Performed by Ell & Associates Inc., November 2000
Contour Interval - 2 Feet

REV	DATE	DESCRIPTION	DRN BY	APP BY

Date: February 2001	Project Title: Mine Waste Characterization and Repository Evaluation Kaniksu National Forest Bonner County, Idaho
Project #: 2009168	
File: envlironmental\gold creek\cadpro\newrailnbo.dwg	
Sheet: 1 of 1	Sheet Title: Site Plan New Rainbow MIne FIGURE 4

MAXIM TECHNOLOGIES INC

TABLE 4
SAMPLING SUMMARY
NEW RAINBOW MINE
NOVEMBER 2000

Method	Sample Site	Location	Total Depth	Sample Name	Sample Interval	Lithology	Waste Rock	Tailings	Cover Soil	Native	Sediment	Waste Interval	Chemical Anal*	Mercury	Sieve Analysis	Hydro-meter	SPLP	Archived	Comments
HS	FS-NR-01	Bench on upper north side of site near trees	2.0	FS-NR-01-0-2.0(W)	0-2.0	Red to gray, flaggy sandy gravel	X					0-2.0+	X	X			X		Capped by vegetation, thin soil
HS	FS-NR-02	Middle bench in center of site	2.0	FS-NR-02-0-2.0(W)	0-2.0	Red to gray, flaggy sandy gravel	X					0-2.0+	X	X			X		Capped by vegetation, thin soil
BH	FS-NR-03	Uppermost accessible part of access road	7.0	FS-NR-03-0-1.0(N)	0-1.0	Gray-brown sandy gravel capped by vegetation			X			0-7.0+	X						
				FS-NR-03-1.0-7.0(W)	1.0-7.0	Unconsolidated gray gravel and cobbles	X						X	X			X		walls of pit cave easily
DR	FS-NR-04	At test pit location FS-NR-03 to determine contact with native material.	24.5	FS-NR-04-13-16.5(W)	13-16.5	Angular/blocky gray gravel and sand	X					0-23	X	X					Drilled at location of FS-NR-03
				FS-NR-04-23-23.5(N)	23-23.5	Brown silt to clayey silt				X			X						
				FS-NR-04-23.5-24.5(N)	23.5-24.5	Brown silt to clayey silt				X			X						

Note: Near-surface waste rock samples collected from backhoe test pit.

Notes:
Depth in feet below ground surface
DR - drill rig
BH - backhoe
HS - hand sample

* - Chemical Analyses includes pH/EC, S-Fract., N-Poten., A/B Acct., SMP, and T. Metals
NA - Not applicable
Duplicate identified in comments column

Total Metals

Waste rock samples generally exceed background Wallace Formation values for cadmium, copper, lead, manganese, nickel, silver, and zinc. Background data for aluminum, arsenic, and selenium are not available in IGS (1997) for the Wallace Formation. Apparent native material sampled between 23.5 and 24.5 feet in borehole FS-NR-04 (Figure 4) generally exhibited total metals at concentrations less than overlying waste rock.

The cleanup guideline (Table 2) for lead was exceeded in one waste sample and for manganese in three waste samples and the single cover soil sample. Mean total metals results (Table A7) show that only the cleanup guideline for manganese was exceeded in waste rock samples. No cleanup guideline was exceeded for native material samples based on mean total metals data.

Leachable Metals

Leachable metals analysis (SPLP) was performed on three waste rock samples (Tables A8 and B2). Concentrations of leachable cadmium, chromium, copper, lead, manganese, nickel, selenium, and silver were not detected above the PQLs for these metals. Sample FS-NR-03 exceeded the mercury standard but the result is qualified because matrix spike recoveries exceed acceptable limits. The leachable zinc concentration in sample FS-NR-02 (0.06 mg/L) exceeded the standard (0.055 mg/L), but was qualified due to zinc in the laboratory blank. All other detections were well below the available chronic aquatic life standards.

Acid Base Accounting

Acid base account data are shown in Tables A9 and B3. Average saturated paste electrical conductivity (EC) for both waste rock and native materials is low (0.57 and 0.36 mmhos/cm, respectively). Saturated paste pH values for all samples were slightly basic, averaging 7.83 s.u. for waste rock and 7.37 s.u. for native material. Based on review of acid base potential and total lime requirements, both the waste rock and native materials are non-acid generating.

3.2.3 Estimated Volume of Mine Waste Material

The approximate areal distribution of waste rock is shown on Figure 4. Waste material was not observed in contact with Gold Creek, although a seep issues from an adit and infiltrates within the waste dump. Longitudinal and transverse cross sections of the waste rock deposit generated using Eagle Point software are shown on Figure 4. Based on surface topography, estimated waste rock limits, and limited waste depth information, the New Rainbow Mine site contains approximately 6,100 cubic yards of waste rock.

3.3 WEBER MINE

Investigative work at the Weber Mine (Figure 5) included constructing 13 test pits and installing five boreholes (Table 5). A corehole (FS-WE-COREHOLE-1) and an additional three test pits (FS-WE-22, -23 and -24) were installed at and near the site for the Weber Mine open pit repository evaluation. These data are discussed in Maxim's repository evaluation report (Maxim, 2001).

Figure 5 is a topographic map of the site showing approximate limits of mapped waste areas, sampling locations, and other site features. Logs of boreholes and test pits are contained in Appendix C and photographs showing representative sampling locations are included in Appendix D.

3.3.1 WASTE DISTRIBUTION, CHARACTER AND THICKNESS

Maxim identified three general waste areas at the site (Figure 5):

- Waste Rock-1, which is located at the northwestern limit of the site and topographically highest point.
- Waste Rock-2, covering the eastern half of the site.
- Waste Rock-3, which is located in the southern end of the site on the east side of Gold Creek.

Waste Rock-2 is the largest dump at the site. It crosses FS 1017 and the lower margin of the dump impinges on Gold Creek. Waste rock consists of brown, silty to sandy gravel. The contact with native material beneath waste was distinguished while drilling boreholes by a change to markedly hard drilling. Field geologists logged the native material in boreholes FS-WE-12 and FS-WE-14 as bedrock (Appendix D). Maximum observed waste thickness in Waste Rock-2 was 51 feet (FS-WE-14, Figure 5). Above FS 1017, waste rock thickness ranged from 2 to 7 feet.

Waste Rock-1 is on the upper slopes of the Weber Mine. Waste rock material was described as brown sand with angular gravel. Platy, weathered, argillaceous bedrock was encountered approximately 2.5 feet beneath waste material.

The third waste area was discovered in the southern portion of the site adjacent to Gold Creek. The deposit is lobate and oriented roughly parallel to Gold Creek. Waste rock material in Waste

Approximate Edge of Waste Rock - 1
AREA
1350 cu. yds.

FS-WE-15
428.35
(0-2.5)

FS-WE-16
420.85
(0-2.0)

Approximate Edge of Waste Rock-2

Cabin

FS-WE-09
210.87
(0-7.0)

FS 1017

FS-WE-08
219.54
(0-0.7)

FS-WE-06
211.46
(0-2.0)

FS-WE-SEEP (SW)

FS-WE-05
220.61
(0-3.5)

FS-WE-03
203.06
(0-16.5)

FS-WE-12
202.37
(0-29.9)

FS-WE-COREHOLE-1
223.19
(0)

FS-WE-07
201.05
(0-8.0+)

1"41 AL CAP
3 1/4" AL CAP

FS-WE-02
199.64
(0-20.5+)

FS-WE-14
200.07
(0-51.0)

Road

Private Property
Forest Service Property

24" CMP

FS-WE-01
198.82
(0-45.0)

FS-WE-13
210.08
(0-5.0)

Gold Creek

FS-WE-11
183.69
(0)

FS-WE-21
172.28
(0)

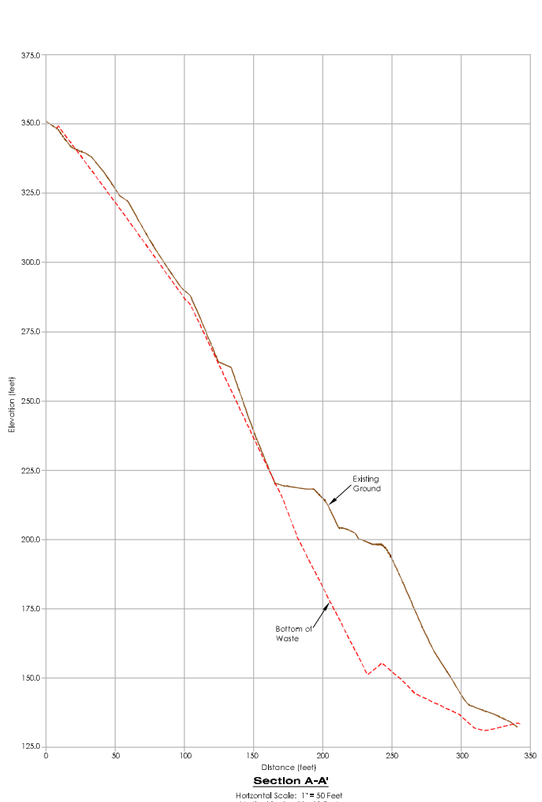
FS-WE-04
161.34
(0-10.0)

FS 1017

24" CMP

FS-WE-10
169.82
(0-3.0)

Approximate Edge of Waste Rock - 3
AREA
3608 cu. yds.



Section A-A'
Horizontal Scale: 1" = 50 Feet
Vertical Scale: 1" = 10 Feet

WEBER MINE - WASTE ROCK VOLUME - 2
Prismoidal Volume Results

Original Surface Model:	weber_exist
Final Surface Model:	weber_bot
Cut Compaction Factor:	0.00 %
Fill Compaction Factor:	0.00 %
Raw Cut Volume:	71506.27 cu yd
Compacted Cut Volume:	0.00 cu yd
Total Cut Volume:	71506.27 cu yd
Raw Fill Volume:	759.05 cu yd
Compacted Fill Volume:	0.00 cu yd
Total Fill Volume:	759.05 cu yd

LEGEND

- Hand Sample Location
- Drill Hole Sample Location
- Test Pit Sample Location
- USFS Aluminum Cap
- Caved/Collapsed Adit
- Caved/Collapsed Shaft
- Open Shaft
- Seep
- Creek
- Surface/ Ground Water Sample Location

FS-WE-03 — Sample Number
88.63 — Ground Surface Elevation At Sample Point (feet) Relative to Local Benchmark
(0 - 7.0 +) — Waste Rock Interval (feet below ground surface)

NOTE: Survey performed by Dll & Associates Inc., June 2001
Contour Interval - 2 Feet

N
0 Feet 100

REV	DATE	DESCRIPTION	DRN BY	APP BY

Date: July 2001
Project #: 2009168
File: environmental\goldcreek\weber mine.dwg
Sheet: 1 of 1

MAXIM TECHNOLOGIES INC

Project Title: Mine Waste Characterization and Repository Evaluation
Kaniksu National Forest
Bonner County, Idaho

Sheet Title: Site Plan
Weber Mine
FIGURE 5

TABLE 5
SAMPLING SUMMARY
WEBER MINE
NOVEMBER 2000 AND JUNE 2001

Method	Sample Site	Location	Total Depth	Sample Name	Sample Interval	Lithology	Waste Rock	Tailings	Cover Soil	Native	Sediment	Waste Interval	Chemical Anal*	Mercury	Sieve Analysis	Hydro-meter	SPLP	Archived	C E C	Atterberg	Soil Analyses	Water Analyses	Comments
DR	FS-WE-01	Near washout below pit	47.5	FS-WE-01-5-6.5(W)	5 - 6.5	Sand & gravel; brown.	X					0-45											
				FS-WE-01-10-11.5(W)	10 - 11.5	Silt, sand, gravel; brown.	X																
				FS-WE-01-15-16.5(W)	15 - 16.5	Gray/white rock frag.	X						X										
				FS-WE-01-20-21.5(W)	20 - 21.5	Silt, sand & gravel; brown	X																
				FS-WE-01-25-26.5(W)	25 - 26.5	Silt, sand & gravel; brown	X																
				FS-WE-01-30-31.5(W)	30 - 31.5	Silt, sand & grvl; lgr rocks	X																
				FS-WE-01-35-36.5(W)	35 - 36.5	Silt & wood debris.	X																
				FS-WE-01-40-41.5(W)	40 - 41.5	Silt & gravel; brown.	X						X	X			X						
				FS-WE-01-45-46.5(N)	45 - 46.5	Silt & gravel; sm rock frag.				X			X										
				FS-WE-01-47-47.5(N)	47 - 47.5	Same as above; hard drilling				X													
DR	FS-WE-02	S. side of Gold Creek Road. S. of Weber Mine.	21	FS-WE-02-2.5-4(W)	2.5-4		X					0-20.5+	X	X									
				FS-WE-02-4-5.5(W)	4-5.5	Green, brown, and orange-brown silty sand and angular gravel	X											X					
				FS-WE-02-5.5-6.5(W)	5.5-6.5		X											X					
				FS-WE-02-9-10.5(W)	9-10.5		X						X	X			X						
				FS-WE-02-19.5-20.5(N)	19.5-20.5	Higher percentage of silt, predominately brown				X								X					
DR	FS-WE-03	East of FS-WE-02	17	FS-WE-03-5-6.5(W)	5 - 6.5	Silt, sand & gravel; brown	X					0-16.5											
				FS-WE-03-10-11.5(W)	10 - 11.5	Same with rock frags.	X																
				FS-WE-03-15-16.5(W)	15 - 16.5	Angular grvls and cobbles	X						X	X			X						
				FS-WE-03-16.5-17(N)	16.5 - 17	Gravel and cobbles				X			X										
BH	FS-WE-04	Across Gold Creek from mine on 'treeless mound' , installed in Nov 2000	8.0	FS-WE-04-0-8.0(N)	0-8.0	Brown sand with gravel and cobbles				X		NA	X				X						
BH	FS-WE-04	Installed in June 2001 at location of FW-WE-08 on 'treeless mound'	12	FS-WE-04-0-8(W)	0 - 8	Gravel & sand, native	X					0-10											
				FS-WE-04-11(N)	11	Brown waste w/ wood.				X													
BH	FS-WE-05	N side of hill on bench	3.5	FS-WE-05-0-3.5(W)	0 - 3.5	Gravel and sand; orange	X					0-3.5			X					X			
BH	FS-WE-06	Ground slipe on WE-05 (rt of pit)	4	FS-WE-06-0-2(W)	0 - 2	Gravel & sand; brown.	X					0-2	X		X	X				X			Duplicate sample taken.
				FS-WE-06-2-4(N)	2 - 4	Brown & orange bedrk				X			X										
BH	FS-WE-07	Further around slope	8	FS-WE-07-0-1.7(W)	0-1.7	Brown sand, some gravel	X					0-8+											
				FS-WE-07-1.7-2.3(W)	1.7-2.3	Grvl & sand, mostly gray	X																
				FS-WE-07-2.3-5(N)	2.3-5	Grvl & sand, brown				X													
BH	FS-WE-08	90 feet north of FS-WE-06	1	NA	NA	Fine grained brown sand and gravel over bedrock	X					0-1											No samples collected.
BH	FS-WE-09	Near FS-WE-05	9	FS-WE-09-0-6(W)	0 - 6	Brwn sand & grvl w/ wood	X					0-7	X	X	X	X	X			X			Water at 5.0 feet
				FS-WE-09-7(N)	7	Orange native				X			X										
BH	FS-WE-10	In Kelly hump across street from WE-04 mound	6	FS-WE-10-0-3(W)	0 - 3	Brown sand & angl gravel	X					0-3	X										
				FS-WE-10-3-6(N)	3 - 6	Grvl & sand, lighter brown				X			X										
BH	FS-WE-11	On slope "facing" side of pit	6	FS-WE-11-0-6(N)	0 - 6	Native brown gravel				X			X										
DR	FS-WE-12	S of FS-WE-03	29.5	FS-WE-12-5-6.5(W)	5 - 6.5	Silty sand and gravel	X					0-29											
				FS-WE-12-10-11.5(W)	10 - 11.5	same as above w/rock fragments	X																
				FS-WE-12-20-21.5(W)	20 - 21.5	silt, sand, and gravel	X																
				FS-WE-12-28-29.5(N)	28 - 29.5	Bedrock				X													
BH	FS-WE-13	2nd bench just left of pit	9	FS-WE-13-0-5(W)	0 - 5	Brown sand & gravel	X					0-5	X										
				FS-WE-13-5-6(N)	5 - 6	Yellow & gray bedrock				X			X						X				
				FS-WE-13-8-9(N)	8 - 9	Same. More competent.				X					X					X			
DR	FS-WE-14	W of FS-WE-02	51.5	FS-WE-14-10-11.5(W)	10 - 11.5	Silt,sand & gravel, brown	X					0-51	X	X			X						
				FS-WE-14-20-21.5(W)	20 - 21.5	Same as above	X																
				FS-WE-14-30-31.5(W)	30 - 31.5	Same as above	X																
				FS-WE-14-40-41.5(W)	40 - 41.5	Same as above	X																
				FS-WE-14-50-51.5(N)	50 - 51.5	Bedrock at 51 feet				X			X										
BH	FS-WE-15	Rt side of bench	5	FS-WE-15-0-2.5(W)	0 - 2.5	Brown sand and anglr grvl	X					0-2.5	X										
BH	FS-WE-16	Lft (facing) side of bench above excavator	5	FS-WE-16-0-2(W)	0 - 2	Loose brown sand	X					0-2											
BH	FS-WE-21	East of FS 1017 and Weber Mine	8.5	FS-WE-21-5.5-18 in. (N)	5.5-18 in.	Brown loam				X		NA								X			
				FS-WE-21-18-31 in. (N)	18-31 in.	Clean gravel				X								X					
				FS-WE-21-31-46 in. (N)	31-46 in.	Yellowish brown sandy loam				X					X	X				X			
				FS-WE-21-46-96 in. (N)	46-96 in.	Gravel				X								X					
BH	FS-WE-22	Approx. 0.5 miles north of Keep Cool Mine	9	FS-WE-22-0-13 in.(N)	0-13 in.	Brown loam				X		NA								X			
				FS-WE-22-13-26 in.(N)	13-26 in.	Lt. Yellowish-brown sandy loam				X					X	X				X			
				FS-WE-22-26-110 in.(N)	26-110 in.	Weathered bedrock				X					X	X							
BH	FS-WE-23	Approx. 0.2 miles south of FS-WE-22	3.25	FS-WE-23-0-9 in.(N)	0-9 in.	Brown loam				X		NA											No samples collected from this test pit.
				FS-WE-23-9-39 in.(N)	9-39 in.	Weathered bedrock				X													
BH	FS-WE-24	Approx. 0.3 miles north of Keep Cool Mine	8	FS-WE-24-2-16 in.(N)	2-16 in.	Brown loam				X		NA								X			
				FS-WE-24-16-24 in.(N)	16-24 in.	Lt. Yellowish-brown sandy loam				X		NA			X	X				X			
				FS-WE-24-24-96 in.(N)	24-96 in.	Weathered bedrock				X		NA						X					
Grab	Weber Open Pit	Seep at base of Weber Open Pit	NA	FS-WE-SEEP(SW)	NA	NA	NA	NA	NA	NA	NA	NA									X		
Grab	Weber Open Pit	Corehole at base of Weber Open Pit	NA	FS-WE-COREHOLE-1	NA	NA	NA	NA	NA	NA	NA	NA									X		

Notes:
Duplicate identified in comments column
Depth in feet below ground surface, unless noted
DR - Drill rig
BH - Backhoe
HS - Hand sample

* - Chemical Analyses includes pH/EC, S-Fract., N-Poten., A/B Acct., SMP, and T. Metals
NA - Not applicable
Sample site numbers FS-WE-17 to -20 not used

Soil Analyses - Saturated paste pH and EC, macronutrients, organic matter, SMP lime req., and acid/base accounting.
Water Analyses - Total and dissolved metals and common ions.

Rock-3 consists of brown sand with angular gravel. Wood debris and large boulders were encountered in the waste material while digging test pit FS-WE-04. Sand with rounded gravel underlies the waste. In the two test pits constructed in this area, the waste thickness was 3 feet (south end) and 10 feet (northern end).

3.3.2 CHEMICAL TEST RESULTS

Over 20 samples of waste rock and native materials were submitted for chemical analyses. Summary statistics for total metals, leachable metals, and acid base accounting are presented in Tables A10, A11, and A12, respectively. Analytical results for these same parameters for individual samples are presented in Tables B1, B2, and B3. Key findings from chemical testing are discussed below.

Total Metals

Average total concentrations of four elements in the 12 waste rock samples exceeded cleanup guidelines (Table 2). These included antimony (382 mg/kg), arsenic (1,236 mg/kg), lead (1,997 mg/kg), and manganese (1,873 mg/kg). In the eight native samples, no cleanup guidelines were exceeded.

Several samples were analyzed from the two smaller waste areas (Waste Rock-1 and Waste Rock-3; Figure 5). In Waste Rock-1, sample FS-WE-15-0-2.5 exhibited concentrations of arsenic (860 mg/kg), lead (1,850 mg/kg), and manganese (3,570 mg/kg) that exceeded cleanup guidelines. Sample FS-WE-04-0-8, collected from Waste Rock-3, exhibited a concentration of arsenic (6,940 mg/kg, Table B1) almost 10 times the cleanup guideline. Other samples from Waste Rock-3 exceeded cleanup standards for antimony, arsenic, cadmium, lead, and manganese (Table B1). In the native sample collected from 3 to 6 feet at FS-WE-10 (Waste Rock-3), substantial attenuation in total metals concentrations was observed relative to the overlying waste sample (Table B1).

Samples collected from Waste Rock-2 also exceeded cleanup guidelines for several metals, including antimony, arsenic, lead, and manganese. Highest concentrations of antimony (2,700 mg/kg) and lead (8,440 mg/kg) were detected in the sample from 15 to 16.5 feet in FS-WE-01.

Leachable Metals

Six waste samples were analyzed for leachable metals according to the SPLP method. Table A11 presents summary statistics according to sample type and Table B2 presents analytical results for each sample.

Review of Table B2 indicates that Idaho's chronic aquatic life standards were exceeded for three metals: cadmium (one sample), lead (two samples), and zinc (five samples). The highest concentrations of each of these leachable metals were exhibited in the 0.0 to 6.0 foot sample from FS-WE-09 (Figure 5, Waste Rock-2). The leachable lead and zinc concentrations were 22.7 mg/L and 3.5 mg/L, respectively. Results for samples FS-WE-02 and FS-WE-04 exceeded the mercury standard, but the results are qualified because matrix spike recoveries exceed acceptable limits.

Acid Base Accounting

Acid base accounting results for waste rock and native samples from the Weber Mine are presented in Tables A12 (summary statistics) and Table B3 (individual samples). Average saturated paste pH in waste rock and native materials is slightly acid (5.96 s.u. and 6.22 s.u., respectively). For both waste rock and native material, the average acid potential is less than 5 t/1000t and average total lime requirement is less than 0 t/1000t.

Several individual samples exhibited higher acidity and moderately high lime requirements. Two waste samples from Waste Rock-3 (FS-WE-04 and FS-WE-10) exhibited saturated paste pH values of 3.6 s.u. and 5.4 s.u. Sample FS-WE-04 had moderate total lime requirement (25 t/1000t). The only other samples with a moderate total lime requirement were from FS-WE-02 collected from the 2.5 to 4 feet depth interval (13 t/1000t) and FW-WE-09 at 7 feet (18 t/1000t). A sample collected from the same borehole (FS-WE-02) from 9 to 10.5 feet exhibited a negative total lime requirement.

3.3.3 PHYSICAL TEST RESULTS

Grain-size distribution was determined for four samples (three waste and one native) obtained from the Waste Rock-2 area. Atterberg limits were determined for two waste and one native samples. Table B4 (Appendix B) presents the data.

Waste rock samples at the Weber Mine exhibit a wide distribution of grain sizes with between 30 and 70 percent gravel-sized material. Percent clay ranged from approximately 7 to 35 percent. The plasticity index determined on two of the waste rock samples was 3 and 6, indicating low plasticity of the silt/clay fraction.

The native material sample collected at the 8 to 9 foot depth interval at FS-WE-13 exhibited a significantly finer grain size than overlying waste rock. Greater than 75 percent of the material was silt/clay and only 2 percent of the material was in the gravel size range. The native sample also exhibited a low plasticity (Table B4).

3.3.4 ESTIMATED VOLUME OF MINE WASTE MATERIAL

Areal extent of waste rock was determined using edges of waste determine during field reconnaissance. These approximate limits were surveyed and are shown on Figure 5 by a dashed line. Field staff did not observe waste rock on the south side of Gold Creek adjacent to Waste Rock-2 or west of Gold Creek adjacent to Waste Rock-3.

Waste rock volumes were calculated using both Eagle Point software (Waste Rock-2) and by calculating the area of waste rock multiplied by average thickness of waste rock (Waste Rock-1 and Waste Rock-3). The second method was used because of the limited thickness data from the two smaller dumps. The estimated average waste rock thickness for these two dumps was:

- Waste Rock-1 – 3 feet.
- Waste Rock-3 – 3 feet south of FS 1017; 10 feet north of FS 1017.

Figure 5 presents a cross section that extends through Waste Rock-2. Approximate (± 15 percent) volume of mine waste for the three areas are as follows:

Location	Volume (cubic yards)
Waste Rock-1	1,350
Waste Rock-2	71,500
Waste Rock-3	3,600
Total	**76,450**

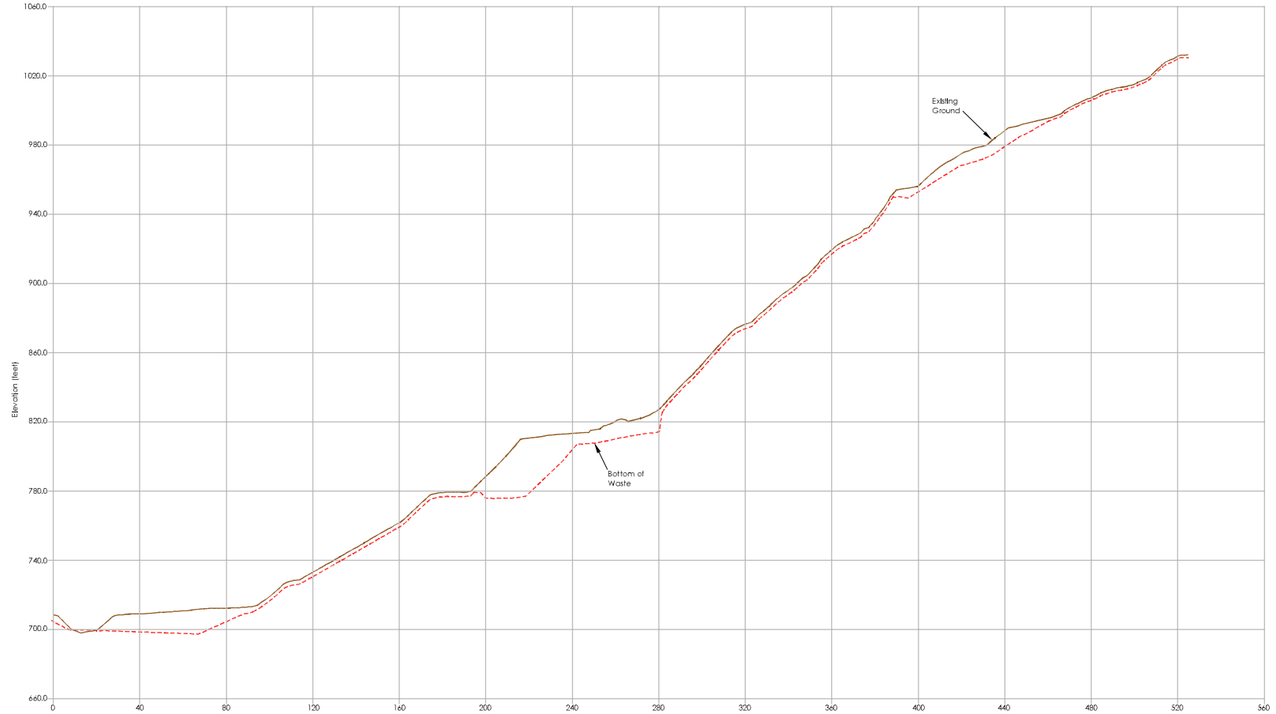
3.4 KEEP COOL MINE

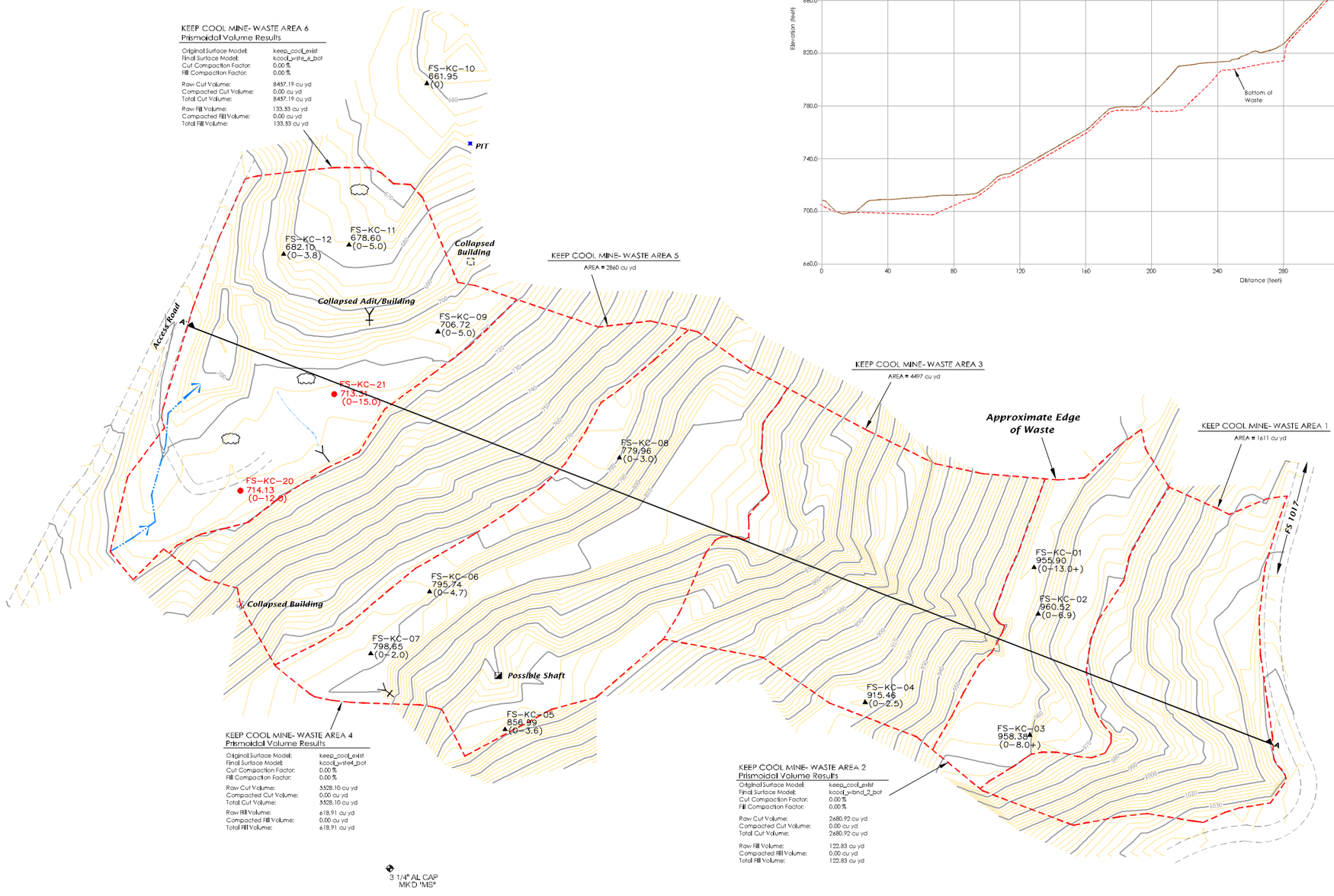
The upper end of the Keep Cool Mine site imposes on FS 1017 and an unimproved road from FS 1017 offers access to this portion of the site. The lower end is accessible by an unimproved road from FS 332. During field activities, one open adit, two collapsed adits, and one possible shaft were discovered. Figure 6 shows topography and key site features.

Maxim installed 12 test pits and two boreholes to investigate characteristics and thickness of mine waste at the mine (Table 6). Four hand samples of streambed/bank material were collected in the gulch below the mine to evaluate if mine waste extended downstream of the

Section A-A'

Horizontal Scale: 1" = 40 Feet
Vertical Scale: 1" = 40 Feet





LEGEND

- Hand Sample Location
- Drill Hole Sample Location
- Test Pit Sample Location
- USFS Aluminum Cap
- Caved/Collapsed Adit
- Open Adit
- Caved/Collapsed Shaft
- Open Shaft
- Seep
- Creek
- Slash Pile
- FS-HL-03 — Sample Number
- 88.63 — Ground Surface Elevation At Sample Point (feet) Relative to Local Benchmark
- (0 - 7.0+) — Waste Rock Interval (feet below ground surface)

NOTE: Survey performed by Eli & Associates Inc., June 2001
Contour Interval - 2 Feet

N

0 Feet 80

REV	DATE	DESCRIPTION	DRN BY	APP BY

Date: August, 2001
Project #: 2009168
File: environmental\goldcreek\keepcool mine.dwg
Sheet: 1 of 1

Project Title: Mine Waste Characterization and Repository Evaluation
Kaniksu National Forest
Bonner County, Idaho

Sheet Title:
Site Plan
Keep Cool Mine
FIGURE 6

MAXIM TECHNOLOGIES INC

TABLE 6
SAMPLING SUMMARY
KEEP COOL MINE
JUNE 2001

Method	Sample Site	Location	Total Depth	Sample Name	Sample Interval	Lithology	Waste Rock	Tailings	Cover Soil	Native	Sediment	Waste Interval	Chemical Anal*	Mercury	Sieve Analysis	Hydrometer	SPLP	Archived	Comments
BH	FS-KC-01	In upper road through dump	13	FS-KC-01-0-4(W)	0 - 4	Brown & yellow gravel & sandy clay	X					0 - 13+	X	X			X		
				FS-KC-01-9(N)	9	Brown sand & gravel				X			X						
BH	FS-KC-02	South of FS-KC-01	9	FS-KC-02-0-1.9(W)	0 - 1.9	Grey brown sandy clay & grvl	X					0 - 6.9	X						
				FS-KC-02-1.9-3.5(W)	1.9 - 3.5	Yellow brown sandy clay & grvl	X						X						
				FS-KC-02-8-9(N)	8 - 9	Wthrd ylw brwn brkn bedrock				X								X	
BH	FS-KC-03	South of FS-KC-02 in mound below gulley.	8	FS-KC-03-0-4(W)	0 - 4	Grey, orange & yellow clay, silt & gravel	X					0 - 8+	X						
				FS-KC-03-4-8(W)	4 - 8	Grey, orange & yellow clay, silt & gravel	X											X	
BH	FS-KC-04	On bench below (west) of FS-KC-03	5	FS-KC-04-0-2.5(W)	0 - 2.5	Yellow gravel & sand	X					0 - 2.5	X	X			X		
				FS-KS-04-2.5-5(N)	2.5 - 5	Brown & red native grvl				X								X	
BH	FS-KC-05	In mound above (south) collapsed adit	3.6	FS-KC-05-0-3.6(W)	0 - 3.6	Brwn coarse sand	X					0 - 3.6	X						No samples collected.
BH	FS-KC-06	On benck below collapsed adit and nc	6	FS-KC-06-0-2.5(W)	0 - 2.5	Gray angular gravel & sand	X					0 - 4.7	X						
				FS-KC-06-4.7-6(N)	4.7 - 6	Bedrock				X			X						
BH	FS-KC-07	Southwest of FS-KC-06	3	FS-KC-07	NA	Veneer of gray gravel & sand						0 - 2							
BH	FS-KC-08	On same bench and northeast of FS-KC-06	7	FS-KC-08-0-3(W)	0 - 3	Gray anglr grvl, silt,sand,clay	X					0 - 3	X		X	X			
				FS-KC-08-3-7(N)	3 - 7	Brown sand, gravel & silt				X			X						
BH	FS-KC-09	On same bench as, and northeast of open adit with flowing water	8	FS-KC-09-0-5(W)	0 - 5	Brown sand & gravel	X					0 - 5	X		X	X			
BH	FS-KC-10	At base of disturbed area north northeast of collapsed adit/building	8	FS-KC-10-0-2.3(N)	0 - 2.3	Brown loamy sand & grvl				X		0						X	Water encountered at 7.5 feet, wood debris and meal piping at 2.3 feet
				FS-KC-10-2.3-4(N)	2.3 - 4	Brwn sand w/ slight yellow sand				X			X						
BH	FS-KC-11	North of collapsed adit/building on next bench downslope of FS-KC 09	8	FS-KC-11-0-5(W)	0 - 5	Gray waste angular gravel	X					0 - 5	X	X			X		Wood debris, cribbing and metal at 0 to 5 feet
BH	FS-KC-12	West of FS-KC-11	8	FS-KC-12-0-3.8(W)	0 - 3.8	Yellow silt & sand	X					0 - 3.8	X	X			X		
				FS-KC-12-3.5(W)	3.5	Yellow silt & sand	X								X	X			
				FS-KC-12-3.8-6(N)	3.8 - 6	Native brown gravel & sand				X			X	X			X		
DR	FS-KC-20	On same bench and southwest of open adit with flowing water	18	FS-KC-20-5-6.5(W)	5 - 6.5	Gravel; angular	X					0 - 12						X	
				FS-KC-20-10-11.5(W)	10 - 11.5	Same with thin gray silt	X						X	X			X		
				FS-KC-20-15-16(N)	15 - 16	Weathered rock; gray/brown				X			X	X			X		
DR	FS-KC-21	On same bench and north of open adit with flowing water	26.5	FS-KC-21-5-6.5(W)	5 - 6.5	Angular gravel with tan silty fine-grained sand	X					0 - 15						X	
				FS-KC-21-10-11.5(W)	10 - 11.5	Yellow-tan silt and coarse sand	X						X						
				FS-KC-21-15-16.5(N)	15 - 16.5	Brown silty sandy gravel				X			X						
				FS-KC-21-20-21.5(N)	20 - 21.5	Brown silty sandy gravel				X								X	
				FS-KC-21-25-26.5(N)	25 - 26.5	Weathered rock; gray/brown and orange/red				X								X	
HS	Keep Cool Gulch	Bank material sample approx. 40 feet upstream of culvert crossing FS 1180	2	FS-KCG-01-0-2(N)	0 - 2	Silt, sand and Gravel				X		NA	X						
HS	Keep Cool Gulch	Bed material sample approx. 40 feet upstream of culvert crossing FS 1180	2	FS-KCG-02-0-2(N)	0 - 2	Silt, sand and Gravel				X		NA	X						
HS	Keep Cool Gulch	Bank material sample approx. 100 feet downstream from FS-KC-10	2	FS-KCG-03-0-2(N)	0 - 2	Silt, sand and Gravel				X		NA	X						
HS	Keep Cool Gulch	Bed material sample approx. 100 feet downstream from FS-KC-10	2	FS-KCG-04-0-2(N)	0 - 2	Silt, sand and Gravel				X		NA	X						

Notes:
Depth in feet below ground surface
DR - Drill rig
BH - Backhoe
HS - Hand sample

* - Chemical Analyses includes pH/EC, S-Fract., N-Poten., A/B Acct., SMP, and T. Metals
NA - Not applicable
Duplicate identified in comments column
Sample Site Numbers FS-KC-13 through FS-KC-19 not used

mine (Table 6). Logs of test pits and boreholes are contained in Appendix C and photographs of several sampling sites are contained in Appendix D.

3.4.1 WASTE DISTRIBUTION, CHARACTER AND THICKNESS

Approximate limits of waste rock are shown on Figure 6. Maxim segregated the contiguous waste rock deposit at the site into six areas based on topography and waste thickness. Waste Areas 1, 3, and 5 are located on relatively steep slopes with waste rock thickness of 1.5, 2.5, and 2 feet, respectively. Waste Areas 2, 4, and 6 are on flat to gentler slopes and exhibited maximum waste thickness of greater than 13.0, 4.7, and 15 feet, respectively (Table 6 and Figure 6).

Waste rock at Waste Areas 1 through 5 was generally observed to be varicolored gravel with varying amounts of sand and clay. The gravelly waste rock material had a range of color, including brown, orange, yellow, and gray (Table 6 and Appendix C). Bedrock was encountered in several sampling sites, including FS-KC-02 and FS-KC-05. Native material was observed to be bedrock and/or a more competent red to brown gravel with silt and sand.

In boreholes and test pits in Waste Area 6, several sampling locations encountered yellow silt and coarse sand (e.g., FS-KC-12 and FS-KC-21). According to the IGS (1997), a 50-ton per day flotation plant was constructed at the site in 1937 and operated until 1938. It is possible these sandy sediments may be associated with former milling operations. Test pit FS-KC-10, just north of Waste Area 6 (Figure 6), encountered a brown sand and wood cribbing. Earth materials in other sampling locations consisted of brown and gray sand and angular gravel.

3.4.2 CHEMICAL TEST RESULTS

Twenty-four samples consisting of waste rock, native material, and streambed/bank samples were submitted for analysis. Samples from Waste Rock Areas 2, 3, 4, and 6 (Figure 6) were obtained and submitted for total metals analyses. The relatively thin veneer of waste rock on the steep slopes at Waste Areas 1 and 5 were not sampled. Summary statistics (minimum, maximum, and average values) for total metals, leachable metals, and acid base accounting are presented in Tables A13, A14, and A15 (Appendix A). Results of individual samples for the same parameters are presented in Tables B1, B2, and B3 (Appendix B). Key findings from the review of analytical results are presented below.

Total Metals

Concentrations of four elements in samples exceed cleanup guidelines (Table B1). These are total arsenic (three waste rock samples), total cadmium (three waste rock samples), total lead (two native samples and 11 waste rock samples), and total manganese (seven native samples and 12 waste rock samples). For average waste rock concentrations (Table A13), total lead exceeded the cleanup guideline by a factor of 10 (12,320 mg/kg) and total manganese was three times the guideline (2,268 mg/kg). In the 11 native samples, the average for total manganese (1,974 mg/kg) exceeded the cleanup guideline.

Analytical results for several samples show that highest total metal concentrations were generally from Waste Areas 3, 4, and 6. The highest total arsenic, total cadmium, and total lead concentrations were detected in sample FS-KC-04 in Waste Area 3. Lead concentrations more than five times the cleanup guideline of 1,100 mg/kg were measured in samples from FS-KC-04 (Waste Area 3), FS-KC-08 (Waste Area 4), and FS- KC-09, -12, and -21 (Waste Area 6).

Four stream bed/bank samples were collected in the gulch below the Keep Cool Mine (Table 6). Samples FS-KCG-01 (stream bank) and -02 (stream bed) were obtained approximately 40 feet upstream of the culvert crossing at FS 1180. Samples FS-KCG-03 (stream bank) and -04 (stream bed) were collected approximately 100 feet downstream of FS-KC-10. Results of total metal analyses for these samples are presented in Table B1. Only the cleanup guideline for total manganese was exceeded in the four samples. The downstream samples (FS-KCG-01 and –02) exhibited higher concentrations of total arsenic and total lead than the samples collected 100 feet below the mine site (Table B1).

Leachable Metals

Leachable metals results for 5 waste rock and 2 native samples are presented in Tables A14 and B2. Only samples from Waste Areas 2, 3, and 6 were analyzed for leachable metals. All seven samples exceeded the chronic aquatic life standards for zinc. The two native samples from Waste Area 6 (FS-KC-12 and FS-KC-21) exhibited the lowest zinc concentrations. In addition to zinc, sample FS-KC-11-0-5 exceeded the standard for lead. Highest concentrations of all leachable metals were measured in samples collected from FS-KC-12 at a depth interval of 0 to 3.8 feet. Values in excess of chronic aquatic life standards are cadmium (0.028 mg/L), copper (0.33 mg/L), lead (15.7 mg/L), mercury (0.0024 mg/L), and zinc (14 mg/L).

Acid Base Accounting

Tables A15 and B3 present summary statistics and individual sample results for acid base accounting tests performed on mine waste and native samples. Samples were obtained from Waste Areas 2, 3, 4, and 6, and from the stream bed/bank of the gulch below the mine (Table 6). Average saturated paste pH for waste rock (13 samples) was slightly to moderately acidic (5.76 s.u.). Native material samples (11 samples) exhibited an average saturated pH of 6.74. The average total lime requirement for all samples was moderate at 26 t/1000t. The average total lime requirement for native material was 0.28 t/1000t.

Table B3 shows that acid potential ranges from 0 to 116 t/1000t with 14 of the 24 samples exhibiting 0 acid potential. Samples exhibiting total lime requirements in the moderately high (30 to 100 t/1000t) to high range (>100 t/1000t) were collected from Waste Areas 3 (one sample), 4 (one sample), and 6 (two samples). Stream bed/bank samples from the gulch below the mine exhibited 0 acid potential and total lime requirements ranging from -4 to 8 t/1000t.

3.4.3 PHYSICAL TEST RESULTS

Grain-size distribution analyses were performed on three samples, including one from Waste Area 4 (FS-KC-08) and two from Waste Area 6 (FS-KC-09 and -12). Table B4 presents the results. The three samples exhibited similar grain-size distributions, with the sample from Waste Area 4 being slightly finer grained. All samples were well-graded and had greater than 50 percent gravel-sized material. Silt and clay ranged from 14 to 17.6 percent.

3.4.4 ESTIMATED VOLUME OF MINE WASTE MATERIAL

Waste volumes for the six waste areas were calculated using two methods. For Waste Areas 2, 4, and 6, sufficient waste depth information was available to model volumes using Eagle Point software. For Waste Areas 1, 3, and 5, volumes were calculated using the mapped waste area and assumed average waste rock thickness of 1.5, 2.5, and 2 feet, respectively.

Figure 6 presents longitudinal cross sections through each waste area showing the 330 feet of relief at the site. The approximate volume of waste rock in the six waste areas ($\pm$ 15 percent) is presented below.

Location	Volume (cubic yards)
Waste Area 1	1,610
Waste Area 2	2,680
Waste Area 3	4,500
Waste Area 4	5,530
Waste Area 5	2,860
Waste Area 6	8,460
Total	**25,640**

3.5 IDAHO LAKEVIEW MINE

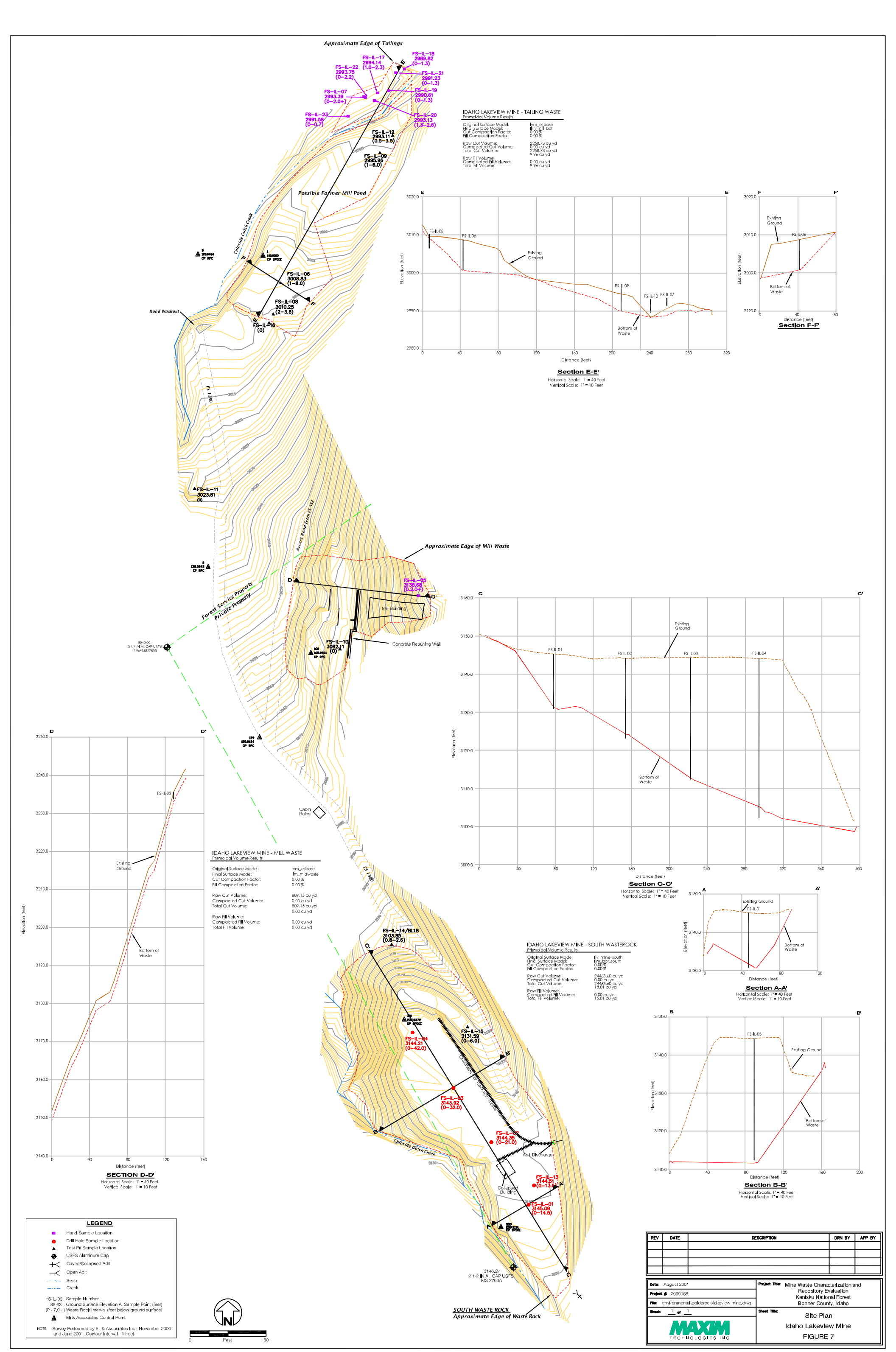
A total of five boreholes, nine backhoe test pits, and nine hand samples (using a hand auger or shovel) were constructed at the Idaho Lakeview Mine. Table 7 provides a summary of the sampling program. Figure 7 is a topographic map of the site and shows three primary mine waste areas:

- South Waste Rock – a large dump on the south end of the site. The dump's surface is planar and hosts an abandoned ore/waste car rail and trestle on the east site of the dump. An open adit and a collapsed adit on the southeast and south ends of the dump, respectively, are the presumed sources of waste rock. During our site investigations, the open adit was discharging water via a small channel to Chloride Gulch. The entire western edge of the dump was adjacent to flowing water in Chloride Gulch, and in places mine waste impinged on the creek.

- Mill Waste – a collapsed mill structure is present in the middle of the site. Concrete foundations and metal and wooden debris litter the area. Ore and/or mill waste is present on the steep slopes adjacent to the mill structures.

- Tailing Waste – a lobate tailing deposit is located on the north end of the site. The tailings are armored over much of the area with slate-type rock. At the northern end, Chloride Gulch Creek bisects the tailing deposit.

Each of these three areas was investigated to evaluate the thickness and characteristics of the mine waste. Logs of borehole and test pits are contained in Appendix C. Representative photographs of several sampling sites are contained in Appendix D.



IDAHO LAKEVIEW MINE - TAILING WASTE
Prismoidal Volume Results

Original Surface Model:	lvm_ellbase
Final Surface Model:	tlm_tailll_bot
Cut Compaction Factor:	0.00 %
Fill Compaction Factor:	0.00 %
Raw Cut Volume:	2258.73 cu yd
Compacted Cut Volume:	0.00 cu yd
Total Cut Volume:	2258.73 cu yd
	9.96 cu yd
Raw Fill Volume:	
Compacted Fill Volume:	0.00 cu yd
Total Fill Volume:	9.96 cu yd

Section E-E'
Horizontal Scale: 1" = 40 Feet
Vertical Scale: 1" = 10 Feet

Section F-F'

Section C-C'
Horizontal Scale: 1" = 40 Feet
Vertical Scale: 1" = 10 Feet

Section A-A'
Horizontal Scale: 1" = 40 Feet
Vertical Scale: 1" = 10 Feet

Section B-B'
Horizontal Scale: 1" = 40 Feet
Vertical Scale: 1" = 10 Feet

SECTION D-D'
Horizontal Scale: 1" = 40 Feet
Vertical Scale: 1" = 10 Feet

IDAHO LAKEVIEW MINE - MILL WASTE
Prismoidal Volume Results

Original Surface Model:	lvm_ellbase
Final Surface Model:	tlm_mldwaste
Cut Compaction Factor:	0.00 %
Fill Compaction Factor:	0.00 %
Raw Cut Volume:	809.15 cu yd
Compacted Cut Volume:	0.00 cu yd
Total Cut Volume:	809.15 cu yd
	0.00 cu yd
Raw Fill Volume:	
Compacted Fill Volume:	0.00 cu yd
Total Fill Volume:	0.00 cu yd

IDAHO LAKEVIEW MINE - SOUTH WASTEROCK
Prismoidal Volume Results

Original Surface Model:	tlv_mine_south
Final Surface Model:	tlm_bot_south
Cut Compaction Factor:	0.00 %
Fill Compaction Factor:	0.00 %
Raw Cut Volume:	24463.60 cu yd
Compacted Cut Volume:	0.00 cu yd
Total Cut Volume:	24463.60 cu yd
	15.01 cu yd
Raw Fill Volume:	
Compacted Fill Volume:	0.00 cu yd
Total Fill Volume:	15.01 cu yd

LEGEND

- Hand Sample Location
- Drill Hole Sample Location
- Test Pit Sample Location
- USFS Aluminum Cap
- Caved/Collapsed Adit
- Open Adit
- Seep
- Creek

FS-IL-03 Sample Number
88.63 Ground Surface Elevation At Sample Point (feet)
(0 - 7.0+) Waste Rock Interval (feet below ground surface)

- Eli & Associates Control Point

NOTE: Survey Performed by Eli & Associates Inc., November 2000 and June 2001, Contour Interval - 1 Feet

REV	DATE	DESCRIPTION	DRN BY	APP BY

Date: August 2001	Project Title: Mine Waste Characterization and Repository Evaluation Kaniksu National Forest Bonner County, Idaho
Project #: 2009168	
File: environmental.goldcreek\lakeview mine.dwg	
Sheet: 1 of 1	Sheet Title: Site Plan Idaho Lakeview Mine FIGURE 7

MAXIM TECHNOLOGIES INC

TABLE 7
SAMPLING SUMMARY
IDAHO LAKEVIEW MINE
NOVEMBER 2000 AND JUNE 2001

Method	Sample Site	Location	Total Depth	Sample Name	Sample Interval	Lithology	Waste Rock	Tailings	Cover Soil	Native	Sediment	Waste Interval	Chemical Anal*	Mercury	Sieve Analysis	Hydro-meter	SPLP	Archived	Comments
DR	FS-IL-01	South end of waste rock dump of adit #1.	21	FS-IL-01-4.5-6.0(W)	4.5-6	Very angular gravel with well graded sand	X					0-14.5	X	X			X		
				FS-IL-01-9.5-11(W)	9.5-11	Gray with zones of orange and red-brown	X						X	X					
				FS-IL-01-14.5-16(N)	14.5-16	As above but predominantly brown				X								X	
				FS-IL-01-19.5-21(N)	19.5-21	Very angular gravel with brown silty sand				X								X	
DR	FS-IL-02	Approx. 70' North of FS-IL-01 on waste rock dump of adit #1.	21	FS-IL-02-11-16(W)	11-16	Very angular gravel with well graded sand, gray to	X					0-21	X	X			X		
				FS-IL-02-16-21(W)	16-21	orange-brown	X						X	X					
				FS-IL-02-21-22(N)	21-22	Sandy gravel; olive color with iron oxide staining				X			X						
				FS-IL-02-22-23(N)	22-23	Sandy gravel as above				X			X						
				FS-IL-02-23-24(N)	23-24	Gray and brown sandy gravel				X								X	
DR	FS-IL-03	Approx 70' North of FS-IL-02 on waste rock dump of adit #1.	41	FS-IL-03-9.5-11(W)	9.5-11	Gravel and sand with rock frags ranging	X					0-32	X	X					
				FS-IL-03-19.5-21(W)	19.5-21	in color from gray to orange-brown.	X											X	
				FS-IL-03-29.5-31(W)	29.5-31	Gravel and sand predominantly gray with	X						X	X					
				FS-IL-03-31-32(N)	31-32	higher percent of silt than above.	X											X	
				FS-IL-03-32-33(N)	32-33					X			X						
				FS-IL-03-33-34(N)	33-34	Gravel and silty sand ranging in color from gray to orange-gray				X			X						
				FS-IL-03-34-35(N)	34-35					X								X	
				FS-IL-03-35-36(N)	35-36					X								X	
				FS-IL-03-36-37(N)	36-37	As above with weathered rock				X								X	
				FS-IL-03-37-38(N)	37-38	As above with weathered rock				X								X	
				FS-IL-03-38-39(N)	38-39	As above with weathered rock				X								X	
				FS-IL-03-39-40(N)	39-40	As above with weathered rock				X								X	
				FS-IL-03-140-41(N)	40-41	As above with weathered rock				X								X	
DR	FS-IL-04	North end of waste rock dump of adit #1.	65.5	FS-IL-04-9.5-26(W)	9.5-26	Angular gravel with med. to coarse sand ranging from gray to orange-brown	X					0-42						X	
				FS-IL-04-29.5-41(W)	29.5-41		X						X	X			X		Blind Field Duplicate, #3
				FS-IL-04-41-42(W)	41-42		X												
				FS-IL-04-42-43(N)	42-43	Angular gravel with silty coarse sand				X			X						
				FS-IL-04-43-44(N)	43-44	Angular gravel with silty coarse sand				X								X	
				FS-IL-04-44.5-46(N)	44.5-46	Gray gravel and sand				X								X	
				FS-IL-04-49.5-51(N)	49.5-51	Very angular green-gray gravel and coarse sand				X								X	
				FS-IL-04-54.5-56(N)	54.5-56	Green-gray gravel and coarse sand				X								X	
				FS-IL-04-59.5-61(N)	59.5-61	Green-gray gravel and coarse sand				X								X	
				FS-IL-04-64.5-65.5(N)	64.5-65.5	Green-gray gravel and coarse sand				X								X	
HS	FS-IL-05	Hand sample - near top of burnt mill in tailings pile	2.0	FS-IL-05-0-2.0(T)	0-2.0	Brown-gray fine sand and silt	X					2.0+	X	X		X	X		
BH	FS-IL-06	South side of 'tailings covered by shale'	12	FS-IL-06-0-1.0(N)	0-1.0	Brown gravelly sandstone capped by flaggy gravel			X			1.0-8.0	X						
				FS-IL-06-1.0-4.8(T)	1.0-4.8	Orange-yellow silt and clay with gray streaks		X					X	X					sulfur odor
				FS-IL-06-4.8-8.0(T)	4.8-8.0	Gray clay and silt		X					X	X		X	X		
HS	FS-IL-07	West of creek adjacent with tailings mound	2.0	FS-IL-07-0-2.0(T)	0-2.0	Orange-yellow silt and clay		X				2.0+	X	X		X	X		
BH	FS-IL-08	Just south of FS-IL-06, just inside berm	10	FS-IL-08-3.8-5.3(N)	3.8-5.3	Red-brown gravelly sandstone, charred debris			X			2.0-3.8						X	Material from 5.3-8 feet likely native channel deposits and not waste rock
				FS-IL-08-5.3-8.0(W)	5.3-8.0	Gray gravel with silt and sand	X						X	X					
BH	FS-IL-09	North side of 'tailings covered by shale'	10	FS-IL-09-0-1.0(N)	0-1.0	Brown gravelly sand with silt			X			1.0-6.0						X	Gray clay from 3-6 feet; water table encountered at 6 feet. Material from 6 to10 feet likely native channel deposits and not waste rock.
				FS-IL-09-1.0-3.0(T)	1.0-3.0	Orange-yellow silt and clay with gray streaks		X					X	X		X	X		
				FS-IL-09-6.0-10(W)	6.0-10	Gray unconsolidated saturated gravel	X						X	X					
BH	FS-IL-10	On bench just below and south of burnt mill	8.0	FS-IL-10-0-8(N)	0-8.0	Brown sandy gravel with silt				X		NA						X	
BH	FS-IL-11	In depression on W. side of road/E. side of creek	6.0	FS-IL-11-0-6(N)	0-6.0	Brown sand and gravel w/ clay at 3' (native)				X		NA						X	
BH	FS-IL-12	North side of tailings (20' N of FS-IL-09)	7.0	FS-IL-12-3.5-7.0(N)	3.5-7.0	Brown-gray gravel with cobbles				X		0.5-3.5	X	X					Blind Field Duplicate, #4
DR	FS-IL-13	Approx 20' NE of FS-IL-01 on S end of waste rock dump of adit #1.	15.5	FS-IL-13-3.0-8.5(W)	3-8.5	Sandy silty gravel predominantly gray with orange to	X					0-13.5	X	X					
				FS-IL-13-8.5-13.5(W)	8.5-13.5	red-brown layers	X						X	X			X		
				FS-IL-13-13.5-14.5(N)	13.5-14.5	Soft brown clayey silt				X			X						
				FS-IL-13-14.5-15.5(N)	14.5-15.5	Soft brown clayey silt				X			X						
BH	FS-IL-14	Dug into toe of northern-most part of upper dump	6.0	FS-IL-14-0-0.8(N)	0-0.8	Brown siltstone with gravel			X			0.8-2.6						X	toe of slope defines waste limit
				FS-IL-14-0.8-1.7(W)	0.8-1.7	Gray clay and silt	X											X	
				FS-IL-14-1.7-2.6(W)	1.7-2.6	Orange clay and silt	X						X	X					
				FS-IL-14-2.6-3.3(N)	2.6-3.3	Brown silt and clay with gravel, charred debris				X			X						
				FS-IL-14-3.3-6(N)	3.3-6.0	Brown silt and clay with gravel				X								X	
BH	FS-IL-15	East side of upper dump	10.0	NA	0-0.5	Brown soil covering waste rock			X			0.5-6.0							
				NA	0.5-6.0	Mottled gray/orange/yellow gravel and sand	X												No samples taken.
				NA	6.0-10	Olive green sandy gravel		X											
BH	FS-IL-16	10 feet south of FS-IL-08	7.0	NA	0-7.0	Brown gravelly sand				X		NA							No samples taken.
HS	FS-IL-17	Mound northeast of Chloride Gulch Creek, north end of mine site	2.3	FS-IL-17	0-2.3	Red orange sand and gravel		X				1 - 2.3							No samples taken.
HS	FS-IL-18	Mound northeast of Chloride Gulch Creek, north end of mine site	2.5	FS-IL-18-0-1.3(T)	0 - 1.3	Red orange sand and gravel		X				0 - 1.3	X	X			X		
				FS-IL-18-1.3-2.5(N)	1.3 - 2.5	Weathered bedrock				X			X						
HS	FS-IL-19	Mound northeast of Chloride Gulch Creek, north end of mine site	2.5	FS-IL-19-0-1.3(T)	0 - 1.3	Red orange sand and gravel		X				0 - 1.3						X	
				FS-IL-19-1.3-2.5(N)	1.3 - 2.5	Weathered bedrock				X								X	
HS	FS-IL-20	Mound northeast of Chloride Gulch Creek, north end of mine site	2.6	FS-IL-20-0-1.3(N)	0 - 1.3	Brwn & orange cover soil			X			1.3 - 2.6						X	
				FS-IL-20-1.3-2.6(T)	1.3 - 2.6	Red orange sand and gravel		X										X	
HS	FS-IL-21	Mound northeast of Chloride Gulch Creek, north end of mine site	1.3	FS-IL-21	0-1.3	Red orange silt and sand		X				0 - 1.3							No samples taken.
HS	FS-IL-22	Mound northeast of Chloride Gulch Creek, north end of mine site	2.2	FS-IL-22	0-2.2	Red orange silt and sand		X				0 - 2.2							No samples taken.
HS	FS-IL-23	Mound northeast of Chloride Gulch Creek, north end of mine site	0.7	FS-IL-23	0-0.7	Red orange silt and sand		X				0 - 0.7							No samples taken.

Notes:
Depth in feet below ground surface
DR - Drill rig
BH - Backhoe
HS - Hand sample

* - Chemical Analyses includes pH/EC, S-Fract., N-Poten., A/B Acct., SMP, and T. Metals
NA - Not applicable
Duplicate identified in comments column

3.5.1 WASTE DISTRIBUTION, CHARACTER AND THICKNESS

A series of boreholes were installed along the axis of the South Waste Rock dump (Figure 7). Over the approximate 400 foot-long length of the dump, the maximum thickness of waste rock was 42 feet (FS-IL-04). Field staff described waste rock as angular gravel with well graded sand, ranging in color from gray to orange-brown. Native materials beneath the waste rock consisted of green-gray gravel and coarse sand.

Waste rock adjacent to the former mill is a relatively thin deposit on the steep hillside. Based on two hand-excavated samples, the material is brown silty sand and brown sandy gravel with silt. Although maximum thickness of waste rock was not conclusively determined, field investigators estimate its thickness at approximately 2 feet.

The tailing deposit on the north end of the site is a fairly distinct topographic feature with a longitudinal (north/south) dimension of approximately 300 feet and a transverse dimension of approximately 80 feet. Tailing deposits are variable in color, ranging from hues of red, orange, yellow, brown and gray. The tailings have a fine sand to silty/clayey texture. Silty gravel was observed beneath tailings. The maximum tailing thickness was 8 feet in the southern portion of the deposit.

3.5.2 CHEMICAL TEST RESULTS

Analytical data for waste rock, tailing and native material samples from the Idaho Lakeview site are presented in Tables A16 and B1 (total metals), A17 and B2 (leachable metals), and A18 and B3 (acid base accounting). Key analytical findings are discussed below.

Total Metals

Average total concentrations (Table 16) of arsenic, cadmium, lead, and manganese exceeded cleanup guidelines in average waste rock (12 samples), tailings (six samples), and in native material (11 samples). Highest average concentrations for total arsenic, cadmium, and lead were measured in tailings samples.

In samples from the South Waste Rock dump, total arsenic ranged from three to 10 times the cleanup guideline (Table B1). Native material sampled beneath waste exhibited total arsenic between 700 and 7,860 mg/kg. Two native samples collected from FS-IL-03 (Figure 7), 1 and 2 feet below the observed base of waste rock exhibited relatively high concentrations of arsenic, cadmium, lead, and manganese, indicating that waste rock may be greater than 32 feet thick in this area or that considerable leaching of these metals from the overlying waste rock has occurred. At FS-IL-13, analytical results of native samples obtained 1 and 2 feet below waste

rock show dramatic reductions in concentrations of total arsenic, cadmium, and lead. These data from FS-IL-03 and -13 suggest that conclusive identification of the contact between waste rock and native materials may be difficult.

One sample from the mill waste area was analyzed for total metals (FS-IL-05-0-2, Table B1). Exceedences of cleanup guidelines were measured for total arsenic (8,560 mg/kg), total cadmium (22 mg/kg), total lead (3,340 mg/kg), and total manganese (5,000 mg/kg).

All of the tailing samples from the north end of the site exceeded the total arsenic cleanup guideline. Three tailing samples exhibited cadmium ranging from 25 to 73 mg/kg. In four of the five tailing samples, the cleanup guideline for total lead was exceeded. With the exception of sample FS-IL-18 collected from 1.3 to 2.5 feet, all native samples collected beneath tailings exhibited concentrations of arsenic, cadmium, and lead below cleanup guidelines.

Leachable Metals

Table B2 presents leachable metals data for 10 samples collected at the Idaho Lakeview Mine. The sample of mill waste did not exceed any chronic aquatic life standard. Samples from the South Waste Rock dump exceeded standards for cadmium (one sample) and for zinc (three samples). The four tailing samples exceeded several standards, including arsenic (one sample), cadmium (three samples), copper (one sample), lead (one sample), and zinc (four samples). The sample from FS-IL-09 at the north end of the tailing deposit exhibited the highest concentrations of leachable metals. The single native sample analyzed (FS-IL-12, beneath tailings) exhibited leachable chromium (0.03 mg/L) above the standard of 0.011 mg/L. Clearly, tailing materials are much more leachable than waste rock at the Idaho Lakeview Mine and Mill site, and probably present a greater hazard to human health and the environment at this site as a result of this characteristic.

Acid Base Accounting

A representative set of mine waste and native samples was collected from the South Waste Rock dump and Tailing Waste area for acid base accounting analyses. A sample from the Mill Waste area was also submitted for acid base accounting tests. Summary statistics are presented in Table A18, and Table B3 presents data for individual samples.

Average waste rock pH was moderate and average pH of tailing was strongly acidic. The 13 waste rock samples exhibited an average pH of 5.7 s.u. and the six tailing samples exhibited an average pH of 5.03 s.u. The average pH of native material samples was 6.35 s.u.

Waste rock samples collected from the large dump had a relatively high average acid potential (114 t/1000t). Average acid potentials for tailing and native samples were approximately 48 t/1000t. Maximum acid potential for individual waste rock and tailing samples were 257 and 147 t/1000t, respectively. The mill waste sample exhibited an acid potential of 147 t/1000t.

On average, a moderately high amount lime would be required to neutralize waste rock and tailing material. Both types of mine waste exhibited average total lime requirements of approximately 50 t/1000t. The average total lime requirement for native material was approximately 33 t/1000t. Excluding two samples designated as native (FS-IL-03-32-33 and FS-IL-03-33-34), the average total lime requirement for native material (10 samples) is approximately 13 t/1000t.

3.5.3 Physical Test Results

Three tailing and one mill waste sample were analyzed for percentages of sand, silt, and clay (Table B4). In general, tailing has a sandy loam texture and contains an average of 62 percent sand, 27 percent silt, and 11 percent clay. The mill waste sample has a slightly coarser texture with 78 percent sand and approximately 22 percent silt and clay.

3.5.4 Estimated Volume of Mine Waste Material

Figure 7 shows the areal extent of waste rock, mill waste and tailings observed. Mine waste volumes for the three distinct areas were determined using Eagle Point software. Due to limited thickness data for mill waste, a waste depth of 2 feet was used to calculate volumes.

Longitudinal and transverse cross sections for the South Waste Rock dump and the tailing deposit is shown on Figure 7. A down-slope cross section of the mill waste is also included on these graphics. Approximate (± 15 percent) volumes of mine waste for the three areas are:

Location	Volume (cubic yards)
South Waste Rock	24,460
Mill Waste	810
Tailing Waste	2,260
Total	**27,530**

3.6 CHLORIDE GULCH

The original intention of the investigation of tailings in Chloride Gulch was to focus on the meadow area (Sections 21, 22, and 28, T53N, R1W; Figure 2). Maxim expanded the investigation based on the widespread presence of tailing waste discovered in the drainage.

The eventual extent of the area investigated extended from the northern end of the Idaho Lakeview Mine to approximately 1,200 feet downstream of the junction of Forest Service Roads FS 1180 and FS 278 (Figure 2).

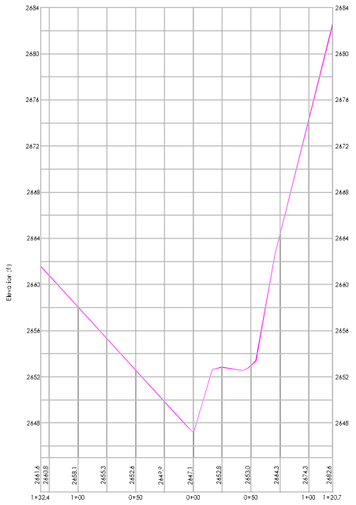
3.6.1 WASTE DISTRIBUTION, CHARACTER AND THICKNESS

Figure 8 shows the Chloride Gulch site. GPS techniques were used to prepare the site map and elevations are related to Forest Service benchmarks located near the junction of Chloride Gulch and East Chloride Gulch. Hip chain measurements and the existing USGS topographical map were also used to locate tributaries and other features on the site map. Seven topographic profiles, ranging from approximately 50 to 150 feet laterally from the stream channel, were surveyed to show the topographic character of the active channel in Chloride Gulch (Figure 8).

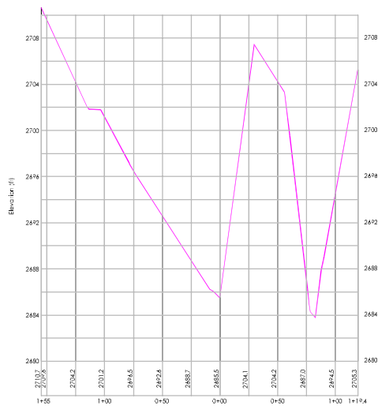
The approximately 11,000-foot long reach of Chloride Gulch surveyed was generally vegetated with forest and riparian vegetation. In general, the lower reaches had a more open forest canopy and a wider creek channel (greater than 20 feet in many locations). The channel in Chloride Gulch was incised in most places with bank heights ranging from 1 foot to more than 20 feet. Multiple abandoned channels were observed adjacent to the active channel at several sampling stations (Figure 8). In June 2001, Chloride Gulch Creek was not flowing below approximately FS-GC-13 (Figure 8), but seeps and small pools were observed in the reach below FS-GC-13. Foot travel in the channel was at times problematic due fallen trees. Photographs in Appendix D represent site conditions in Chloride Gulch.

A primary focus of the investigation was to evaluate the presence of tailing deposits in or adjacent to the creek channel in Chloride Gulch. Table 8 presents data for 22 sites sampled in Chloride Gulch. Maxim observed that tailings were ubiquitous in the streambanks over the surveyed reach of Chloride Gulch.

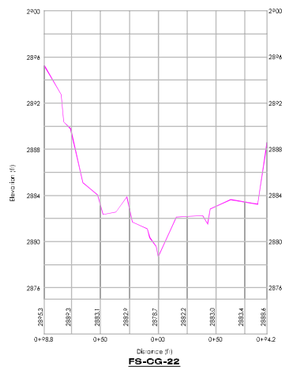
In the lower reach of the gulch (below FS-CG-05, Figure 8), tailings in the streambank often occurred adjacent to large trees or root balls and were less apt to be found very far from the active channel. Upstream of this reach, tailings were present in the flood plain wherever the floodplain was more level, especially on the east-southeast of the gulch. Tailings range in color from red/orange brown to gray and yellow. In places, red/orange deposits were streaked with



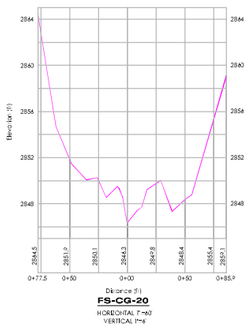
FS-CG-08
HORIZONTAL 1"=60'
VERTICAL 1"=6'



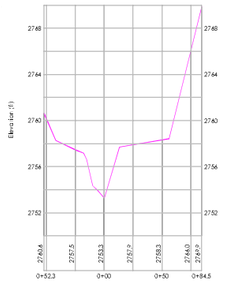
FS-CG-13
HORIZONTAL 1"=60'
VERTICAL 1"=6'



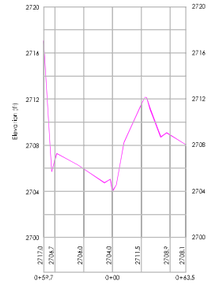
FS-CG-22
HORIZONTAL 1"=60'
VERTICAL 1"=6'



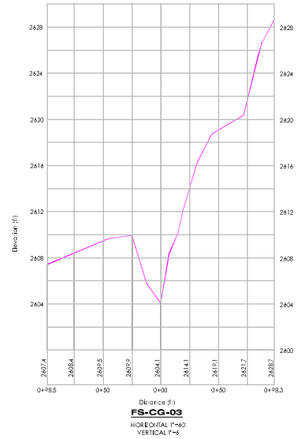
FS-CG-20
HORIZONTAL 1"=60'
VERTICAL 1"=6'



FS-CG-15
HORIZONTAL 1"=60'
VERTICAL 1"=6'



FS-CG-14
HORIZONTAL 1"=60'
VERTICAL 1"=6'



FS-CG-03
HORIZONTAL 1"=60'
VERTICAL 1"=6'

LEGEND

- Spot Elevation
- Cross Section Sample Location
- Sample Location
- USFS Aluminum Cap
- Pioneer Sample Site
- Exposed Tailings, Vegetated
- Seep
- Creek

HS-SL-03 Sample Number
2877.07 Ground Surface Elevation At Sample Point (feet)

NOTE: Locations for FS-CG-1,2,4,5,6,7,9,10,11,12,16,18,19, 21, and 23 estimated using "hip-chain" measurements along creek channel. All other sampling locations surveyed by Ell & Associates, Inc.

Sample site number FS-CG-17 not used

Survey performed by Ell & Associates Inc., June 2001

REV	DATE	DESCRIPTION	DRN BY	APP BY

Date: August, 2001	Project Title: Mine Waste Characterization and Repository Evaluation Kaniksu National Forest Bonner County, Idaho
Project #: 2009168	
File: environmental\gold creek\chloridegulch.dwg	
Sheet: 1 of 1	Sheet Title: Site Plan Chloride Gulch FIGURE 8

MAXIM TECHNOLOGIES INC

TABLE 8
SAMPLING SUMMARY
CHLORIDE GULCH MINE
NOVEMBER 2000 AND JUNE 2001

Method	Sample Site	Location	Total Depth	Sample Name	Sample Interval	Lithology	Waste Rock	Tailings	Cover Soil	Native	Sediment	Waste Interval	Chemical Anal*	Mercury	Sieve Analysis	Hydro-meter	SPLP	Archived	Comments
HS	FS-CG-01	280 feet from junction of Chloride Gulch and FS 1180	NA	FS-CG-01(T)	0.3-1.3	Brown to orange-brown fine sand		X				Not Determined	X	X					Tailings 1.0 feet thick
HS	FS-CG-02	329 feet from junction of Chloride Gulch and FS 1180	NA	FS-GC-02(T)	0.25-0.9	Brown to orange-brown fine sand		X				Not Determined						X	Tailings 0.6 feet thick
HS	FS-CG-03	694 feet from junction of Chloride Gulch and FS 1180	NA	FS-CG-03(T)	0.25-0.75	Red-brown to orange very fine sand		X				Not Determined	X	X		X	X		Tailings 0.5 feet thick
HS	FS-CG-04	2035 feet from junction of Chloride Gulch and FS 1180	NA	FS-CG-04(T)	0.25-1.25	Orange-brown fine sand		X				Not Determined	X	X		X	X		Tailings 1.0 foot thick
HS	FS-CG-05	2358 feet from junction of Chloride Gulch and FS 1180	NA	FS-GC-05(T)	0.16-1.0	Gray and red-orange fine sand		X				Not Determined						X	Tailings 0.8 feet thick
HS	FS-CG-06	2450 feet from junction of Chloride Gulch and FS 1180	NA	FS-CG-06(T)	5.5-6.0	Orange-brown fine sand		X				Not Determined	X	X					Tailings 0.5 feet thick
HS	FS-CG-07	2594 feet from junction of Chloride Gulch and FS 1180	NA	FS-GC-07(T)	0.1-0.4	Orange-brown fine sand		X				Not Determined						X	Tailings 0.3 feet thick
HS	FS-CG-08	3062 feet from junction of Chloride Gulch and FS 1180	NA	FS-CG-08(T)	0.1-0.6	Orange-brown silt and fine sand		X				Not Determined	X	X					Tailings 0.5 feet thick
HS	FS-CG-09	3287 feet from junction of Chloride Gulch and FS 1180	NA	FS-GC-09(T)	1.2-3.2	Orange-brown silt and fine sand		X				Not Determined						X	Unknown thickness of tailings
HS	FS-CG-10	3805 feet from junction of Chloride Gulch and FS 1180	NA	FS-CG-10(T)	0.1-0.75	Orange-brown silt and fine sand		X				Not Determined	X	X		X	X		Tailings 0.75 feet thick
HS	FS-CG-11	4444 feet from junction of Chloride Gulch and FS 1180	NA	FS-GC-11(T)	0.4-2.0	Orange-brown silt and fine sand		X				Not Determined						X	Tailings at least 1.5 feet thick
HS	FS-CG-12	4585 feet from junction of Chloride Gulch and FS 1180	NA	FS-CG-12(T)	0.25-0.8	Orange-brown silt and fine sand		X				Not Determined	X	X					Tailings 0.5 feet thick
HS	FS-CG-13	4701 feet from junction of Chloride Gulch and FS 1180	NA	FS-CG-13(T)	0.3-0.8	Orange-brown silt and fine sand		X				Not Determined	X	X					Tailings 0.5 feet thick
HS	FS-CG-14	5337 feet from junction of Chloride Gulch and FS 1180	NA	FS-CG-14(T)	0.0-6.0	Orange-brown silt and fine sand, stiff gray clay layer		X				Not Determined	X	X					6.0 feet tall mound of tailings
HS	Near FS-CG-14	Within discrete tailing deposit near FS-CG-14	2.5	FS-ML-1-1-2.5	1 - 2.5	Orange, brn, and yellow silt and fine sand		X				0 - 2.5						X	Within mound of tailings
HS	Near FS-CG-14	Within discrete tailing deposit near FS-CG-14	5	FS-ML-2-1-5	1 - 5	Orange, brn, and yellow silt and fine sand		X				to 5'						X	Within mound of tailings
HS	Near FS-CG-14	Within discrete tailing deposit near FS-CG-14	6	FS-ML-3-1-6	1 - 6	Orange, brn, and yellow silt and fine sand		X				to 6'						X	Within mound of tailings
HS	Near FS-CG-14	Within discrete tailing deposit near FS-CG-14	8	FS-ML-4-1-8	1 - 8	Orange, brn, and yellow silt and fine sand		X				to 8'						X	Within mound of tailings
HS	FS-CG-15	7060 feet from junction of Chloride Gulch and FS 1180	NA	FS-CG-15(T)	0.1-1.4	Orange-brown silt and fine sand		X				Not Determined	X	X		X	X		Tailings 1.3 feet thick
HS	FS-CG-16	2753 feet downstream of north end of Idaho Lakeview Mine	NA	FS-CG-16(T)	0 - 0.2	Orange-brown silt and fine sand		X				Not Determined	X	X			X		
HS	FS-CG-18	2300 feet downstream of north end of Idaho Lakeview Mine	NA	FS-CG-18(T)	0 - 0.2	Orange-brown silt and fine sand		X				Not Determined						X	
HS	FS-CG-19	1750 feet downstream of north end of Idaho Lakeview Mine	NA	FS-CG-19(T)	0 - 0.2	Orange-brown silt and fine sand		X				Not Determined						X	
HS	FS-CG-20	1200 feet downstream of north end of Idaho Lakeview Mine	NA	FS-CG-20(T)	0 - 0.2	Orange-brown silt and fine sand		X				Not Determined						X	
HS	FS-CG-21	908 feet downstream of north end of Idaho Lakeview Mine	NA	FS-CG-21(T)	0 - 0.2	Orange-brown silt and fine sand		X				Not Determined	X						Duplicate Sample Taken.
HS	FS-CG-22	550 feet downstream of north end of Idaho Lakeview Mine	NA	FS-CG-22(T)	0 - 0.2	Orange-brown silt and fine sand		X				Not Determined						X	
HS	FS-CG-23	At north end of Idaho Lakeview Mine	NA	FS-CG-23	0 - 0.2	Gravel, semi-rounded stream gravel				X		NA	X						

Notes:
Distances shown were measured with a hip chain
Depth in feet below ground surface
DR - drill rig
BH - backhoe
HS - hand sample
FS-ML-1 through FS-ML-4 at discrete tailing deposit near FS-GC-14

* - Chemical Analyses includes pH/EC, S-Fract., N-Poten., A/B Acct., SMP, and T. Metals
NA - Not applicable
Duplicate identified in comments column
Sample site number FS-GC-17 not used

gray and yellow bands. The tailings are fine sand to silty in texture and are similar in color and texture to the Idaho Lakeview Mine tailing deposit, the suspected origin of the tailings.

Tailing deposits are both exposed in the banks of Chloride Gulch Creek and buried in the low terraces adjacent to the creek. Tailings thickness in the creek banks in excess of 1 foot were observed at stations FS-CG-01, -04, -11, -14, and –15 (Table 8). In the first (lowest) terrace above the active creek channel, buried tailings were discovered in many locations. In all locations where buried tailings were found, the ground was vegetated above the tailings. The buried tailings were covered by a few to more than 14 inches (FS-CG-09) of brown, root-ridden, organic-rich soil.

A relatively large discrete deposit (mound) of tailings was observed adjacent to FS-GC-14 (Figure 8), approximately 1 mile downstream from the tailings deposit at the Idaho Lakeview Mine site. The mound is bound on the north by the confluence of East Chloride Gulch Creek (flowing) and Chloride Gulch Creek, and on the west by Chloride Gulch Creek. The mound has dimensions of 210 feet parallel to Chloride Gulch and is approximately 50 feet wide. The majority of the tailings in the mound is exposed and is thickly vegetated with small diameter conifers. The maximum thickness of tailings was 8 feet, but the average tailing thickness appeared to be approximately 3 feet thick. At the south (upstream) end of the tailing mound, tailings are buried by 6 to 8 inches of soil. Tailings are mostly red/orange fine sand. In several hand excavations and auger holes into the mound, steel gray silty to clayey tailings were observed beneath the red/orange sandy tailings. In addition, gray silt/clay tailings were present in the bed of East Chloride Gulch 30 to 40 feet upstream of its confluence with Chloride Gulch.

3.6.2 CHEMICAL TEST RESULTS

Maxim selected 13 samples collected from the banks of Chloride Gulch for chemical analyses. All but one of the samples were fine-grained tailings. Sample FS-CG-23 (Figure 8), collected just downstream of the Idaho Lakeview Mine, consisted of semi-rounded sandy gravel and was considered to represent native stream bank material. Sample FS-GC-14 was obtained adjacent to the discrete mound of tailings at the confluence of Chloride Gulch and East Chloride Gulch. Analytical laboratory data for these samples are presented in several tables located in Appendices A and B. Summary statistics for total metals, leachable metals, and acid base accounting are presented in Tables A19, A20, and A21, respectively (Appendix A). Results for individual samples for these parameters are presented in Tables B1, B2 and B3 (Appendix B). Key findings are presented below.

Total Metals

Average total concentrations for the 12 tailing samples and the native sample exceeded the cleanup guidelines for arsenic and manganese (Table A19). Average tailing samples exceeded the arsenic cleanup guideline by a factor of five. Tailing samples also exceeded cleanup guidelines for average total cadmium and lead.

All samples submitted analyzed from the approximately 11,000-foot long reach of Chloride Gulch exceeded the arsenic cleanup guideline (Table B1). Arsenic concentrations ranged from 1,140 mg/kg (FS-GC-15) to 6,600 mg/kg (FS-CG-16, Figure 8). Eight of the samples exceeded the guideline for cadmium (maximum 54 mg/kg, FS-CG-16) and six samples exceed the cleanup guideline for lead (maximum 2,140 mg/kg, FS-CG-06). Manganese was detected at concentrations above the cleanup guideline in all but one sample.

The gravelly sample collected just downstream of the Idaho Lakeview Mine (FS-CG-23) was collected to represent native stream bank material due to its absence of fine sand and silt. The sample exceeded the cleanup guideline for arsenic (1,660 mg/kg) and manganese (2,080 mg/kg). The sample also exhibited the lowest concentration of lead (440 mg/kg) for all the Chloride Gulch samples.

Leachable Metals

Five samples were submitted for leachable metals analysis (Table B2). Several samples exceeded standards for leachable arsenic (FS-CG-04 and -10), cadmium (FS-CG-16), lead (FS-CG-04, -10 and -16), and zinc (FS-CG-03, -04, -10, -15 and -16). Copper was detected above the standard in sample FS-CG-04 but the result is qualified due to the presence of copper in the SPLP extraction blank or preparation blank. Sample FS-CG-15 exceeded the mercury standard, but the result is qualified because matrix spike recoveries exceed acceptable limits.

Acid Base Accounting

Twelve tailing samples and one native sample were analyzed for the acid base account suite of parameters. Table A21 shows summary statistics and Table B3 presents data for individual samples. The average saturated paste pH of the tailing samples was extremely acidic (4.79 s.u.). Only two of the 13 samples analyzed from Chloride Gulch exhibited a pH greater than 5.5 s.u. (tailing sample FS-CG-15 and native sample FS-CG-23). The saturated paste electrical conductivity for tailing samples averaged 1.02 mmhos/cm, with a maximum of 5.01 mmhos/cm in sample FS-GC-14 (adjacent to the discrete tailings mound). The average total lime requirement for tailing samples was low to moderate at approximately 12 t/1000t. The site

maximum total lime requirement was 33.7 t/1000t measured in upstream sample FS-CG-21 (Figure 8). The native sample (FS-CG-23) exhibited a total lime requirement of 4.6 t/1000t.

3.6.3 PHYSICAL TEST RESULTS

Textural analyses were performed on four tailing samples from Chloride Gulch (Table B4). All are classified as a sandy loam. In the four samples, the average percents sand, silt and clay are 64, 26, and 10 percent, respectively.

3.6.4 ESTIMATED VOLUME OF MINE WASTE MATERIAL

Maxim observed tailings throughout the 11,000-foot long reach of Chloride Gulch that was surveyed from the Idaho Lakeview Mine to approximately 1,000 feet downstream of the intersection of Forest Service Roads FS 1180 and 278. With the exception of one discrete deposit adjacent to FS-CG-14, the variable distribution and generally thin nature of most of the deposits observed did not lend itself to an accurate calculation of volume. Using a typical thickness of 0.5 feet and a typical lateral distribution of 25 feet either side of the stream bank, a volume of 10,000 cubic yards would be a conservative, and probable overestimation, of Chloride Gulch tailings. For the discrete mound-like deposit at FS-GC-14 near the confluence of Chloride Gulch and East Chloride Gulch, there is approximately 1,000 cubic yards of exposed tailings based on field measurements and assuming an average tailing thickness of three feet.

4.0 ANALYTICAL DATA QA/QC ASSESSMENT

This section presents an assessment of quality control/quality assurance (QA/QC) associated with the analytical data collected during the site investigation and characterization of the six sites in the Gold Creek drainage. These data were collected to help fulfill the project's decision statement, which was to determine the quantity and characteristics of mine waste present at the six sites to support potential cleanup actions (Maxim, 2000). Data quality objectives for the project were developed to provide a systematic planning effort to establish data quality criteria and for data collection activities. Data quality objectives were:

- Determine chemical characteristics of mine wastes,
- Collect data that reflect the average current condition of the sites,
- Use mean concentrations of metals in mine waste materials to access risks presented to human health and the environment,
- Minimize decision error by obtaining a relatively large number of mine waste samples that represent the range of concentrations present in the mine wastes, and
- Apply a stratified biased sampling method that partitions wastes into three strata (waste rock, mill tailings, and native soil).

During this investigation, 152 samples (waste rock, mill tailings, sediment, and native soil), two water samples (Maxim, 2001), and two rock core samples (Maxim, 2001) were collected and analyzed. Samples were collected and submitted for analysis in the following periods:

- Eighty-three soil samples were collected from November 2 to 9, 2000 and sent to the laboratory on November 10, 2000,
- Sixty-nine soil samples were collected from June 13 to 21, 2001 and sent to the laboratory on June 22, 2001,
- Two water samples collected on June 27, 2001 were sent to the laboratory on June 28, 2001, and
- Two rock core samples were collected on June 18, 2001 and sent to the laboratory on September 18, 2001.

4.1 SAMPLING AND ANALYTICAL SUMMARY

This subsection describes the sample set, lists analytical methods, and presents the 14 sample digestion groups (SDGs) generated during the project.

Sample Set

A total of 152 soil samples were sent to the laboratory for analysis. Of the total, 145 samples were natural samples and seven were field duplicates. One sample was sent only for sieve analysis. One seep sample and one groundwater sample from the Weber Mine site were also submitted for analysis. Northern Analytical Laboratories, Inc. (NAL) of Billings, Montana completed soil and water analyses. Two rock core samples collected from the corehole at the Weber Mine were submitted to SVE Analytical in Kellogg, Idaho for whole rock acid/base accounting analyses. Analytical data from NAL were electronically transferred into a Microsoft Access database. Appendix M (Volume II) of this report contains analytical laboratory reports for the samples.

Tests for physical properties were performed on 23 soil samples at Maxim's Missoula, Montana materials laboratory. The resulting data were entered in the project database. Copies of these testing reports are also contained in Appendix M.

Analytical Methods

Tests were conducted by NAL in accordance with several method references including: SW-846 *Test Methods for Evaluating Solid Waste*, 3rd Edition, updates, I, II, IIA, IIB, III; Western States Laboratory Proficiency Testing Program, *Soil & Plant Analytical Methods*; EPA/540/R95/121 USEPA Contract Laboratory Program *Statement of Work for Inorganics Analysis, Multimedia, Multiconcentration,* ILM04.0, and *Field and Laboratory Methods Applicable to Overburdens and Mine Soils* by A. Sobek et al. Soil samples were analyzed for aluminum, antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver and zinc, plus pH/EH, sulfur fractions, neutralization potential, SMP, and acid/base accounting.

Physical properties tests were completed according to ASTM methods. Various tests were performed including particle size distribution (ASTM C136, D1140, and C117), clay content (ASTM D422), and Atterberg limits (ASTM D4318).

Sample Digestion Groups

Samples were sent to the laboratories in 14 SDGs. Table 9 lists key information for each SDG.

TABLE 9
SUMMARY OF SAMPLE DIGESTION GROUPS
Site Investigation and Characterization
Various Mines, Gold Creek Drainage, IPNF

SDG	Year	Lab	Parameters	No. of Samples	Field Duplicate
2000110190	2000	NAL	Metals, pH/EH, S-Fract., N-Poten., SMP, Acid/Base	11	
2000110191	2000	NAL	Metals, pH/EH, S-Fract., N-Poten., SMP, Acid/Base, Texture	19	FS-IL-04-29.5-41(W) FS-CM-06-0-1.3(W) FS-IL-12-3.5-7.0(N)
2000110192	2000	NAL	Metals, pH/EH, S-Fract., N-Poten., SMP, Acid/Base	13	
2000110193	2000	NAL	Metals, pH/EH, S-Fract., N-Poten., SMP, Acid/Base	20	FS-CM-07-0-2(W)
2000110194	2000	NAL	Metals, pH/EH, S-Fract., N-Poten., SMP, Acid/Base, Texture	10	
2000110195	2000	NAL	Metals, pH/EH, S-Fract., N-Poten., SMP, Acid/Base, Texture	10	
2001010094	2000	NAL	Texture	1	
2001060221	2001	NAL	Metals, pH/EH, S-Fract., N-Poten., SMP, Acid/Base	17	
2001060222	2001	NAL	Metals, pH/EH, S-Fract., N-Poten., SMP, Acid/Base	18	
2001060223	2001	NAL	Metals, pH/EH, S-Fract., N-Poten., SMP, Acid/Base	8	
2001060224	2001	NAL	Metals, pH/EH, S-Fract., N-Poten., SMP, Acid/Base	15	FS-WE-06-0-2 (W) FS-CM-29-0-2 (W) FS-CG-21-0-2(T)
2001060261	2001	NAL	Metals, pH/EH, S-Fract., N-Poten., SMP, Acid/Base	6	
2001070272	2001	NAL	Cation Exchange	2	
99266	2001	SVL	S-Fract., N-Poten., Acid/Base	2	
2001060287	2001	NAL	Common ions, total and dissolved metals	2	
			Totals	154	7

4.2 DATA VALIDATION

Results of Maxim's data validation are presented below. A review of both laboratory QA/QC and field quality control are discussed.

4.2.1 LABORATORY QA/QC

NAL received soil samples from Gold Creek project on: November 8 and 18, 2000; January 11, 2001; June 23, 27 and 29; and July 26, 2001. SVL Analytical received the core samples on September 18, 2001. Chain of custody documents accompanied the samples from sample collection to receipt at the laboratory. Water samples were received at the laboratory cool (1.3 ºC). All samples were received within holding time.

NAL's quality assurance coordinator reviewed all analytical data associated with these samples. This review included calibration standards, calibration verification, laboratory controls, laboratory duplicates, and laboratory spikes on a daily basis. Review of these quality indicators showed that all analyses were in compliance with NAL's published QA/QC criteria.

Certain data were qualified by NAL. Table 10 lists the flags (qualifiers) assigned by NAL to describe the circumstances of the test or to qualify the usability of the data. Cover sheets for each SDG (Appendix M) contain details for specific samples.

TABLE 10
LABORATORY RESULT AND DATA QUALIFIERS
Site Investigation and Characterization
Various Mines, Gold Creek Drainage, IPNF

Flag	Description
B	This analyte contained in the preparation blank at or above the reporting limit
U	Not detected at the concentration reported (NAL)
<	Not detected at the concentration reported (SVL)
(1)	Insufficient sample was available to perform the test
M	Matrix effects are present. The matrix spike recovery was not within control limits
J	Estimated concentration - the duplication was not within 20 percent RPD
NA	Not analyzed or applicable
B	This analyte was found in the SPLP extraction blank

4.2.2 DATA ASSESSMENT

Portions of the soil samples were dried in an oven at less than 60º C. Subsamples of this material were ground to -10 mesh and were used to prepare saturated pastes. The pH of the pastes was measured and the pastes vacuum filtered to obtain the saturation liquid. The electrical conductivity of the saturation liquid was measured and reported. Additional subsamples of the -10 mesh material were used to measure pH in the SMP buffer solution.

Acid potential, neutralization potential, metals, and extractable and total sulfur were determined on subsamples of the -10 mesh material, which were reduced in particle size with a mortar and pestle to -60 mesh.

Samples for metals analysis were digested in accordance with EPA Method 3050B and analyzed using EPA Method 6010B (inductively coupled plasma emission) for all metals except mercury and selenium. Selenium analysis was performed using EPA Method 7762, hydride generation. Mercury determinations were performed in accordance with EPA Method 245.5CLP-M. Three mercury measurements were made for each sample and the average of the three determinations was reported.

Determination of the various forms of sulfur was performed using a LECO sulfur analyzer. The extractable sulfur data is Level II, screening data only. The results of these tests, along with the SMP buffer pH, were used to calculate the lime requirement.

Portions of the samples were not dried but were reduced in particle size (if necessary) in accordance with EPA Method 1312, the SPLP. The extractions were performed using Extraction Fluid 2 for projects located west of the Mississippi River. The extracts were digested using EPA Methods 3010A and 3020 and analyzed using EPA Method 6010B and EPA Method 6020 (inductively coupled plasma with mass spectral detection). Mercury determinations were made using EPA Method 7470A.

Holding Times

No samples exceeded the holding time.

Calibration

NAL and analytical method calibration criteria were met for all data. Appendix F contains calibration verification data.

Laboratory Blanks

Laboratory blank results were assessed to determine the existence and magnitude of contamination. Arsenic was found in the SPLP extraction blank in SDG 2000110193; zinc was found in the SPLP extraction blanks in SDG 2000110190, 2000110191, 2000110193, 2000110194, 2000110195, 2001060221, 2001060222 and 2001060223; and copper was found in the SPLP extraction blank for SDG 2000119195. These were flagged as B. Laboratory blank data are presented in Appendix G.

Inductively Coupled Plasma Interference Check Sample

The inductively coupled plasma interference check sample (ICP ICS) consists of two solutions (solution A and solution B) that are analyzed to verify inter-element and background correction factors. The ICP ICS did not exceed the RPD of 20 percent for any analysis. Appendix H contains ICP ICS data.

Inductively Coupled Plasma Serial Dilution

The ICP serial dilution monitors physical or chemical interferences due to the sample matrix. No results were qualified due to ICP serial dilution results. ICP serial dilution data are presented in Appendix I.

Laboratory Control Sample

The laboratory control sample (LCS) monitors the overall performance of the analysis, including sample preparations. All LCS results were within established control limits. Appendix J contains LCS data.

Laboratory Duplicate Sample

Duplicate sample results are a measure of laboratory precision. A sample is considered estimated if the RPD is in excess of 20 percent. Residual sulfur in SDG 2000110190 exhibited a RPD greater than 20 percent and was flagged J. SPLP mercury in SDG 2000110190, 2000110191 and 2000110194 exhibited RPDs in excess of 20 percent due to matrix effects. These were flagged as M. Appendix K presents LDS data.

Acid potential and lime requirement exhibit a RPD greater 20 percent in SDG 2001060222 due to the HCl extractable sulfur duplicate difference of 0.2 percent and 0.3 percent. The HCl extractable sulfur is an acceptable difference as the absolute value difference is equal to the

reporting limit. Cadmium in SDG 2001060224 has an RPD greater than 20 percent; however this is an acceptable duplication as the absolute value difference is equal to the reporting limit. These data were not flagged.

Matrix Spike Sample

The matrix spike sample results are used to assess the effect of the matrix on the accuracy of the reported data. The following elements/parameters in several samples exceeded the matrix spike recovery control limits:

- Aluminum, arsenic, iron, lead, manganese, and zinc, in SDG 2000110190; aluminum, arsenic, iron, manganese, and zinc, in SDG 2000110191; aluminum, iron and manganese in SDG 2000110192; aluminum, iron, and manganese in SDG 2000110193; aluminum, iron, manganese, and zinc in SDG 2000100194; and aluminum, arsenic, and iron in SDG 2000110195 had sample results greater than four times the spike added. Therefore, the spike is not valid. The data did not require flagging.

- Antimony in SDG 2000110190, 2000110191, 2000110192, 2000110193 and 2000110194; arsenic in SDG 2000110192; neutralization potential in SDG 2000110194; zinc in SDG 2000100193; SPLP mercury in SDG 2000110191 and 2000110194; SPLP aluminum, SPLP mercury and SPLP silver in SDG 2000110195; aluminum, arsenic, copper, iron, lead, zinc, and SPLP lead in SDG 2001060221; aluminum and iron in SDG 2001060222; aluminum, arsenic, iron, lead, zinc, and neutralization potential in SDG 2001060223; and aluminum, antimony, arsenic, iron, lead, manganese, zinc in SDG 20010602224 had matrix effects present and the results were not within control limits. Results for these analytes in these SDGs were flagged with a "M" indicating they were qualified due to a peculiarity with the sample matrix. However, NAL's data validator did not believe there was any doubt as to their precision or accuracy. Appendix L presents matrix spike and matrix spike duplicate data.

4.2.2 FIELD QUALITY CONTROL

Field duplicate samples were collected at sites FS-CM-06-0-1.3(W), FS-CM-07-0-2(W), FS-IL-04-29.5-41(W), FS-IL-12-3.5-7.0(N), FS-WE-06-0-2 (W), FS-CM-29-0-2 (W), and FS-CG-21-0-2(T). Duplicate samples were analyzed for aluminum, antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc, plus pH/EH, sulfur fractions, neutralization potential, SMP, and acid/base accounting. Analytical results for the original and field duplicate samples were evaluated using the following criteria:

1) The RPD between the two samples was calculated when both values of the natural/duplicate pair were greater than 5 times the laboratory PQL for a given analyte,

2) The absolute value difference (AVD) between the natural and duplicate sample for a given analyte was calculated when one or both values were less than five times the PQL.

RPDs are calculated by dividing the difference between the two reported values for a given parameter by the average of the two parameters. Analytical results of parameters where the RPD was greater than 35 percent are considered estimated concentrations. Results from natural/duplicate pairs with values less than five times the PQL are considered estimated when the AVD exceeds the PQL.

Table 11 presents the natural/duplicate sample pairs that failed either the RPD and/or the AVD tests. The following summaries these failures:

- Lead dry basis and sulfur total in SDG 2000110191 failed the RPD test and all associated natural samples were flagged as estimated (JF%),

- Cadmium dry basis, electrical conductivity and lead as Pb in SDG 2000110193 failed the RPD test. All associated natural samples were flagged as estimated.

- Antimony dry basis, iron as Fe, and sulfur water extractable in SDG 200110193 failed the AVD test, and all associated natural samples were flagged as estimated (JF).

RPD and AVD tests were not performed on several natural/duplicate sample pairs because the natural sample and duplicate sample were not included in the same sample digestion group. Natural sample FS-IL-04-29.5-41(W) was tested in SDG 2000110190 and its field duplicate sample was tested in SDG 2000110191. The field duplicates for the June 2001 sampling event were submitted with SDG 2001060224 and the natural samples were submitted with SDG 2001060221 and 2001060222.

TABLE 11
FIELD DUPLICATE RPD and AVD EXCEEDENCES
Site Investigation and Characterization
Various Mines, Gold Creek Drainage, IPNF

SDG	Sample ID	Parameter	N Value	D Value	RPD	Qualifier
2000110191	FS-IL-12-3.5-7.0(N)	Lead Dry Basis	140	240	53%	JF%
2000110191	FS-IL-12-3.5-7.0(N)	Sulfur Total	0.06	0.31	135%	JF%
2000110193	FS-CM-06-0-1.3(W)	Cadmium Dry Basis	45	27	50%	JF%
2000110193	FS-CM-06-0-1.3(W)	Electrical Cond.	0.91	1.75	63%	JF%
2000110193	FS-CM-07-0-2(W)	Lead as Pb	1.53	5.94	118%	JF%

SDG	Sample ID	Parameter	N Value	D Value	AVD	PQL	Qualifier
2000110193	FS-CM-06-0-1.3(W)	Antimony Dry Basis	80	160	80	50	JF
2000110193	FS-CM-07-0-2(W)	Iron as Fe	0.05	0.22	0.17	0.05	JF
2000110193	FS-CM-07-0-2(W)	Sulfur H_2O Ext.	0.1	0.3	0.2	0.1	JF

Notes:
N value = Natural sample value
D value = Duplicate sample value
RPD = Relative percent difference
AVD = Absolute value difference
PQL = Laboratory practical quantitation limit
JF% = Estimated value, field duplicate results exceed allowable limits – RPD determination
JF = Estimated value, field duplicate results exceed acceptable limits – PQL determination

4.3 PARCC STATEMENT

Data collected during the Gold Creek investigation generally met project data quality objectives presented at the beginning of Section 4.0 and in the QAPP (Maxim, 2000). An assessment of the precision, accuracy, representativeness, completeness, and comparability (PARCC) of the data follows:

- Precision: Precision acceptance and rejection for this project was based on the RPD of laboratory duplicates for metals analysis (Maxim, 2000). Of all the metals analyzed, only SPLP mercury had to be qualified in three of the 13 SDGs (SDGs 2000110190, 2000110191 and 2000110194, Appendix K). As a result, the precision objective was met.

- Accuracy: Accuracy acceptance or rejection was primarily based on the percent recovery of the laboratory control sample for solid samples (Maxim, 2000). Because all laboratory control samples were within control limits (Appendix L) the data are considered accurate with a few exceptions. Several samples were flagged with an "M" because matrix effects were present and the analytical results were not within control limits (Section 4.2.2 and Appendix L). However, based on the goal of characterizing mine wastes at the six sites using these data, the interpretations made as a result of the investigation should not be affected.

- Representativeness: Our objective in addressing representativeness was to assess whether information obtained during the investigation accurately represents site conditions. We believe this data quality objective was met because: A relatively large number of samples were collected and analyzed (152 soil samples) to represent the range of concentrations present at the sites; the majority of unique/discrete mine waste areas at each of the six sites were sampled; and samples of waste rock, tailings, and native materials were collected when present at the sites.

- Completeness: The completeness goal for the project was 90 percent. Completeness was assessed by comparing both the number samples collected to that proposed in the SAP (Maxim, 2000) and the number of valid sample results to the total number of samples collected. At five of the sites, Maxim collected and analyzed the same or more than the number of samples for total metals and acid/base account listed in the SAP (Table 7, Maxim 2000). At the Chloride Gulch site, fewer samples than anticipated were necessary to characterize the tailing waste (13 samples were collected versus 20 proposed).

  For leachable metals analyses, the number of samples collected equaled the number proposed in the SAP (Maxim, 2000). Based on site conditions and field observations, fewer samples than originally proposed were collected from Chloride Gulch (two less) and the Keep Cool Mine (one less). However, based on site conditions, Maxim felt it was necessary to collect two additional samples from the Weber Mine and one additional sample from the Idaho Lakeview Mine.

  Thirty samples were proposed for sieve analysis (Maxim, 2000) and a total of 23 were submitted for testing. Samples were not collected from the New Rainbow Mine site based

on review of November 2000 analytical data that indicated a relatively low risk from metals in the waste rock. In addition, results of the soils investigation for the Weber Mine open pit repository evaluation (Maxim, 2001) indicated that few soils at the site would be suitable for use in repository construction. Therefore, some tests were not performed (e.g. moisture density and remolded hydraulic conductivity) and fewer tests than planned in the SAP (Maxim, 2000) were required. Although fewer samples were tested during the entire project than anticipated, Maxim believes the material test results adequately satisfy the completeness objective with respect to the conditions present at the sites.

Based on the above discussion and the fact that no analytical or material test data were rejected, we believe the data set satisfies the objective of completeness.

- Comparability: The objective for comparability was to assess if data collected during the Gold Creek investigation could be compare to another set of data. We believe this objective was fulfilled because standard EPA and ASTM testing methods were used, industry standard data units/values were used, sampling locations were surveyed, and standard field collection methods were used.

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