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ABANDONED-INACTIVE MINES PROGRAM
DEERLODGE NATIONAL FOREST
VOLUME 1
BASIN CREEK DRAINAGE

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ABANDONED - INACTIVE MINE INVENTORY
FOR THE DEERLODGE NATIONAL FOREST

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INTRODUCTION

In order to fulfill its obligations under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Northern Region of the United States Forest Service (USFS) desires to identify and characterize the abandoned and inactive mines with environmental, health, and/or safety problems that are on or affecting National Forest System lands. The Northern Region of the USFS administers National Forest System lands in Montana and parts of Idaho and North Dakota. Meanwhile, the Montana Bureau of Mines and Geology (MBMG) collects and distributes information about the geology, mineral resources, and groundwater of Montana. Consequently, the USFS and the MBMG determined that an inventory and preliminary characterization of abandoned and inactive mines in Montana would be beneficial to both agencies, and have entered into a series of participating agreements to accomplish this work.

1.1. PROJECT OBJECTIVES

In 1992, the USFS and MBMG entered into the first of these agreements to identify and characterize abandoned and inactive mines on or affecting National Forest System lands in Montana. The objectives of this discovery process, as defined by the USFS, were to:

1. Utilize a formal, systematic program to identify the "Universe" of sites with possible human health, environmental, and/or safety related problems that are either on or affecting National Forest System lands.

2. Identify the human health and environmental risks at each site based on site characterization factors including screening level soil and water data that has been taken and analyzed in accordance with EPA quality control procedures.

3. Based on site characterization factors, including screening level sample data where appropriate, identify those sites that are not affecting National Forest System lands, and can therefore be eliminated from further consideration.

4. Cooperate with other State and Federal agencies, and integrate the Northern Region program with their programs.

5. Develop and maintain a data file of site information that will allow the Region to pro-actively respond to governmental and public interest group concerns.

In addition to the USFS objectives outlined above, the MBMG objectives also included gathering new information on the economic geology and hydrogeology associated with these abandoned and inactive mines. Enacted by the Legislative Assembly of the State of Montana (Section 75-607, R.C.M., 1947, Amended) the scope and duties of the MBMG include: the collection, compilation, and publication of information on Montana's geology, mining, milling, and smelting operations, and ground-water resources; investigations of Montana geology emphasizing economic mineral resources and ground-water quality and quantity.

1.2. ABANDONED AND INACTIVE MINES DEFINED

For the purposes of this study, past mining, milling or other processing facilities related to mineral extraction and/or processing are defined as abandoned or inactive as follows:

> A mine is considered abandoned if there are no identifiable owners or operators for the facilities, or if the facilities have reverted to federal ownership.
>
> A mine is considered to be inactive if there is an identifiable owner or operator of the facility, but the facility is not currently operating and there are no approved authorizations or permits to operate.

1.3. HEALTH AND ENVIRONMENTAL PROBLEMS AT MINES

Abandoned and inactive mines may host a variety of safety, health, and environmental problems. These may include metals that contaminate groundwater, surface water, and soils; airborne dust from abandoned tailings impoundments; sedimentation in surface waters from eroding mine and mill waste materials; unstable waste piles with the potential for catastrophic failure; and physical hazards associated with mine openings and dilapidated structures. Although all problems were examined at least visually (See Appendix I - Field Form), the hydrologic environment appears to be affected to the greatest extent. Therefore, this investigation focused most heavily on impacts from the mines to surface and ground water.

Metals are often transported from a mine by water (groundwater discharges or surface runoff) either by being dissolved, suspended, or carried as part of the bedload. When sulfides are present, acid can form which, in turn, increases the solubility of metals. This condition known as Acid Mine Drainage (AMD) is a significant source of metal releases at many of the mine sites in Montana.

1.3.1. Acid Mine Drainage

Trexler and others (1975) identified six components that govern the formation of metal-laden acid mine waters. They are

1) availability of sulfides, especially pyrite,
2) presence of oxygen,
3) water in the atmosphere,
4) availability of leachable metals,
5) availability of water to transport the dissolved constituents, and
6) mine characteristics, which affect the other five elements.

To this list, most geochemists would add the availability of minerals such as calcite that can neutralize the acidity. These six components occur not only within the mines themselves, but can exist within mine dumps and mill tailings piles, making waste materials sources of contamination as well.

Acid Mine Drainage (AMD) is formed by the oxidation and dissolution of sulfides, particularly iron pyrite (FeS_2) and pyrrhotite ($Fe_{1-x}S$). Other sulfides play a minor role in acid generation. Oxidation of iron sulfides forms an acid, sulfate ($SO_4^{=}$), and reduced iron (Fe^{2+}). Mining of sulfide bearing rock exposes the sulfide to atmospheric oxygen thereby beginning the first step of acid formation. Subsequent flooding of mines with oxygen-bearing water provides the needed water and additional oxygen.

The rate limiting step of acid formation is the oxidation of the reduced iron. This oxidation rate can be greatly increased by iron-oxidizing bacteria (*Thiobacillus ferrooxidans*). The oxidized iron produced by biological activity is able to promote further oxidation and dissolution of pyrite, pyrrhotite, and marcassite.

Once formed, the acid can dissolve other metal-sulfide minerals such as arsenopyrite, chalcopyrite, galena, tetrahedrite, and sphalerite to produce high concentrations of copper, lead, zinc, and other metals. Aluminum can be leached by the dissolution of aluminosilicates common in soils and waste material found in southwestern Montana by the acid and ferric iron in AMD. The dissolution of any given metal is controlled by the solubility of that metal.

1.3.2. Solubility of Selected Metals

At a pH above 2.2, ferric hydroxide ($FeOH_3$) precipitates to produce a brown-orange color in surface waters and forms a similar colored coating on rocks in affected streams. Other metals, if present in the source rock, such as copper, lead, cadmium, zinc, and aluminum may co-precipitate or adsorb onto the ferric hydroxide (Stumm and Morgan, 1981). Alunite [$KAl_3(SO_4)_2(OH)_6$] and jarosite [$KFe_3(SO_4)_2(OH)_6$] will also precipitate at pH less than 4 depending on $SO_4^=$ and K^+ activities (Lindsay, 1979). Once the acid conditions are present, the solubility of the metal governs its fate and transport:

Manganese solubility is strongly controlled by the redox state of the water and is limited by several minerals such as pyrolusite and manganite; under reduced conditions, pyrolusite is dissolved and manganite is precipitated. Manganese is found in mineralized environments as rhodochrosite ($MnCO_3$) and its weathering products.

Aluminum is most often controlled by alunite, as discussed, or by gibbsite depending on pH. Aluminum is one of the most common elements in rock forming minerals such as feldspars, micas, and clays.

Silver solubility is strongly affected by the activities of halides such as Cl^-, F^-, Br^-, and I^-. Redox and pH also affect the solubility of silver, but to a lesser degree. Silver substitutes for other cations in common ore minerals such as tetrahedrite and galena, and is found in the less common hydrothermal minerals pyrargyrite (Ag_3SbS_2) and proustite (Ag_3AsS_3).

Arsenic tends to precipitate and adsorb with iron at low pH and de-sorb or dissolve at higher pH. Thus, once oxidized, arsenic will be found in solution in higher pH waters. At pHs between 3 and 7, the dominant arsenic compound is a monovalent arsenate H_2AsO_4. Arsenic is abundant in metallic mineral deposits in arsenopyrite (FeAsS), enargite (Cu_3AsS_4), and tennantite ($Cu_{12}As_4S_{13}$), to name a few.

Cadmium solubility data is limited. Depending on CO_2 content in water, the solubility of cadmium may be limited by the carbonate species octavite at a pH above 7.5 and by strengite at a pH below 6. In soils, octavite is the dominant control on solubility of cadmium. Cadmium mainly substitutes for zinc in sphalerite (ZnS).

Copper solubility in natural waters is controlled primarily by the carbonate content; malachite and azurite control solubility when CO_3 is available in sufficient concentrations. In soil, copper complexes readily with soil-iron to form cupric ferrite. Other compounds such as sulfate and phosphates in soil may also control copper solubility in soils. Copper is present in many ore minerals, including chalcopyrite ($CuFeS_2$), bornite (Cu_5FeS_4), chalcocite (Cu_2S), and tetrahedrite ($Cu_{12}Sb_4S_{13}$).

Mercury is readily able to vaporize under atmospheric conditions and thus, is most often found in concentrations well below the 25 ug/L equilibrium concentration. The most stable form of mercury in water is in its elemental form. Mercury is found in low temperature hydrothermal ores in cinnabar (HgS) and was also used in the processing of gold ores at some mills.

Lead concentrations in natural waters is controlled by lead carbonate which has an equilibrium concentration of 50 ug/L at pHs between 7.5 and 8.5. As with other metals, concentrations in solution increase with decreasing pH. In sulfate soils with a pH less than 6, anglesite controls solubility while cerussite, a lead carbonate, controls solubility in buffered soils. Lead occurs in the common ore mineral galena (PbS).

Zinc solubility is controlled by the formation of zinc-hydroxide and zinc-carbonate in natural waters. At pHs greater than 8, the equilibrium concentration of zinc in waters with a high bicarbonate content is less than 100 ug/L. Franklinite may control solubility at pH less than 5 in water and soils, and is strongly affected by sulfate concentrations. Thus, production of sulfate from AMD may ultimately control solubility of zinc in water affected by mining. Sphalerite (ZnS) is common in mineralized systems.

(References: Lindsay, 1979; Stumm and Morgan, 1981; Hem, 1985; Maest and Metesh, 1993)

1.3.3. The Use of pH and SC to Identify Problems

In similar mine evaluations studies, pH and specific conductance (SC) have been used to distinguish "problem" mine sites from those that had no adverse water-related impacts. The general assumption is that low pH (<6.8) and high SC (variable) indicates a problem, and that neutral or higher pH and low SC indicates no problem.

Limiting data collection to pH and SC largely ignores the various controls on solubility and can lead to erroneous conclusions. Arsenic, for example, is most mobile in waters with higher pH values (>7) and its concentration is strongly dependent on the presence of dissolved iron. Cadmium and lead may also exceed standards in waters with pH values within acceptable limits.

Similarly, reliance on SC as an indicator of site conditions can also lead to erroneous conclusions. The SC value represents 55 to 75 percent of the total dissolved solids (TDS) depending on the concentration of sulfate. Without knowing the sulfate concentration, an estimate of TDS based on SC has a 25 percent error range and, without having a statistically significant amount of SC data for the area of interest, it is hard to define what constitutes a high or low SC value.

Thus, a water-sample with a near-neutral pH and a moderate SC could be interpreted to mean that no adverse impacts have occurred when, in fact, one or more dissolved metals species may exceed standards. With this in mind, the evaluation of a mine site for adverse impacts on water and soil must include the collection of samples for analysis of metals, cations, and anions.

1.4. METHODOLOGY

1.4.1. DATA SOURCES

The MBMG began this inventory effort by completing a literature search of all known mines in Montana. The MBMG plotted the published location(s) of the mines on US Forest Service maps. From the maps, the MBMG developed an inventory of all known mines which were located on or could affect National Forests System lands in Montana. The following data sources were used:

1) the MILS database (U.S. Bureau of Mines),
2) the MRDS database (U.S. Geological Survey),
3) published compilations of mines and prospects data,
4) state publications on mineral deposits,
5) U.S. Geological Survey publications on the general geology of some quads, and
6) recent USGS/USBM mineral resource potential studies of proposed wilderness areas.

During subsequent field visits, the MBMG located numerous mines and prospects for which no previous information existed. Conversely, other mines for which data existed could not be found.

1.4.2. Pre-field Screening

Field crews visited only sites with the potential to release hazardous substances, and sites which did not have enough information to make that determination without a field visit. For problems to exist, a site must have both a source of hazardous substances and a method of transport from the site. Most metal mines contain a source for hazardous substances, but the common transport mechanism, water, is not always present. Consequently, sites on dry ridgetops were assumed to be lacking this transport mechanism, while mines described in the literature as small prospects were considered to have an inconsequential hazardous materials source; neither were visited.

In addition, the MBMG and the USFS developed screening criteria (Table 1) which they used to determine if a site had the potential to release hazardous substances or posed other environmental or safety hazards. The first page of the Field Form (Appendix I) contains the screening criteria. If any of the answers were 'yes' or unknown, the site was visited. Personal knowledge of a site and published information were used to answer the questions. Forest Service mineral administrators used these criteria to "screen out" several sites using their knowledge of an area.

Table 1
Screening Criteria

Yes No
_ _ 1. Mill site or Tailings present
_ _ 2. Adits with discharge or evidence of a discharge
_ _ 3. Evidence of or strong likelihood for metal leaching or AMD (water stains, stressed or lack of vegetation, waste below water table, etc.)
_ _ 4. Mine waste in floodplain or shows signs of water erosion
_ _ 5. Residences, high public use area, or environmentally sensitive area (as listed in HRS) within 200 feet of disturbance
_ _ 6. Hazardous wastes/materials (chemical containers, explosives, etc.)
_ _ 7. Open adits/shafts, highwalls, or hazardous structures/debris

If the answers to questions 1 through 6 were <u>all</u> "No" (based on literature, personal knowledge, or site visit), then the site was not investigated any further.

Mine sites which were not visited were retained in the database along with the data source(s) that were consulted (See Appendix II). However, often these sites were visualized from a distance while visiting another site. In this way the accuracy of the consulted information was often checked.

Placer mines were not studied as part of this project. Although mercury was used in amalgamation, the complex nature of placer deposits makes detection of mercury difficult and is beyond the scope of this inventory. Due their oxidized nauture, placer deposits are not likely to contain other anomalous concentrations of heavy metals, Limestone and building stone quarries, gravel pits, and phosphate mines were considered to be free of anomalous concentrations of hazardous substances, and were not examined.

<u>1.4.3. Field Screening</u>

All sites which could not be screened out, as described above, were visited. All visits were conducted in accordance with a Health and Safety Plan which was developed for each Forest. A MBMG geologist usually made the initial field visit. The geologist gathered information on environmental degradation, hazardous mine openings, presence of historic structures, and land ownership. All site locations were refined using conventional field methods or by USFS Geographic Position System (GPS) crews.

At sites for which little geologic or mining data existed, geologists characterized the geology, collected samples for geochemical analysis, evaluated the deposit, and described workings and processing facilities present.

Sites with potential environmental problems were studied more extensively. The selection of these sites was made during the initial field visit using the previously developed screening criteria (Table 1). In other words, if at least one of the first six screening criteria was met, the site was studied further. Sites which were not studied further are included in Appendix III.

At sites on public lands with groundwater discharge, flowing surface water, or contaminated soils as indicated by impacts on vegetation, the geologist constructed a Brunton and tape map showing the workings, exposed geology, dumps, tailings, surface water, and geologic-sample locations.

1.4.3.1. Collection of Geologic Samples

The geologist took the following samples, as appropriate:

1) select samples - specimens representing a particular rock type taken for assay;

2) composite samples - rock and soil taken systematically from a dump or tailings pile for assay, representing the overall composition of material in the source;

3) leach samples - duplicates of selected composite samples for testing leachable metals (EPA Method 1312).

The three types of samples were used, respectively, to characterize the economic geology of the deposit, to examine the value and metal content of dumps and tailings, and to check the availability of metals for leaching when exposed to water. Assay samples (Appendix IV) were only taken to provide some information on the type of metals present and a rough indication of their concentration. Outcrops and waste-materials were not sampled extensively enough to provide reliable estimates of tonnages, grades, or economic feasibility.

1.4.4. Field Methods

A hydrogeologist visited all of the sites that the geologist determined had the potential for environmental problems. A hydrogeologist also visited the sites that only had evidence of seasonal water discharges, possible sedimentation, airborne dust, mine hazards, or stability problems and determined if the these sites had the potential for significant environmental problems and whether sampling was warranted. The hydrogeologist selected locations for all soil and water sampling.

1.4.4.1. Selection of Sample Sites

This project focused on the impact of mining on surface water, ground water, and soils. The reasoning behind this approach was that, a mine disturbance may have high total metal concentrations yet be releasing few metals into the surface water, ground water or soil. Conversely, another disturbance could have lower total metal content, and be releasing metals in concentrations that adversely impact the environment.

The hydrogeologist selected and marked water and soil sampling locations based on field parameters (SC, pH, Eh, etc.) and observations (e.g. erosion and staining of soils/streambeds). The hydrogeologist chose sample locations that would provide the best information on the relative impact of the site to surface water and soils. If possible, surface water sample locations were chosen that were upstream, downstream, and at any discharge points associated with the site. Locations for soil sample were selected in areas where waste material was obviously impacting natural material. In most cases, where applicable, a composite sample across a soil/waste mixing area was selected. In addition, all sample sites were located so as to assess conditions on National Forest System lands; therefore, samples sites were located on National Forest System lands to the extent ownership boundaries were known.

Since monitoring wells were not installed as part of this investigation, the evaluation of impacts to ground water was limited to strategic sampling of surface water and soils. Background water-quality data is restricted to upstream surface water samples; background soil samples were not collected. Laboratory tests were used to determine the propensity of waste material to release metals and may lend additional insight to possible ground water contamination at a site.

1.4.4.2. Marking and Labeling Sample Sites

Sample location stakes were placed as close as possible to the actual sample location and labeled with a sample identification number. The visiting hydrogeologist wrote a site sampling and analysis plan (SAP) for each mine site or development area which was then approved by the USFS project manager. Each sample location was plotted on the site map or topographic map and described in the SAP; each sample site was given a unique identifier based on its location as follows:

D DA T L I C

D: Drainage area - determined from topographic map
DA: Development Area (dominant mine)
T: Sample type: T - Tailings, W - Waste Rock, D - Soil, A - Alluvium, L - Slag S - Surface Water, G - Ground Water
L: Sample Location (1-9)
I: Sample Interval (default is 0)
C: Sample Concentration (High, Medium, Low) determined by the hydrogeologist based on field parameters.

1.4.4.3. Collection of Water and Soil Samples

Sampling crews collected solid and liquid samples, and took field measurements (e.g. streamflow) in accordance with the following:

Sampling and Analysis Plan (SAP) - These plans are site specific and they specify the type, location, and number of samples and field measurements to be taken at a site.

Quality Assurance Project Plan or QAPP (Metesh, 1992) - This plan guides the overall collection, transportation, storage, and analysis of samples, and the collection of field measurements.

MBMG Standard Field Operating Procedures (SOP) - The SOP specifies how field samples and measurements will be taken.

1.4.4.4. Existing Data

Data collected in previous investigations were not qualified nor validated under the auspices of this project. The Quality Assurance Managers and Project Hydrogeologist determined the useability of such data.

1.4.5. Analytical Methods

The MBMG Analytical Division performed the laboratory analysis and conformed, as applicable, to the following:

Contract Laboratory Statement of Work, Inorganic Analyses, Multi-media, Multi-concentration. March 1990, SOW 3/90, Document Number ILM02.0, U.S. EPA, Environmental Monitoring and Support Laboratory, Las Vegas, NV.

Method 200.8 Determination of Trace Metals in Water and Waste by Inductively Coupled Plasma and Mass Spectrometry - U.S. EPA

Method 200.7 Determination of Trace Metals in Water and Waste by Inductively Coupled Plasma and Mass Spectrometry - U.S. EPA

If a Contract Laboratory Procedure method did not exist for a given analysis, the following method was used:

Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846, 3rd edition, U.S. EPA, Washington D.C.

EPA Method 1312 Acid-rain Simulation Leach Test Procedure - Physical/Chemical Methods, SW-846, 3rd edition, U.S. EPA, Washington D.C., Appendix G.

All analyses performed in the laboratory conformed to the MBMG Laboratory Analytical Protocol (LAP).

1.4.6. Standards

EPA and various state agencies have developed human health and environmental standards for various metals. In order to try and put the metal concentrations that were measured into some perspective, they were compared to these developed standards. However, it is understood that metal concentrations in mineralized areas may naturally exceed these standards.

1.4.6.1. Water-Quality Standards

The Safe Drinking Water Act (SDWA) directs EPA to develop standards for **potable** water. Some of these standards are mandatory (primary) and some are desired (secondary). The standards established under the SDWA are often referred to as primary and secondary maximum contaminant levels (MCLs).
Similarly, the Clean Water Act (CWA) directs EPA to develop acute and chronic standards for water that will protect **aquatic organisms**. These standards may vary with water hardness and are often referred to as the Aquatic Life Standards. The primary and secondary MCLs along with the acute and chronic Aquatic Life Standards for selected metals are listed in Table 2.

1.4.6.2. Soil Standards

There are no federal standards for the concentration of metals and other constituents in soils; acceptable limits for such are often based on human and/or environmental risk assessments for an area. Since no assessments of this kind have been done, concentrations of metals in soils were compared to the limits postulated by the U.S. EPA and the Montana Department of Health and Environmental Sciences for sites within the Clark Fork River Basin in Montana. The proposed upper limit for lead in soils is 1000 mg/Kg to 2000 mg/Kg, and 80 to 100 mg/Kg for arsenic in **residential** areas. The Clark Fork Superfund Background Levels (Harrington-MDHES, 1993) are listed in Table 3.

Table 2
Water-quality Standards

	PRIMARY MCL[1] (mg/l)	SECONDARY MCL[2] (mg/l)	AQUATIC LIFE ACUTE[3,4] (mg/l)	AQUATIC LIFE CHRONIC[3,5] (mg/l)
Aluminum		.05-.2	.05	.087
Arsenic	.05		.36	.19
Barium	2			
Cadmium	.005		.0039/.0086[6]	.0011/.0020[6]
Chromium	.1		1.7/3.1[6,7]	.21/.37[6,7]
Copper		1	.018/.034[6]	.012/.012[6]
Iron		.3	1	
Lead	.05		.082/.2[6]	.0032/.0077[6]
Manganese		.05		
Mercury	.002		.0024	.000012
Nickel	.1		1.4/2.5[6]	.16/.28[6]
Silver		.1	.0041[8]	.000012[8]
Zinc		5	.12/.21[6]	.11/.19[6]
Chloride		.25		
Nitrate	10 (as N)			
Sulfate	500[9]	250		
pH		6.5 - 8.5		

(1) 40 CFR 141; revised through 8/3/93
(2) 40 CFR 143; revised through 7/1/91
(3) Priority Pollutants, EPA Region VIII, August 1990
(4) Maximum concentration not to be exceeded more than once every 3 years.
(5) 4-day average not to be exceeded more than once every 3 years.
(6) Hardness dependent. Values are calculated at 100 mg/L and 200 mg/L.
(7) Cr^{+3} species.
(8) Hardness dependent. Values are calculated at 100 mg/L.
(9) Proposed, secondary will be superseded.

Table 3
Clark Fork Superfund Background Levels (mg/Kg) for Soils

Reference	As	Cd	Cu	Pb	Zn
U.S. Mean soil	6.7	.73	24.0	20.0	58
Helena Valley Mean soil	16.5	.24	16.3	11.5	46.9
Missoula Lake Bed Sediments	-	.2	25.0	34.0	105
Blackfoot River	4.0	<.1	13.0	-	-
Phytotoxic Concentration	100	100	100	1,000	500

1.4.7. Analytical Results

The results of the sample analyses were used to estimate the nature and extent of potential impact to environmental and human health. Selected results for each site are presented in the discussion; a complete listing of water-quality, soil chemistry, and acid rain leach test results are presented in Appendix V.

All of the data that was collected for this project was compiled with existing data and incorporated into a new MBMG minerals database. The database will eventually include mines and prospects throughout Montana. The database is designed to be the most complete compilation available for information on the location, geology, hydrogeology, production history, mine workings, references, and environmental impact of each of Montana's mining properties. The data-fields in the current database are presented in Appendix VI and is compatible with the MBMG ARC/INFO Geographical Information System (GIS).

1.5. DEERLODGE NATIONAL FOREST

The 1.3 million-acre Deerlodge National Forest straddles the Continental Divide in southwestern Montana (Figure 1). Headquartered in Butte, it lies in the heart of historic mining country. The Forest's eight mountain ranges, with elevations ranging from 4,075 to 10,604 feet, create a diverse landscape graduating from semiarid grassland foothills near the valley bottoms, to coniferous forests, to alpine regions of steep rocky peaks.

1.5.1 History of Mining

Some knowledge of the local mining history is helpful in understanding the problems created by the abandoned and inactive mines in the area. Gold was first discovered in the Deerlodge National Forest area on Gold Creek in the southwest portion of Powell County in 1852. By 1860, some gold placer mines were operating on Gold Creek, but most gold placers in the forest were discovered about 1865. Associated lode deposits were located soon thereafter.

Placers reached their maximum production before 1872, when the richest ones began to play out. By 1870, production from gold and silver lode deposits had become important. Most lode mines had been discovered by the late 1880s, with the main period of production from 1880 to 1907. Mines with silver as the major commodity were most active from 1883 until 1893, when the silver panic forced the closure of many of these polymetallic mines. Many operations never resumed. Mines yielding gold ores, especially of the "free milling" variety, which contain free gold, enjoyed a greater longevity. Some of these gold producers were worked until 1942, when the federal government placed restrictions on gold mining as a result of World War II. Activity on mining properties has been minimal since the forties. A few base metal mines have been active, and some small precious metal mines were worked intermittently.

1.5.1.1 Production

The total value of minerals produced from lode mines within the Deerlodge National Forest boundaries was probably more than $60 million at the time of production (Elliott and others, 1992; Loen and Pearson, 1984; USGS/USBM, 1978; O'Neill and others, 1983). This excludes the Butte and Philipsburg districts, which lie adjacent to, but outside of, the Deerlodge National Forest, and whose production totals are $6 billion and $91 million, respectively.

Vicinity Map
Deerlodge National Forest

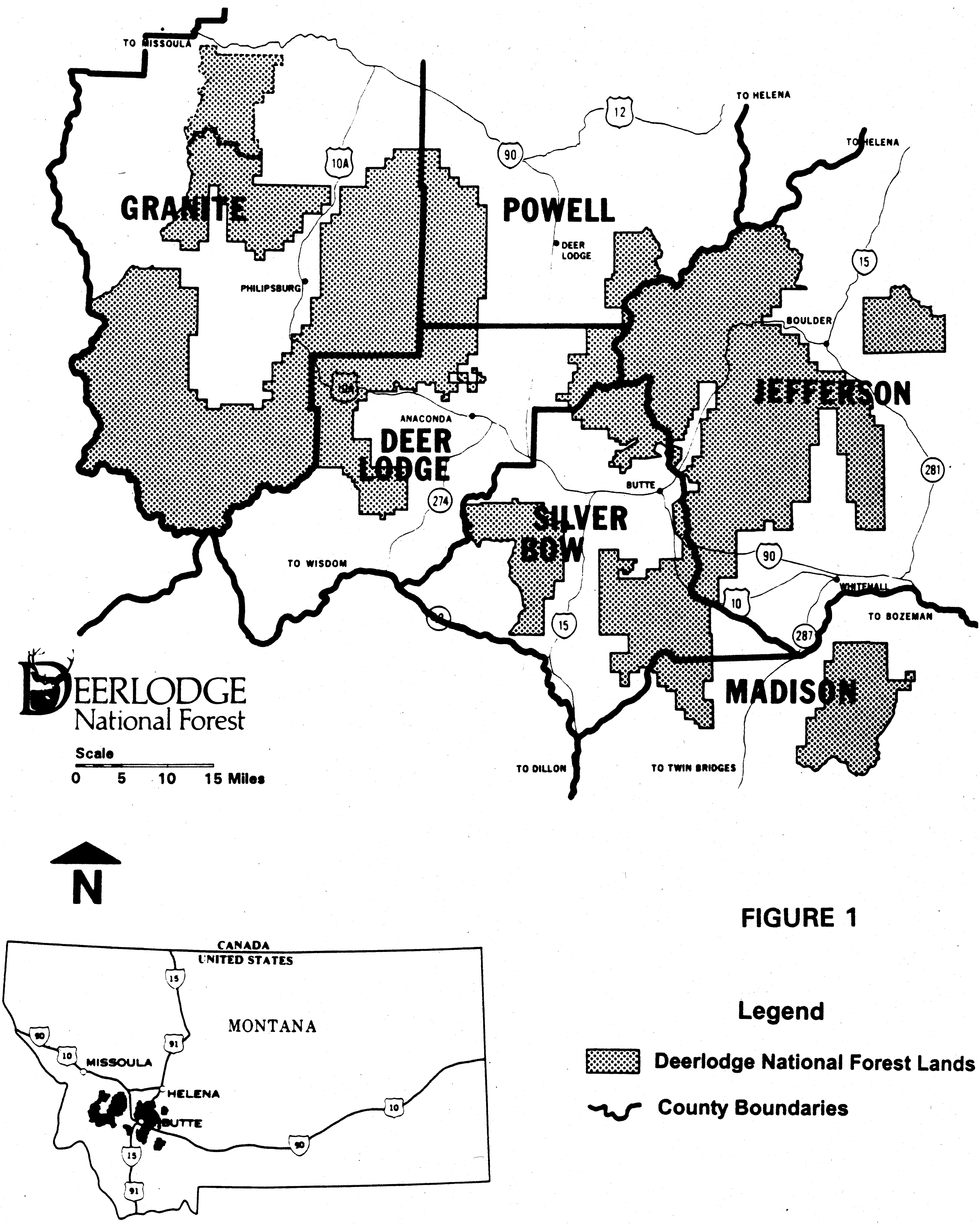

FIGURE 1

1.5.1.2. Milling

An understanding of the history of milling developments is essential to interpreting mill sites, understanding tailings characteristics, and determining potential for the presence of hazardous substances. Mills, usually located adjacent to the mine, produce two materials: 1) a product which is either the commodity itself or a concentrate which is shipped off the forest to other facilities for further refinement, and 2) waste, which is called tailings.

In the 1800s, almost all mills treated ore by crushing and/or grinding to a fairly coarse size followed by concentration using gravity methods. Polymetallic sulfide ores were concentrated and shipped to be smelted (usually to cities off national forest land); gold was often removed from free milling ores at the mill by mercury amalgamation. Cyanidation arrived in the U.S. about 1891 and, because it resulted in greater recovery rates, it revolutionized gold extraction in many districts. Like amalgamation, cyanidation also worked only on free milling ores, but it required a finer particle size. About 1910 froth flotation became widely used to concentrate sulfide ores. This process required that the ore be very finely ground and mixed with oils to liberate the ore-bearing minerals from the barren rock.

Overall, then, there were two fundamental processes used for ore concentration: gravity and flotation, and three main processes used for commodity extraction: amalgamation, cyanidation, and smelting. Each combination of methods produced tailings of different size and composition, each used different chemicals in the process, and each was associated with a different geologic environment.

1.6. SUMMARY OF THE DEERLODGE NATIONAL FOREST INVESTIGATION

A literature search (MILS database, U.S. Bureau of Mines; MRDS database, U.S. Geological Survey; Elliott and others, 1992; Loen and Pearson, 1984; Krohn and Weist, 1977; Roby and others, 1960; McClernan, 1976; Earll, 1972; Emmons and Calkins, 1913; Ruppel, 1963; Becraft and others, 1963; Elliott and others, 1985; USGS/USBM, 1978; Erickson and others, 1981; Elliott and others, 1988b; Federspiel and Mayerle, 1988; O'Neill, 1983; Wallace and others, 1983) identified 1057 sites in the genral area of the Deerlodge National Forest. The pre-field investigation that followed indicated that there are least 795 abandoned or inactive metal mines and mills that are located on or affecting the Deerlodge National Forest. Most became inoperative long before environmental regulations were put into effect, so tailings piles, waste rock dumps, and mine discharges persist to potentially adversely affect the environment today. Table 4 summarizes the results of the Deerlodge National Forest inventory.

Table 4
Summary of Deerlodge National Forest Investigation

Total Number of Abandoned/Inactive Mine Sites that were:

PART A - Field Form		
Located in general area from Literature Search		1057
Not on or affecting Deerlodge NF	-262	
PART B - Field Form (Screening Criteria)		
Possibly affecting the Deerlodge NF	**795**	
Screened out by DNF minerals administrator **OR**		
Screened out by description in literature	-275	
Not found (location inaccurate)	- 86	
Visited by geologist	**432**	
Screened out by geologist	-327	
Visited by hydrogeologist	**105**	
Screened out by hydrogeologist	- 4	
PART C - Field Form		
Sampled (Water and Soil)	101	

A separate discussion of each of the 101 sites where samples were taken is included in the four volumes that comprise the DNF report. All 1057 sites which had the potential to affect the DNF are listed in Appendix II of this report.

1.7. MINING DISTRICTS AND DRAINAGE BASINS

The Deerlodge National Forest includes all or part of 30 mining districts as defined by the USGS (Elliott and others, 1992; Loen and Pearson, 1984). Some mines are not located in traditional districts and for the purposes of this study have been organized into areas delineated by topography. In either case, boundaries have been determined in part by changes in geology and in part by drainage divides. This provides a convenient way to separate the forest into manageable areas for discussion of both geology and hydrology; and perhaps more important, it is an aid to the assessment of cumulative environmental impacts on the drainage.

BASIN MINING DISTRICT
(BASIN CREEK DRAINAGE)

The Basin Mining District located in the northeast part of the Deerlodge National Forest (Figure 2) contains two main watersheds, Basin Creek and Cataract Creek; both are tributaries of the Boulder River. A few mines with the District are located on other small tributaries of the Boulder River. Figure 3 shows the location of the mines and major drainages within the Basin Mining District.

Land use in the District is restricted by the deeply incised streams and rough terrain. Elevations range from a high of 8,739 feet on Jack Mountain to 5,355 feet at the town of Basin. The town of Basin sits at the mouth of Basin Creek and has a population of less than 100 (1990 Montana Census). In addition, there are approximately 20 to 30 homes along Basin and Cataract Creeks; some are year-round residences and others seasonal. One recreational site is, at present, located in the area: Basin Canyon Picnic area located about 4 miles north of the town of Basin along Basin Creek.

2.1. GEOLOGY

The geologic setting of the Basin District has been well described by Ruppel (1963) and Becraft and others (1963). Throughout the district, quartz monzonite and granodiorite of the Cretaceous Boulder Batholith have intruded quartz latite and andesite of the comagmatic (Rutland, 1985; Watson, 1986) Elkhorn Mountain Volcanics. Tertiary Lowland Creek Volcanics and younger Tertiary rhyolite unconformably overlie portions of the batholith. Unconsolidated Quaternary sediments obscure much of the bedrock geology in the district.

2.2. ECONOMIC GEOLOGY

The economic geology was characterized by Roby and others (1960), Pinckney (1965), and Derkey and Matsueda (1987). The majority of mines and prospects explore veins of quartz, tourmaline, pyrite, galena, tetrahedrite, sphalerite, arsenopyrite, chalcopyrite, and siderite that occupy east-trending, late Cretaceous, extensional (Woodward, 1986) shear zones in the batholith and adjacent areas of the Elkhorn Volcanics. The veins are concentrated in several elliptical centers of mineralization. In these mineralization centers, veins are closely spaced, wide (up to 40 feet), and have alteration haloes with concentric quartz-sericite-pyrite, kaolinite-siderite, and montmorillonite-chlorite alteration products (Pinckney, 1965).

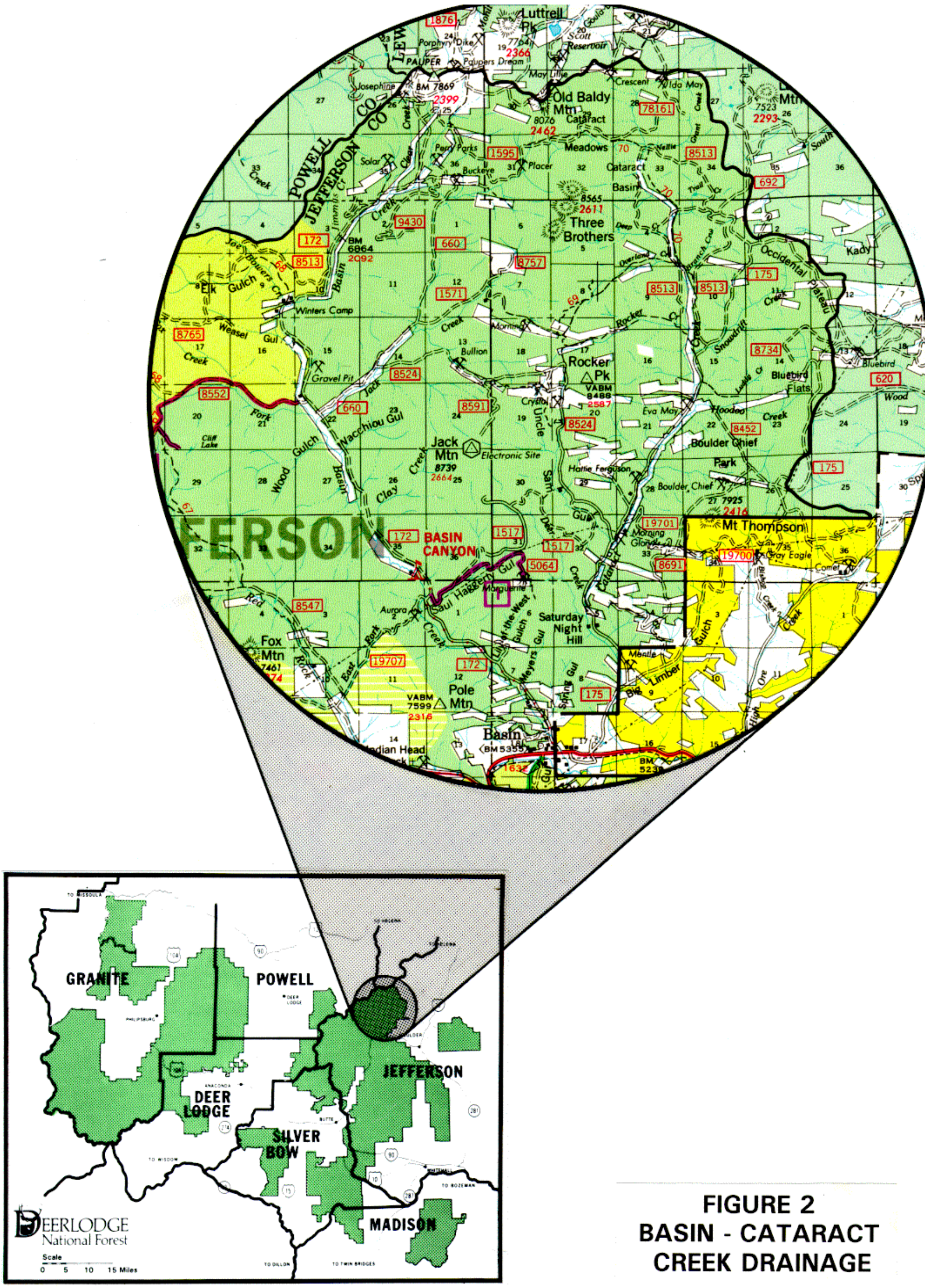

FIGURE 2
BASIN - CATARACT CREEK DRAINAGE

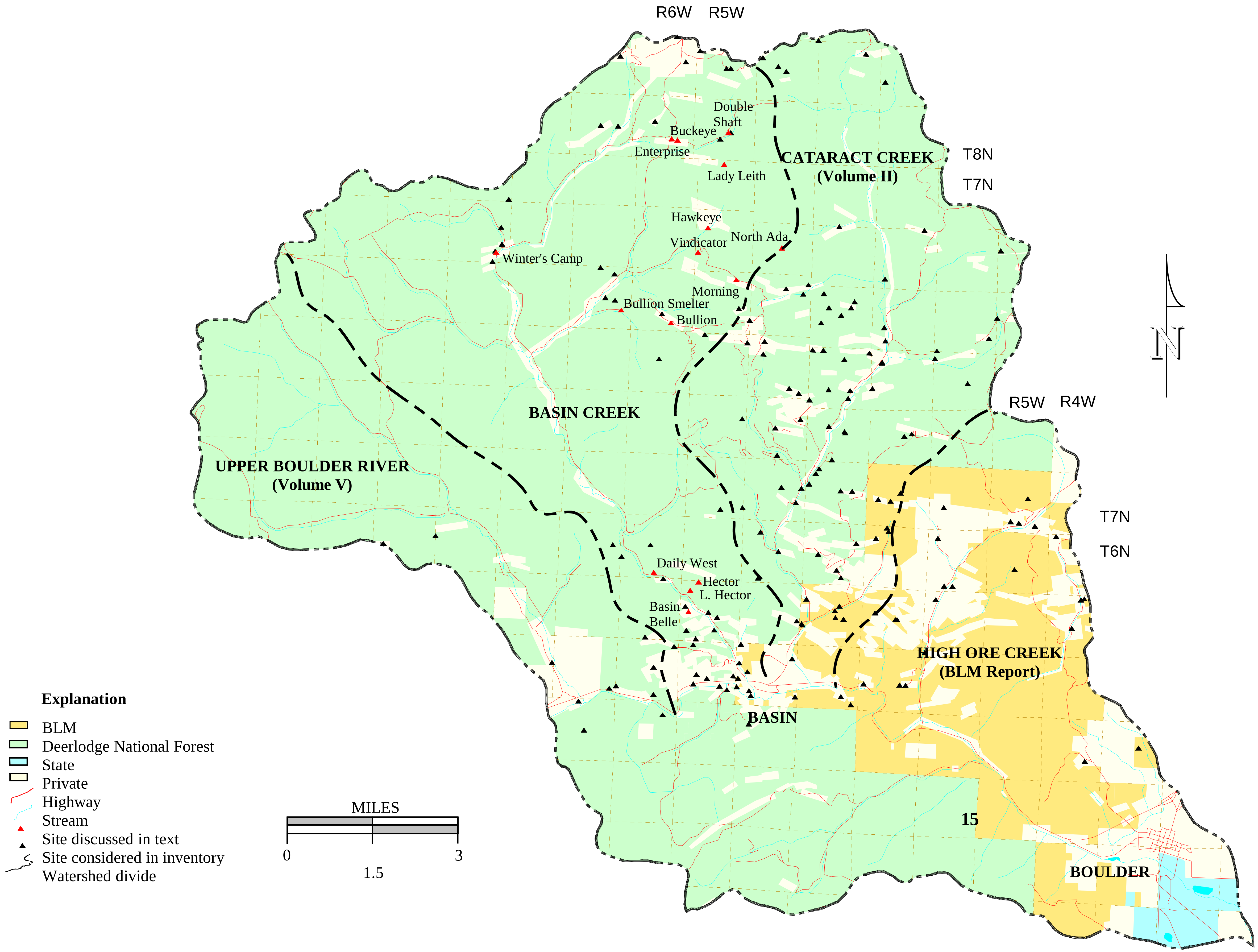

Figure 3. The Basin Creek drainage is in the upper Boulder River drainage which includes Cataract Creek (Volume II). The remaining sites on USFS adminitered lands in the upper Boulder River are discussed in the Jefferson River report (Volume V). Abandoned - inactive mines in High Ore Creek are on BLM administered lands and are discussed in MBMG Open-file report348.

The veins themselves can be several miles in length, but on their distal ends they narrow, have less wallrock alteration, bear fewer sulfides, and contain more siderite, chalcedony, and calcite. The veins were mined mainly for their silver and base metal content, although some contained appreciable amounts of gold. Silver to gold ratios were very high. Our own samples averaged 80:1.

Lode production in the district from 1902-1957 was 129,040 oz gold (Au), 5,603,300 oz silver (Ag), 4,237,522 lbs copper (Cu), 35,293,697 lbs lead (Pb), and 27,201,179 lbs zinc (Zn), worth $15,609,000 at the time of production (Elliot and others, 1992).

A few mines and prospects are located in late Cretaceous to early Tertiary NW- to NE-striking veins and breccia zones that cross-cut and offset the east-west veins. This mineralization consists mostly of fine-grained to microcrystalline quartz, hematite, minor pyrite, and local barite. Metal values are usually low and little production has been recorded from this type of system. The breccia zones were often later intruded by Tertiary quartz latite clastic dikes with no associated alteration or mineralization (Ruppel, 1963).

2.2.1. Processing

The high-sulfide ores required concentration by gravity or flotation in mills scattered throughout the district. The concentrate was usually smelted to recover metals; probably neither mercury nor cyanide were used at most mills in the Basin District. Both mine dumps and mill tailings in the area usually have abundant pyrite and significant metal content, and can be sources of contamination.

2.2.2. Uranium

Uranium mineralization is associated with the late stages of hydrothermal activity in these veins (Becraft, 1956; Thurlow and Reyner, 1952). As a result, slightly elevated gamma radiation levels can be detected at many of the dumps and tailings piles. Radioactivity is especially anomalous at the lower Bullion smelter site (Section 2.6), where uranium was apparently concentrated in the slag. No uranium production from the district has been recorded.

2.2.3. Open Pit Mines

At the Basin Creek Mine, an active mine on the boundary between Deerlodge National Forest and Helena National Forest, disseminated gold has been open pit mined from Tertiary rhyolite which covers the batholith. The feasibility of resuming this operation is now being studied. All abandoned mines associated with this orebody are outside Deerlodge National Forest boundaries.

2.2.4. Placer Mines

Gold placer workings are common in the district. The placers appear to be unrelated to the east-west veins. In one case, at the Double Shaft, placer gold appears to originate in a mineralization associated with a northeast-trending breccia zone. However, the distribution of placer gold was probably complicated by Pleistocene glaciation. A by-product of some placer operations was cassiterite in the form of wood tin. Its source may be the Tertiary rhyolite (Brinker, 1944).

2.3. MINERAL RESOURCE POTENTIAL

Although a detailed mineral resource potential study was not done, some inferences can be made from the literature, sample results, and geologic observations. Mineral potential is similar to that described for the Electric Peak Wilderness Area to the northwest (Federspiel and Mayerle, 1988). There is a high potential for the discovery of small high grade silver veins with base metals and some associated gold both adjacent to inactive mines and at depth on known deposits. In fact, Elliott and others (1992) assigned a very high rating for potential discovery of new deposits of this type to much of the Basin district. Similar veins may exist to the northwest, where batholithic host rocks are covered by Tertiary volcanic rocks and Quaternary sediments.

However, deposits are small, contain only unpredictable and sporadic gold, have high arsenic content, and must be mined by expensive underground methods. This deposit type is probably of interest only to small miners. A few larger exploration targets may exist. These are areas of closely spaced veins with high gold values and relatively extensive associated alteration haloes that have the potential to host disseminated gold. Examples are the Eldorado and Plateau area, the Uncle Sam area, and the Sirius area. Some of these have recently been tested by exploration programs, but results are not available.

Under Quaternary cover to the west and northwest of the area, there is some potential for Tertiary disseminated gold mineralization similar to that of the Basin Creek Mine.

Dumps and tailings piles may also constitute a resource in the Basin District. Preliminary sampling suggests that some of the higher grade waste piles are the Buckeye-Enterprise dumps (15,000 tons at .066 oz/ton Au), Buckeye tailings (16,000 tons at .098 oz/ton Au and 1.12 oz/ton Ag), and the Cataract tailings (1000 tons at .053 oz/ton Au and 3.37 oz/ton Ag). Placer tin deposits could become reserves under favorable economic conditions.

2.4. HYDROLOGY AND HYDROGEOLOGY

The average annual precipitation for the area ranges from 12 to 14 inches in valleys; most precipitation occurs in the spring months in the form of snow or rain. Temperatures in southwest Montana can be extreme and range from well below 0^{o}F during the winter months to over 90^{o}F during the summer; freezing temperatures can occur at any time during the year.

The District contains two main drainages which discharge to the Boulder River. Tributary drainages are numerous and largely controlled by the structure of the underlying plutonic rocks and glacial deposits. There are no stream gage stations in either drainage; both Basin Creek and Cataract Creek are perennial streams.

Ground water occurs in the fractured bedrock, the alluvial valley fill and glacial moraines within valley bottoms. Controls on ground water flow in the bedrock is likely to be similar to those in other locations on the Boulder Batholith (for example, see Betz, 1977). Ground water flow in the unconsolidated material is probably controlled more by local flow conditions than by the bedrock aquifer (Metesh and others, 1994). This fact becomes important on mine and mill sites where there is the potential for leaching metals from the waste material.

2.5. SUMMARY OF THE BASIN MINING DISTRICT - BASIN CREEK DRAINAGE

The Basin Mining District contains 39 abandoned and inactive hard rock mines on NFS lands, which includes four abandoned mill sites with tailings, and one abandoned smelter site. These 39 sites are displayed in Figure 3 and listed in Table 5. Twenty-nine of the 39 sites were visited; 14 of these were identified as having a potential to contribute to environmental degradation and samples were collected. Six of these 14 sites within the Basin Creek drainage are located in the Jack Creek Drainage. Eight mine openings (shaft or adit) exhibited at least some discharge; some sites had discharges from two or more adits.

Table 5
Summary of Basin Mining District (Basin Creek Drainage)

MINE[1]	OWNER[2]	VISIT	SAMPLE[3]	REMARKS
Adelaide	F	Y	N	Dry caved adits
Aurora	F	Y	N	Dry caved adits
Basin Belle	P	Y	Y	Streamside waste dump
Boulder	M	Y	N	Dry workings
Buckeye-Enterprise				
Buckeye-Enterprise[4]	P	Y	Y	Shaft discharge
Buckeye Tailings[4]	F	Y	Y	Streamside tailing
Bullion				
Main Development[4]	M	Y	Y	Adit discharge; tailings
Smelter Area[4]	F	Y	Y	Dry; tailings
Columbus	P	Y	N	Dry caved adits
Daily West	F	Y	Y	Streamside waste dump
Doris	P	N	N	Visualized; dry
Double Shaft	F	Y	N	Flooded shafts
Dumortierite Prospect	F	Y	N	Dry covered workings
Golden Glow	M	Y	N	Dry caved workings
Hawkeye	M	Y	Y	Adit discharge; waste dumps
Hector	U	Y	Y	Streamside waste dumps
Highland	P	Y	N	Dry workings
Jack Creek Ridge	F	N	N	Ridgetop location
Jessie	F	Y	N	Dry caved adit
Joe Bower's Mine	P	Y	N	Adit discharge
Josephine	P	N	N	Basin Creek Mine (active)
Keller's Hematite	F	N	N	Dry
Lady Lieth	F	Y	Y	Two adit discharges
Lower Hector	F	Y	Y	Dry prospects
Lula Bell	F	Y	N	Dry prospect pit
Marguerite	M	N	N	Mountaintop location
Morning	M	Y	Y	Adit discharge
Morning Star	P	Y	N	Dry caved workings
N462471	U	N	N	Unable to locate
North Ada - Piermont	F	Y	Y	Adit discharge
Pearl	F	Y	N	Short flooded shaft
Solar	F	Y	N	Dry caved workings
Unnamed Fire Clay	U	N	N	Unable to locate
Unnamed Uranium	P	N	N	Basin Creek Mine (active)
Venus	P	N	N	Basin Creek Mine (active)
Vindicator	F	Y	Y	Streamside waste dumps
Winter's Camp	P	Y	Y	Adit discharge

1) Mines in **bold** may pose environmental problems and are discussed in the text; others are included only in Appendix II (all mines) and Appendix III (sites visted).

2) Admisnitration/Ownership Designation
   F: USFS (DNF)
   P: Private
   M: Mixed (DNF and private)
   U: Owner unknown

3) Solid and/or water samples (including leach test samples) 4) Mill sites present

2.5.1. Summary of Environmental Observations

Based on down-stream samples, some sites, such as the Bullion Mine and Buckeye-Enterprise Mine in the Basin Creek Drainage, and the Crystal Mine in the Cataract Creek drainage, appeared to be major contributors to the dissolved-metals loading in the creeks. Several of the mines are on private ground upstream of NFS land; at these sites, sample collection was restricted to areas below the mine on NFS land. However, at least some data were collected for all sites with a potential for off-site impacts to surface water, ground water or soils, on private as well as NFS land. The sites listed in **bold** in Table 5 are those that displayed at least some indication of adverse impact and were sampled; these sites are discussed in more detail in the following sections.

As noted, the inspection of mine sites was restricted to sites which are on NFS lands or affecting NFS lands. Thus, an assessment of the cumulative effect of all mines in the Basin/Cataract Creek drainage is likewise restricted. With exceptions, the impacts to surface water and soils from past mining activity in the Basin/Cataract drainage is largely restricted to the mine site or within a few hundred feet of the mine site. The most significant exception is in the Jack Creek Drainage; a tributary to Basin Creek.

The group of mines evaluated in the Jack Creek drainage have the greatest individual and collective impact of any others in the Basin/Cataract Creek Drainage. This impact is apparent as far downstream as the Jack Creek - Basin Creek confluence as evidenced by the exceedence of water-quality criteria for several constituents. This is of special concern in consideration of the proposed sale of housing tracts on the lower reaches of Jack Creek. Ground water as well as surface water development will likely be unsuccessful due to poor water quality. The influence of the poor water quality in Jack Creek is also evident in Basin Creek just below the confluence, but appears non-existent at Spring Creek several miles downstream.

The upper reaches of Basin Creek drainage also display poor water quality, but as mentioned, most mining impacts are restricted to each mine site. The exceedence of water-quality standards for aluminum in Basin Creek cannot be attributed to any particular site or group of sites; this area in particular had mines that were excluded from consideration because of ownership.

The samples collected from Basin Creek below all of the mines that were visited indicated a high arsenic concentration. This may be a result of ground water and sediments entering Basin Creek from the Basin Belle Mine or Daily West Mine. It should be noted that much of the sampling at mine sites and the major streams was conducted during a period of several precipitation events. The relative amounts of contaminated water and metals-laden sediment from a given mine site likely changes throughout the year.

2.5.2. Correlations to Deposit Mineralogy

Because the veins are remarkably similar across the district, an attempt was made to correlate environmental hazards with geology and/or mining activity. However, virtually all mine waters from this type of deposit are environmentally detrimental. Only unproductive mines on the distal, poorly mineralized, carbonate-rich ends of these veins have untainted water. Examples are the Blue Diamond / Occidental mine and Winter's Camp mine.

Water quality could not be correlated with grade, production, or mineralogy except in a very qualitative way. Likewise, water quality could not be related to extent of the workings; even some short workings generated acid water.

2.6. BULLION MINE

2.6.1. Site Location and Access

The Bullion has been the largest and most productive abandoned/inactive mine in the Basin Mining District (T7N R6W Sections 13 and 14); the development area consists of several disturbed areas located on two separate, unnamed tributaries of Jack Creek (Figure 4). The main development area is within one drainage and the smelter area is within a second drainage which flows into Jack Creek downstream of the first.

Access to the Bullion is by means of a primitive road from the Basin Creek road; the smelter area is approximately 1.5 miles upstream from the confluence of Jack Creek and Basin Creek and the main development area is another mile up the same road.

2.6.2. Site History - Geologic Features

The Bullion Mine was worked periodically from 1897 to 1955, with some surface mining done in 1963 (MBMG files, unpublished information). According to Ruppel (1963), the smelter and a gravity concentrator were constructed in 1902. In 1929, a flotation mill was constructed in the main development area. The Bullion Mine in the main development area consisted of three levels, connected by stopes and inclines, with about 4500 feet of total workings.

A quartz-pyrite-tetrahedrite-galena-sphalerite-chalcopyrite-arsenopyrite-siderite vein trends N70W 50-70NE in quartz monzonite and is from .2 to 40 feet wide. There is some evidence of vertical zoning. Ore from the lower level contained abundant siderite, and averaged .05 oz/ton Au, 3-5 oz/ton Ag, .1% Cu, 2-5% Pb, and 3-4% Zn. That of the middle level averaged .2 oz/ton Au, 9.5 oz/ton Ag, 1-1.5% Cu, and included very little Pb, Zn, or siderite. Approximate total production was 30,000 tons of ore containing 3500 oz Au, 250,000 oz Ag, 300 tons Cu, 1000 tons Pb, and 1000 tons Zn. Uraninite mineralization is associated with late hydrothermal chalcedony in the Bullion veins (Thurlow and Reyner, 1952), and gamma radiation on dumps and tailings is abnormally high. At the smelter site uranium must have been concentrated in the slag, which has gamma radiation values from 5-10 times background.

2.6.3A. Environmental Condition - Main Development Area

Figure 4 shows the specific features of and sample locations in the area adjacent to the Bullion Mine. This area includes the portion of the Bullion Mine that is on NFS land, the tailings impoundments on NFS land, and a small adit near the uppermost tailings impoundment on NFS land.

2.6.3A.1. Site Features - Sample Locations

The main development area contains the Bullion Mine which consists of four adits (the upper three adits and the Bullion Tailings adit on NFS land), several large waste rock and development rock dumps on which several buildings and ore bins have been constructed, a mill with associated tailings, and two breached tailings impoundments on the unnamed creek. The upper three adits, along with most of the waste rock dumps and some of the tailings are on private land. The property boundary between the private land and NFS land runs roughly east-west just below the mill.

The main adit (the lowest adit of the upper three) is about 100 feet east of the mill building on private land and is discharging water that flows for about 550 feet before entering the unnamed creek on NFS land. The Bullion Tailings adit is near the uppermost tailings impoundment; there was no discharge from this adit at the time it was visited, but there were indications of previous discharges. The underground workings probably total about 250 feet with an estimated 500 tons of dump material present. Presumably this adit crosscut to a vein which is the western extension of the Bullion vein. About half of the dump material is unaltered quartz monzonite, the other half is quartz monzonite with quartz, sericite, and pyrite alteration products. The tailings within the impoundments total approximately 4800 tons and both impoundments contain about .03 oz/ton Au, 1 oz/ton Ag, and less than one-half percent base metals. A composite sample of the mineralized portion of the waste dump associated with the small adit next to the tailings impoundments ran only .01 Au oz/ton, .08 Ag oz/ton, .012% Cu, .047% Pb, .050% Zn.

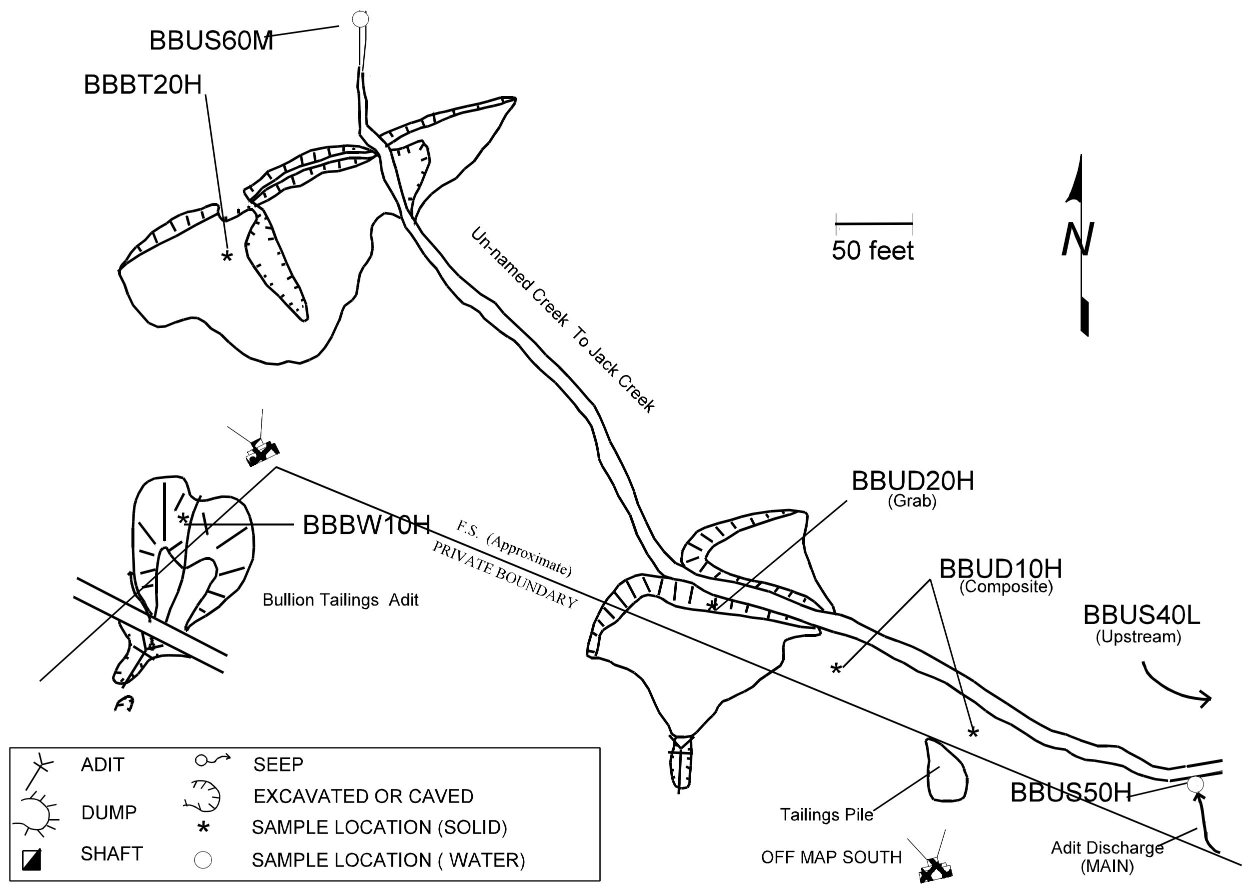

Figure 4 Main development area of the Bullion Mine. The adit discharge and waste material on private land are impacting the stream on USFS land. The stream flows through tailings impoundments on USFS land. Camera symbol show location of photographs shown in Figure 4a.

Figure 4A. Discharge streams from main development area of the Bullion mine; tailings on Jack Creek downstream of the mine.

2.6.3A.2. Soil

Although most of the waste material associated with the main development area is on private ground, large amounts of tailings and waste rock have been eroded and deposited on NFS lands. Immediately adjacent to the unnamed creek, soils have been severely impacted by both tailings and fine-grained waste material. Soil composite samples were collected in the two areas where waste material and soils had been washed into the creek during runoff. The results of the soil samples are summarized in Table 6.

Table 6
Soil Sampling Results - Main Development Area
Bullion Mine
(mg/kg)

Sample Location	**As**	**Cd**	**Cu**	**Pb**	**Zn**
Upper soils wash area (BBUD10H)	7835[1,2]	8.9[1]	309[1,2]	5356[1,2]	1937[1,2]
Tailings wash area (BBUD20H)	794[1,2]	1.3[1]	49.2[1]	504[1]	86.6

(1) Exceeds one or more Clark Fork Superfund Background Levels (Table 3)
(2) Exceeds Phytotoxic levels (Table 3)

2.6.3A.3. Water

The discharge water from the main adit had a pH less than 3 above its confluence with the unnamed creek; the pH was greater than 7 above the confluence. Ferric hydroxide deposits were strongly evident in the adit discharge and in the creek below its confluence with the adit discharge. Surface water samples were collected upstream of the site from the unnamed creek and from the adit discharge (Figure 4).

The two breached tailings impoundments downstream of the development area on NFS lands provide large amounts of material to the unnamed creek, especially during storm events and spring runoff. Specific conductance values increased with distance downstream throughout the stretch near the tailings. A surface water sample was collected from the creek at a point below the lower tailings impoundment.

In addition to the dissolved-metals load to the unnamed creek and Jack Creek, waste material and tailings were obviously being actively eroded and washed into the streams; stream-bed and stream-side tailings were observed in several sections of Jack Creek several thousand feet downstream.

With the exception of aluminum, which exceeds the secondary Maximum Contaminant Level (MCL) and aquatic life standards, the concentrations of metals and other constituents in a sample collected upstream of the main development area meet all the water-quality standards considered (Table 3). At the point immediately below the tailings impoundment, standards were exceeded for pH and several metals. The impact of the main adit is strongly evident; standards were exceeded for several constituents in samples collected downstream. The sample locations and exceedences are listed in Table 7.

Dissolved metals concentrations in the sample collected on Jack Creek above its confluence with the unnamed creek met water-quality standards, with the exception of mercury; several metals concentrations were in excess of standards in samples collected from the unnamed creek just above its confluence with Jack Creek and on Jack Creek below the confluence. These exceedences are also summarized in Table 7.

Table 7
Water Quality Exceedences at the Main Development Area
Bullion Mine

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Unnamed stream - upstream of development area (BBUS40L)	S																		
Main adit discharge (BBUS50H)	S A C	P		P A C		S A C	S A C	S A C	S	C			S A C				P		S
Unnamed stream - downstream of development area (BBUS60H)	S			P A C		A C				C			A C						S
Jack Creek - above confluence with unnamed stream (BBUS20L)										C									
Jack Creek - below confluence with unnamed stream (BBUS30L)				A C		A C			S	C			A C						
Unnamed stream - above confluence with Jack Creek (BBUS10M)				P A C		A C			S	C			A C						

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The actual analytical results are listed in Appendix V

2.6.3A.4. Vegetation

The area below the waste material is almost devoid of vegetation. The vegetation within the floodplain of the unnamed stream has been either killed or greatly stressed to its confluence with Jack Creek. Isolated tailings deposits and stressed vegetation are evident as far downstream as the Jack Creek - Basin Creek confluence.

2.6.3A.5. Summary of Environmental Condition - Main Development Area

The main development area of the Bullion Mine site has one or more adits on private ground discharging contaminated water to the nearby creek; the impact is evident for several thousand feet downstream to Jack Creek. A large amount of soil has been affected by mill tailings and other waste material being eroded and washed down from private ground to the unnamed creek. The entire hillside is all but devoid of vegetation and recent logging will probably enhance the likelihood of mass wasting. The fine grained nature of much of the material and the large area of impact increases the possibility of wind erosion. Two tailings impoundments associated with the site are located within the flood plain of the creek on NFS land. These breached impoundments provide additional material for erosion by runoff and dissolution of metals to the ground water and surface water.

2.6.3B. Environmental Condition - Smelter Area

The area referred to here as the smelter area includes the smelter which has several concrete and rock foundations, slag piles, and a large collapsed mill; a group of cabins in various states of disrepair, and two adits, one of which discharges water (Figure 5).

2.6.3B.1. Site Features - Sample Locations

There is a smelter and two small adits in a second tributary to Jack Creek south of the drainage that contains the development area (Figure 5). The smelter and adits are within an unnamed drainage approximately 3000 feet upstream of its confluence with Jack Creek. There was no evidence of mill tailings in the immediate area or adjacent to the unnamed creek. However, tailings in the creek were observed on private ground in Jack Creek approximately 500 feet downstream of its confluence with the unnamed creek. The source of these tailings may either be the smelter site or the tailings impoundments associated with the main development area.

The smelter site consists of foundations, a large collapsed building, and slag pile on the north site of the road; and several small abandoned dwellings on the south side of the road next to the creek. All the features associated with the smelter are on NFS lands.

There are two adits located upstream of the smelter site. The uppermost adit was caved and was not discharging water. The lower adit was also caved, but was discharging a small amount of water which infiltrated the ground within a few feet. Ferric hydroxide and iron-bacteria were strongly evident in the adit discharge.

2.6.3B.2. Soil

Slag from the smelter, along with building material, is restricted to the immediate area of the smelter. The same is true for the waste rock dump of the lower, discharging adit. This dump, which has been cut by the road to the main development area, consists of coarse material and is not prone to erosion. Overall, the disturbed soils are restricted to the immediate vicinity of the smelter and adits; road maintenance activities have had a greater effect on the stability of the soils.

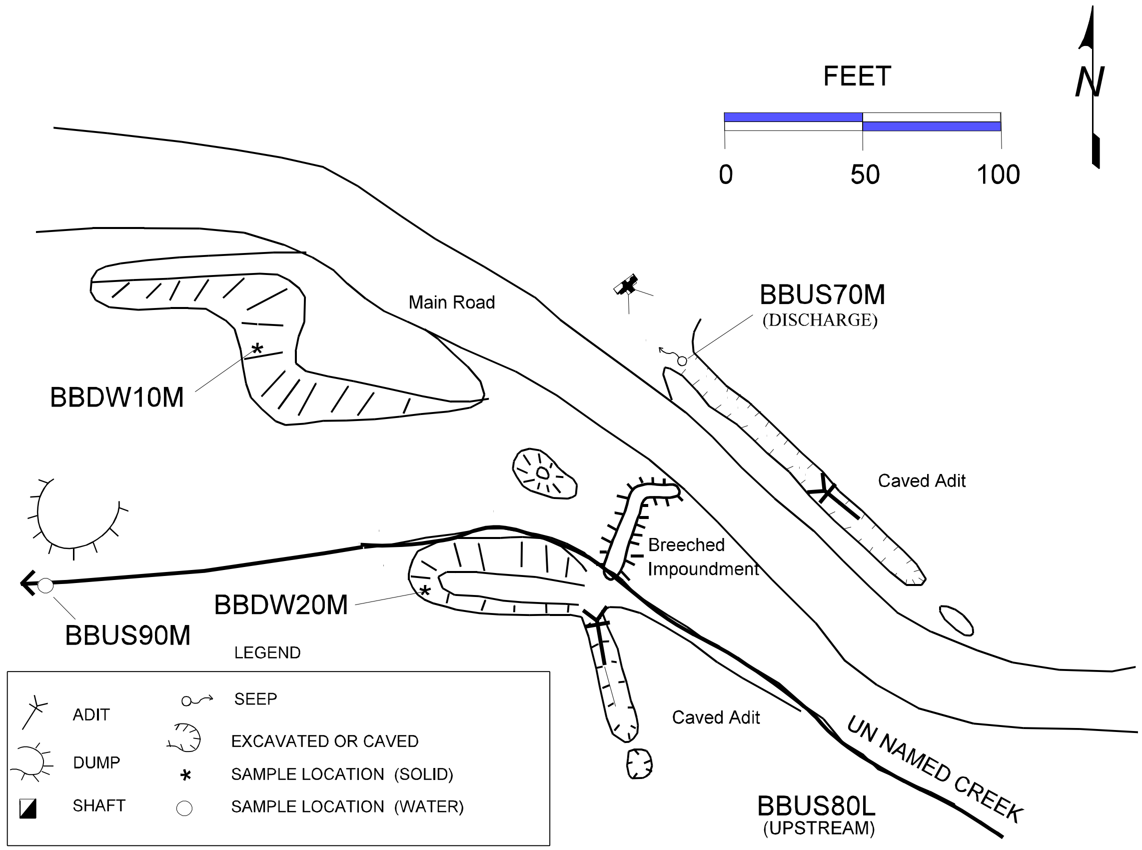

Figure 5 Smelter area of the Bullion Mine. Water samples were collected upstream and downstream of the area and at the adit discharge.

Figure 5A. Smelter area with slag piles and foundation material; adit discharge sample location (BBUS70M). The camera symbols in Figure 5 indicates location of photographs.

2.6.3B.3. Water

Surface water samples were collected from the unnamed creek above the discharging adit and below the smelter site, and in a ground-water discharge area (swamp) downstream of the discharging adit. A sample of the adit discharge was also collected (Figure 5).

The creek was sampled twice over a two week period because of incomplete sampling in the first round. A comparison of the sites that were sampled twice indicates differences that may be attributed to precipitation which was quite variable during this period. Aluminum concentrations were in excess of secondary standards and mercury concentrations were in excess of chronic aquatic life criteria in the first round of sampling, but were below the water-quality criteria in the second round of sampling.

In general, a comparison of the upstream sample and the downstream sample of the creek indicates little impact by mining activity; water-quality standards were exceeded for aluminum and mercury in the upstream sample, yet were not exceeded in the downstream sample. The adit discharge sample, however, exceeded several criteria for metals. The unnamed stream below the smelter indicates an increase in concentration of several dissolved constituents and exceeds water-quality standards for iron, mercury and pH. Sample locations and exceedences of water-quality standards are summarized in Table 8.

Table 8
Water Quality Exceedences at the Smelter Area
Bullion Mine

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Unnamed stream - upstream of smelter and discharging adit (BBUS80L)	S									C									
Adit discharge (BBUS70H)	S						S A C		S	C									
Unnamed stream below discharging adit and below smelter (BBUSA0M)							S			C									S

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The actual analytical results are listed in Appendix V

2.6.3B.4. Vegetation

The impact to vegetation appears to be restricted to the disturbed areas (dumps, slag piles, and near the road). The dam and many of the foundations of the cabins have been grown over. Vegetation along Jack Creek shows some degree of stress in isolated areas of tailings deposits; the source of the tailings is not certain.

2.6.3B.5. Summary of Environmental Impacts - Smelter Area

Waste material at the two adits and smelter in the second drainage appears to be stable with respect to water and wind erosion. Results from soil analyses indicate little impact and, although the water quality of the adit discharge is poor, it infiltrates before reaching the creek and no impact to the creek is evident. Local impact to ground water is possible, but not evident. Although stable, the smelter site is immediately adjacent to a well travelled road and provides ample opportunity for access.

2.6.4. Structures

The main development area had several structures including buildings, an ore bin, and the remnants of a flotation mill, all on private ground. Structures used to distribute tailings were present on the tailings dams on NFS ground near the unnamed creek. Several dilapidated structures including cabins and foundations are present at the smelter site.

2.6.5. Safety

The poor state of repair on many of the structures may pose a threat to safety. In the main development area, trees that have been killed as a result of exposure to the waste material may also pose a threat to safety; in several cases the soil has been eroded away from the base of the tree. The slag associated with the smelter site indicated a large increase of radioactivity over background. The unstable structures on both the main development area and the smelter area may pose a safety risk.

2.7. NORTH ADA - PIERMONT #1 EAST

2.7.1. Site Location and Access

The North Ada Mine site is located on the drainage divide between Basin Creek and Cataract Creek on NFS land (T7N R5W Section 8). The site can be accessed by way of a jeep trail from either the Cataract Creek road or the Jack Creek road (Basin Creek); the mine is approximately 6 miles from the Jack Creek road and is about the same distance from Cataract Creek road.

2.7.2. Site History - Geologic Features

Dumps, workings, and outcrops have been disturbed and covered by recent cat work, and it is difficult to obtain much information about the property. Workings presumably examine a west trending vein of quartz, pyrite, galena, sphalerite, enargite, siderite, and tetrahedrite. A select sample of the vein material ran .076 oz/ton Au, 8.58 oz/ton Ag, .81% Cu, 2.85% Pb, and 2.48% Zn. Acid waters emerge from one shaft.

No information is available on the history or production at the North Ada - Piermont Mine.

2.7.3. Environmental Condition

The mine site is entirely on NFS land in a heavily wooded area. Major features and sampling points are presented in Figure 6. The site consists of a flooded, discharging shaft and associated waste dumps on the Cataract Creek drainage and a second, covered shaft and dumps in the Basin Creek drainage.

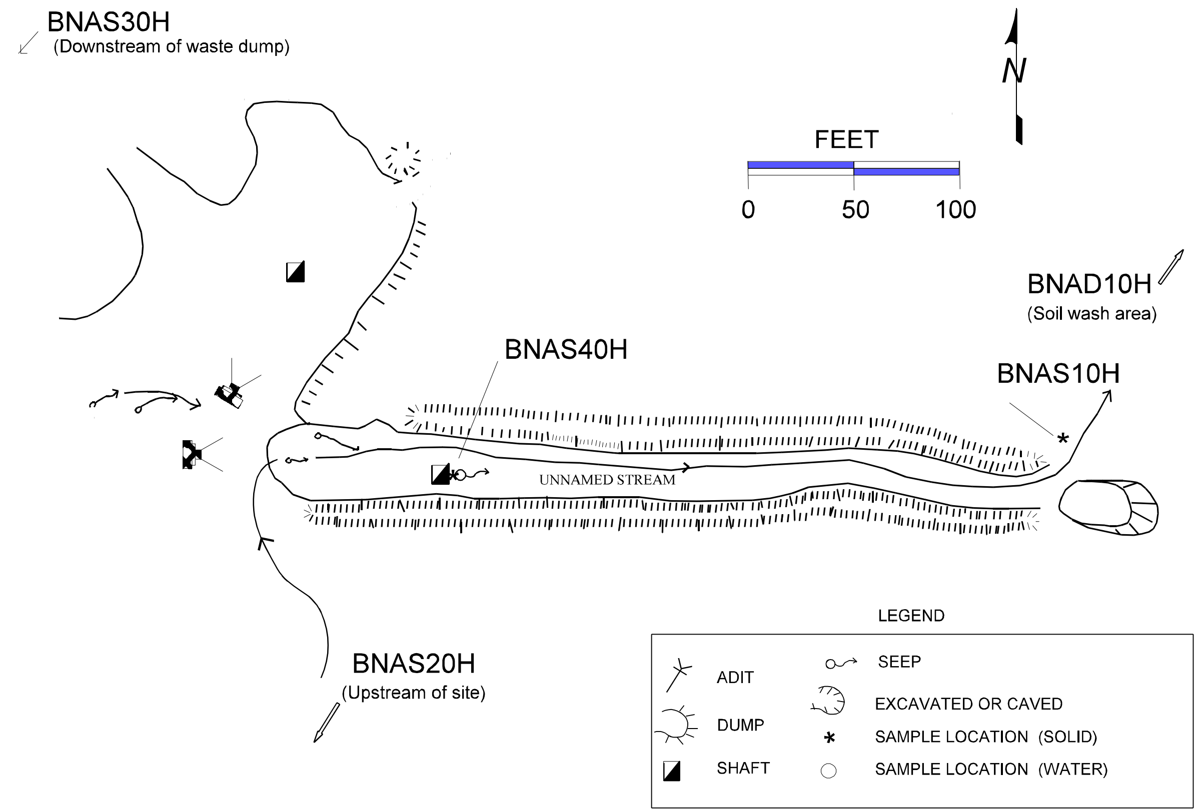

Figure 6 The North Ada - Piermont Mine is on the Basin Creek - Cataract Creek drainage divide. Water flows from the site toward both drainages.

Figure 6A. The west shaft of the North Ada mine is discharging water toward the Cataract Creek drainage; the north shaft was inaccessible. The locations of the photographs are shown in Figure 6.

2.7.3.1 Site Features - Sample Locations

After merging with a small natural stream captured by the open cut, the shaft discharge stream flows toward the Cataract Creek drainage for several hundred feet before infiltrating the ground surface; its ultimate destination is uncertain, but is likely to affect the Cataract drainage. Field pH and SC indicated poor-quality water discharging from the shaft (pH 4.4, SC 476 umhos/cm @ 25ºC); water quality degrades even more as the stream travels over the waste rock (pH 3.15, SC 430 umhos/cm @ 25ºC). A sample was collected at a depth of 10 feet in the shaft (BNAS40H).

Waste material washed down from the waste rock dump by the stream covers an area of several hundred square feet. A surface water sample was collected upstream of the wash area (BNAS30H) and a soil grab-sample was collected in the wash area (BNAD10H). Ferric hydroxide staining of the soil was evident throughout the runoff area where the stream infiltrated.

A portion of the natural stream has been artificially diverted toward the Jack Creek drainage; a sample was collected from the stream at a point above the diversion (BNAS20H). The diverted stream crosses beneath the access road and then infiltrates the base of a waste rock dump. Field parameters indicated poor water quality in the stream after it emerges from the dump (pH 5.4, SC 416 umhos/cm @ 25ºC). A sample was collected of the seep at the base of the waste rock dump (BNAS30H). This stream also infiltrated the ground within a few hundred feet downhill from the dump, but stained soils and deposits of fine-grained waste material indicated that much more flow occurs during spring runoff and storm events.

2.7.3.2 Soil

Concentrations of arsenic and lead in the soil were in excess of 1500 mg/Kg each in this area. A comparison of concentrations with the Clark Fork Background Levels is presented in Table 9. A sample of waste material was used for the acid rain simulation test. The result was a notable increase in dissolved metals and SC, and a corresponding decrease in pH (Table 10) indicating a strong propensity for the material to leach metals.

Table 9
Soil Sampling Results - North Ada - Piermont Mine
(mg/kg)

Sample Location	**As**	**Cd**	**Cu**	**Pb**	**Zn**
Soil wash area below shaft (BNAD10H)	BDL	0.56[1]	BDL	BDL	14.94
Repeat of sample (BNAD10H-A)	1780[1,2]	0.31[1]	56.6[1]	1673[1,2]	154.5[1]

(1) Exceeds one or more Clark Fork Superfund Background Levels (Table 3)
(2) Exceeds Phytotoxic levels (Table 3)
BDL = Below Detection Limit

Table 10
Acid Rain Leach Test Results

Sample Site	SC1 umhos/cm	SC2 umhos/cm	pH1	pH2	Ag mg/L	As mg/L	Cu mg/L	Hg mg/L	Mn mg/L	Pb mg/L	Zn mg/L
Waste rock (BNAW10H)	20.8	282.0	5.05	3.57	BDL	161.1	106.7	0.08	756.4	704.0	1306.5

BDL = Below Detection Limit
SC1/pH1 - values at begining of test
SC2/pH1 - values at end of test

2.7.3.3 Water

The natural stream above the development area did not exceed any of the water-quality standards considered. The shaft water, the shaft discharge, and the stream below the waste rock dump exceeds several water-quality criteria. These exceedences are summarized in Table 11.

Table 11
Water Quality Exceedences at the North Ada - Piermont Mine

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Shaft - 10-foot depth (BNAS40H)	S A C					A C	S	P A C	S				A C						S
Shaft discharge - 300 feet downstream (BNAS10H)	S A C	P		P A C		A C	S A	P A C	S				S A C						S
Small stream below dump on Jack Creek drainage (BNAS30H)	S A C			P A C			S A	C	S				A C						S

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The actual analytical results are listed in Appendix V

2.7.3.4 Vegetation

The vegetation in the disturbed area was, at best, sparse; vegetation in the soil wash areas below dumps is obviously stressed. The areas adjacent to the two discharge streams indicates a moderate stress to vegetation, but the reduced flow in the latter part of the summer probably permits revegetation.

2.7.3.5 Summary of Environmental Condition

As indicated by the water-quality analyses, the Piermont - North Ada Mine site adversely impacts surface water within the disturbed area. The extent of ground water impact could not be estimated, but is probably limited since there were no indications of acid mine seeps downstream of the site. Impact to soils was also restricted to the disturbed area with the exception of the area downstream of the discharging shaft and the waste rock dumps. Waste material has been eroded and deposited several hundred feet downstream of the disturbed area on both the Basin Creek and the Cataract Creek side of the drainage divide.

2.7.4 Structures

Several buildings of varying degree of repair were observed on the site. The largest building was a small, frame house that appeared to be in sound condition and shows evidence of recent activity. The flooded shafts are covered with timbers which have a limited life expectancy.

2.7.5 Safety

Both shafts present at least some potential for entrapment; both were covered by timbers, but neither were locked or barred. The frame house and sheds were locked and appeared to be secured from easy entry.

2.8 MORNING MINE

2.8.1 Site Location and Access

The Morning Mine (T7N R5W Section 18) can be accessed by way of a jeep trail from either the Cataract Creek road or the Jack Creek road (Basin Creek); the mine is approximately 5 miles from the Jack Creek road and is about 7 miles from Cataract Creek road. The mine is approximately 4000 feet west and down drainage of the North Ada - Piermont Mine, well above any natural stream.

2.8.2 Site History - Geologic Features

Ruppel (1963) describes the Morning mine in some detail. The site consists of three adits that crosscut to the vein, 2 shafts up to 40 feet deep, one inclined shaft, and numerous pits and bulldozer cuts. Workings probably total about 1000 feet in length. The Morning vein is up to 5 feet wide and is within a 10 to 30 foot wide, N70W 70NE shear zone in altered quartz monzonite. Vein minerals include quartz, tourmaline, galena, sphalerite, chalcopyrite, tetrahedrite, covellite, and cerussite. The secondarily enriched "carbonate" ore averaged .3 oz/ton Au, 8-10 oz/ton Ag, and 2-6% Pb. Sulfide ore averaged .2 oz/ton Au, 1-4 oz/ton Ag, and 1-2% Zn. Our own sulfide vein sample ran .120 oz/ton Au, 19.1 oz/ton Ag, .59% Cu, 5.72% Pb, 2.19% Zn. Production figures from 1939-1957, the main period of operation, are 314 tons of ore relinquishing 85 oz of Au, 2691 oz Ag, 1140 lbs of Cu, 23,340 lbs of Pb, and 6040 lbs of Zn.

2.8.3 Environmental Condition

The mine site is on NFS and private land and is situated on a steep rocky hillside above a tributary of Jack Creek. Major features and sampling points are presented in Figure 7. The site consists of two caved adits and associated dumps, several dilapidated buildings, and scattered debris. The second, lower adit was not discovered until the visit by the hydrogeologist; subsequently this area was not mapped in detail.

2.8.3.1 Site Features - Sample Locations

At present, all workings are caved, and a discharge issues from the main (upper) adit and the secondary (lower) adit. The discharge stream from the upper adit flowed only a few feet onto the dump before infiltrating; no seeps were emanating from the base of the dump. Discharge from the lower adit continued across the dump and into the undisturbed area below the site before infiltrating the ground surface. It was evident that both discharge streams recently had higher flow. The adit discharges represent the only surface water near the site and samples were collected at both. The field pH of both discharges was above 6; SC was greater than 300 umhos/cm @ 25°C for both. Samples were collected from both the upper adit (BMOS10L) and the lower adit (BMOS20L).

The dump associated with the upper adit contains roughly 1300 tons of iron stained quartz monzonite and clays. A composite sample yielded .034 oz/ton Au, 1.98 oz/ton Ag, .075% Cu, .78% Pb, and .068% Zn. Much of the area on and around the dumps has been reworked with heavy equipment.

2.8.3.2 Soils

Impact to soils appeared to be restricted to the waste rock dumps and road work downhill from the site. Mass wasting of material during runoff events appeared to be restricted to a few feet beyond the base of the dumps. No soil samples were collected.

2.8.3.3 Water

There were no natural streams to obtain background water-quality information nor were there active streams within several thousand feet below the site. Both adit discharges exceeded one or more water-quality criteria and are summarized in Table 12

Table 12
Water Quality Exceedences at the Morning Mine

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Upper adit discharge (BMOS10L)				A C		A C							A C						S
Lower adit discharge (BMOS20L)				P A C		A C	S		S				S A C						S

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The actual analytical results are listed in Appendix V

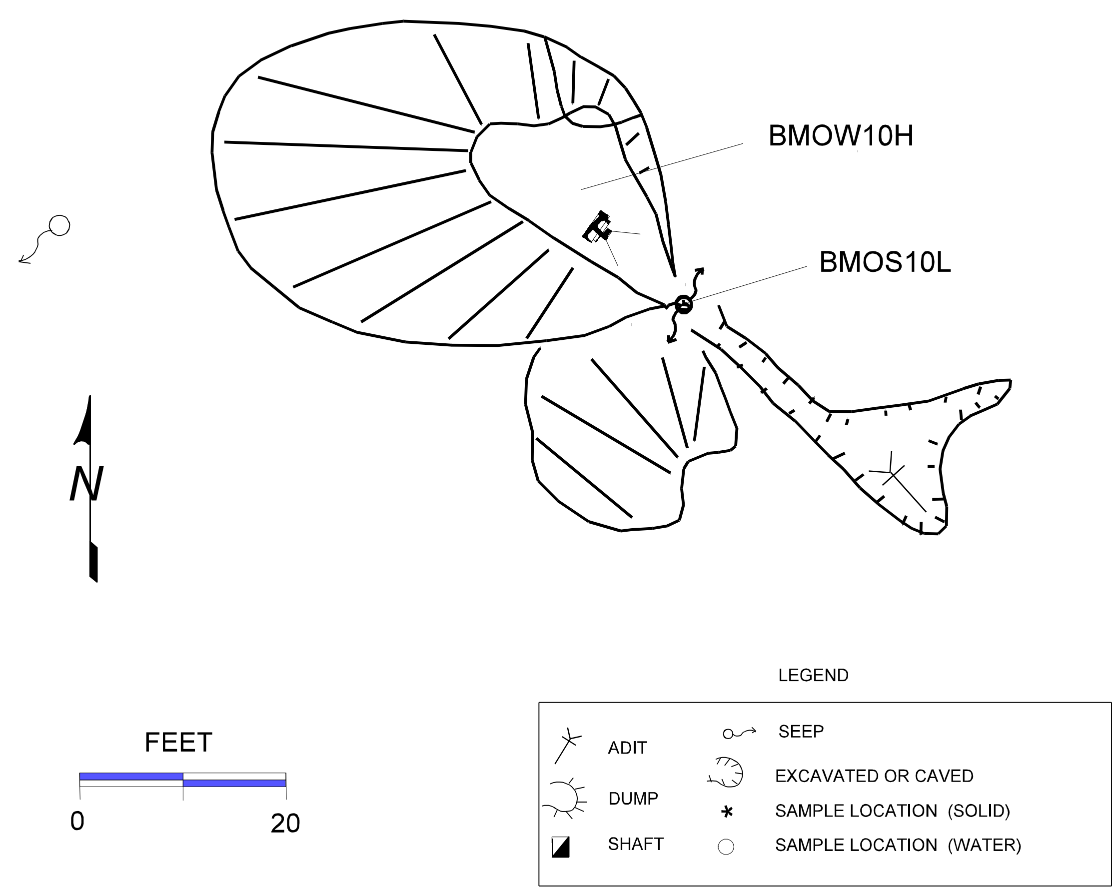

Figure 7 The Morning Mine has two discharging adits; only the upper (south) adit was mapped. These discharges represent the only surface water in the area.

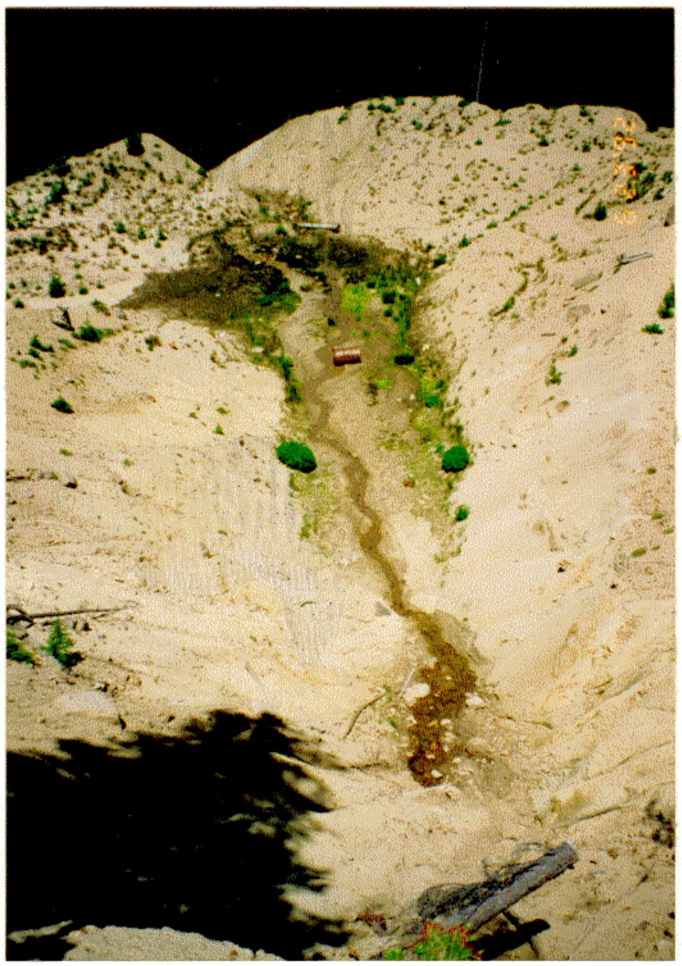

Figure 7A. Adit discharges from the Morning mine. The location of the upper photograph is shown on Figure 7, the lower adit was not mapped.

2.8.3.4 Vegetation

Impact to vegetation appeared to be restricted to the disturbed area. Vegetation on the dumps was sparse; much of the area away from the dumps that had recently been graded showed signs of revegetation. The recent cat work, made it difficult to determine if the discharge from the lower adit had any effect on the health of nearby vegetation.

2.8.3.5 Summary of Environmental Condition

Water quality affected by mining activity at the Morning Mine site appears limited to discharge from the upper and lower adits. No water-quality degradation was evident in the stream several hundred feet downhill of the disturbed area. The disturbed area is relatively large, but much of the disturbance is due to re-working of the dumps and not mass wasting.

2.8.4 Structures

Along the access road to the upper adit there are several dilapidated buildings and an ore bin on the edge of a steep incline. These buildings are the only structures in the immediate area.

2.8.5 Safety

The proximity to the steep incline and the dilapidated state of the buildings present a safety concern. The area is generally steep and the waste rock piles, comprised of cobble sized material, is often loose.

2.9 VINDICATOR MINE

2.9.1 Site Access and Location

The Vindicator Mine is located on a small tributary to the upper portion of Jack Creek on DNF administered land (T7N R6W Section 12). The mine is approximately 1500 feet east of the upper Jack Creek road; the road continues on toward the Morning Mine but is impassable beyond the Vindicator mine site.

2.9.2 Site History - Geologic Features

Ruppel (1963) states that most mining on the Vindicator was done in the 1930's, with production from 1936 to 1940 being only 92 tons of ore containing 22 oz of Au and 270 oz of Ag (Roby and others, 1960). This was probably mined from near surface, secondarily enriched zones, as the unoxidized sulfide ore is of low grade (Ruppel, 1963). Our own sampling concurs, with three chip samples across the main vein averaging only .026 oz/ton Au, 2.77 oz/ton Ag, .03% Cu, .517% Pb, and .31% Zn. Composite samples from the dumps were even lower grade.

Mining was done on veins occupying three parallel shear zones (Ruppel, 1963). These N75-80W 65-80N zones averaged 5 feet wide, but veins within them appear to be discontinuous and podiform. The unoxidized portions contained the typical Boulder batholith vein assemblage of quartz, calcite, pyrite, galena, sphalerite, tetrahedrite, chalcopyrite, and tourmaline. The total extent of the workings is probably less than 1000 feet.

2.9.3 Environmental Condition

The site consists of a large, deep cut leading to the lowest adit with a large waste rock dump below. Above the main adit, following the drainage, are several small caved adits and dumps, one of which has been fenced. Above the workings, at the upper end of the drainage, there are several small cat cuts. Major features and sample locations are presented in Figure 8.

2.9.3.1 Site Features - Sample Locations

A large discharge was observed coming from the lowest adit, but it actually has its origins above in numerous small springs and possible discharges from the smaller workings. The lower adit, which was caved and stope-cut, is in a small drainage with active surface streams flowing through the workings and waste rock dumps. At least four more adits are within the same drainage above the main adit; one of which is discharging water. There are also several trenches and cat cuts across the drainage including one above the workings that is also discharging water. A fifth adit is located out of the small drainage and is also discharging water through a pipe.

Ferric-hydroxide and/or iron-bacteria were observed in several places along the stream and was especially heavy in the seeps below the main dump. Field parameters indicated a slight drop in pH (7.01 to 6.5 to 6.68) and a moderate rise in SC (92 umhos/cm @25^{o}C to 223 umhos/cm @25^{o}C to 190 umhos/cm @25^{o}C) from the upper-most seep to the lower adit. Surface water samples were collected at each of the seeps within the disturbed area, including the discharge from the adit away from the main disturbed area. A sample point was staked at the uppermost seeps above the workings; however, this was dry before samples could be collected.

2.9.3.2 Soil

The area below the adit located away from the main workings indicated that waste material was being washed downhill during runoff events. Vegetation was somewhat reduced in a small area at the base of the dump. Metals concentrations in a grab sample of the soil (BVID10M) were detectable and of similar composition as a sample obtained from the main dump (BVID20M). The analytical results are summarized in Table 13

Table 13
Soil Sampling Results - Vindicator Mine
(mg/kg)

Sample Location	As	Cd	Cu	Pb	Zn
Soil at base of small dump (BVID10M)	25.86[1]	1.47[1]	37.99[1]	97.27[1]	151.04[1]
Main dump area (BVID20M)	175.7[1,2]	1.41[1]	26.71[1]	107.83[1]	94.28[1]

(1) Exceeds one or more Clark Fork Superfund Background Levels (Table 3)
(2) Exceeds Phytotoxic levels (Table 3)
BDL = Below Detection Limit

2.9.3.3 Water

Concentrations of metals exceeded secondary and aquatic life criteria at discharge sites within the mine area and downstream of the main workings.

Table 14
Water Quality Exceedences at the Vindicator Mine

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Adit - north, away from main workings (BVIS10M)	S			S A C		A C		C					A C						
Upper adit discharge stream above main adit (BVIS40M)				A C									A C						S
Stream below site (BVIS50M)							S		S										

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The actual analytical results are listed in Appendix V

2.9.3.4 Vegetation

Vegetation in the disturbed areas is generally sparse; vegetation near the streams out of the disturbed area showed only a slight degree of stress. The area in which the first soil sample was collected (BVID10M) showed a marked decrease on vegetation.

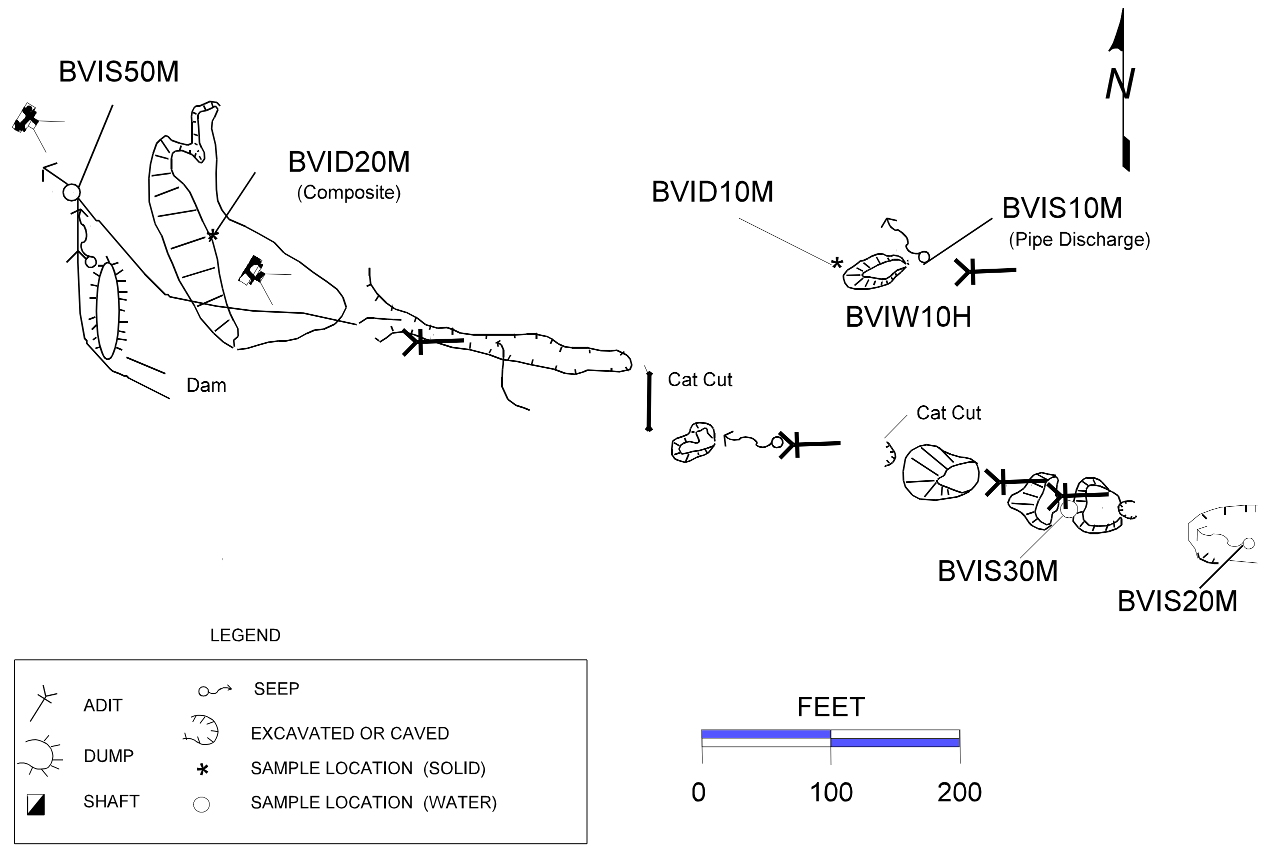

Figure 8 The main development area of the Vindicator Mine is in a wet drainage; sample locations were chosen that best represent the impact of the workings on soil and water.

Figure 8A. Adit discharges cross the main dump (top); several discharges come together below the dam (bottom). The locations of the photographs are shown in Figure 8.

2.9.3.5 Summary of Environmental Condition

The mine workings and associated waste rock dumps are located in a natural drainage. As a result, the water quality of the stream is directly affected by mine discharge. The surface disturbance and runoff from snowmelt or storm events likely produces a significant quantity of poor quality water. Soils impact is generally restricted to the disturbed area; the exception being the area below the waste rock dump away from the main workings.

2.9.4 Structures

There were several structures in various states of disrepair throughout the area near the mine, none of which had evidence of recent occupation. Machine parts, tanks, drums, and other debris were observed in several areas away from the main area.

2.9.5 Safety

The structures and steep cuts represent at least some safety risk at this site. An open adit in the upper area had been fenced (chain-link) and posted.

2.10. HAWKEYE MINE

2.10.1 Site Location and Access

The Hawkeye Mine is located just below the head of Jack Creek and the end of the Jack Creek road (T7N R5W Section 7). This is the only vehicle access to the mine. The road is, at present, in fair condition, but is not maintained.

2.10.2 Site History - Geologic Features

Two veins were explored at the Hawkeye mine. The veins trend N85W and dip steeply north in quartz monzonite (Ruppel, 1963). The veins and workings have been obscured by recent cat work on private land. One dump and a caved portal can be found on DNF land. This was a 300-400 foot crosscut to the southerly vein, and the entire dump is unaltered quartz monzonite. The vein apparently was enriched to high grade silver ore in the shallow oxidized zone, but a sample of sulfide vein material with quartz, chalcedony, pyrite, galena, sphalerite, and siderite contained only .03 oz/ton Au, 7.64 oz/ton Ag, .57% Cu, 1.33% Pb, and .18% Zn. This crosscut discharges a small amount of water as seeps near the portal.

The northerly vein workings are on private land and are also covered by recent work. Vein material from an old dump contained quartz, tourmaline, and pyrite, and assayed at .032 oz/ton Au, 1.76 oz/ton Ag, .24% Cu, .14% Pb, and .055% Zn.

2.10.3 Environmental Condition

The mine site consists of a large area of open pits, trenches, and dumps primarily on private land. An ore bin and dilapidated cabins are below the workings next to Jack Creek. As this site was entirely on private ground, no site map was constructed.

2.10.3.1 Site Features - Sample Locations

The site is located just below the head of Jack Creek near the Basin Creek - Cataract Creek divide. Several seeps were observed at the base of the waste rock dumps on DNF ground. Field parameters indicated near neutral pH and moderate SC (400-500 umhos/cm @ 25°C). Water samples were collected on Jack Creek at a point upstream (BHES20L) and downstream of the mine site (BHES40L). Additional samples were collected at seeps originating from the base of the lower-most waste rock dumps (BHES10L and BHES30L). The extensive re-working (reclamation ?) of the site has resulted in numerous depressions capable of trapping water as well as increasing the possibility of mass wasting.

2.10.3.2 Soils

Disturbed or impacted soil was restricted to the re-worked area. Some small soil/waste wash areas were developing near the base of the dumps nearest the creek. Soil grab-samples were collected in these areas. Although the concentration of metals in the soil is relatively minor compared to other sites in the drainage, phytotoxic levels were approached by arsenic and copper (Table 15). The recent disturbance of waste rock material has caused a noticeable increase in the amount of material being washed toward the creek. Nearly all of the material that had been washed toward the creek appeared to be the result of recent precipitation.

Table 15
Soil Sampling Results - Hawkeye Mine
(mg/kg)

Sample Location	**As**	**Cd**	**Cu**	**Pb**	**Zn**
Soil at base of upper dump (BHED10M)	36.21[1]	1.40[1]	29.57[1]	42.08[1]	134.53[1]
Soil at base of main dump (BHED20M)	97.62[1]	3.21[1]	61.84[1]	123.22[1]	309.57[1]

(1) Exceeds one or more Clark Fork Superfund Background Levels (Table 3)
(2) Exceeds Phytotoxic levels (Table 3)
BDL = Below Detection Limit

2.10.3.3 Water

All water samples collected near this site, including the upstream sample, exceeded the aquatic life criteria (chronic) for mercury. A slight increase in the concentration of several metals from upstream to downstream is apparent; however, only the seepage at the base of the dump exceeded any other criteria (Table 16).

Table 16
Water Quality Exceedences at the Hawkeye Mine

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Jack Creek - above mine (BHES20L)										C									
Seep - above mine (BHES10L)										C									
Seep below main dump on NFS land (BHES30M)									S	C			A C						
Jack Creek - below mine (BHES40L)										C									

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The actual analytical results are listed in Appendix V

2.10.3.4 Vegetation

Except in areas where material had recently been washed down, the base of the lower dumps were generally overgrown by vegetation. The same is true for the area around the ore bin and the cabins near the creek. As with the soils, however, this condition may change as more material is eroded from the dumps.

2.10.3.5 Summary of Environmental Condition

The quality of the water discharging from the adit is uncertain; however, waste material, which has been extensively reworked, has adversely affected water quality in the seeps emanating from the base of the dumps which are on DNF administered land. The reworking will probably contribute a great deal to the amount of precipitation that infiltrates the waste dumps and to the erosion of the waste material.

2.10.4 Structures

The only structures observed on the site were an ore bin and two small cabins near Jack Creek.

2.10.5 Safety

The cabins which were almost completely destroyed and the ore bin may be of concern with regard to safety. There were also several unstable slopes evident throughout the site, on private land, which may be prone to collapse and mass wasting. Many of the steep slopes and cuts were the result of the recent cat work and showed signs of imminent failure.

2.11. BUCKEYE-ENTERPRISE MINE-MILL

2.11.1 Site Location and Access

The Buckeye-Enterprise (T8N R6W Section 36) site is in the upper Basin Creek drainage approximately 2 miles west of the main road. Overall the road is in fair condition, but in several places is quite rough. Several primitive roads approach the site from the west and the south but their condition is unknown.

2.11.2 Site History - Geologic Features

The Buckeye and Enterprise mines are treated as one site here. They were apparently worked as a single operation for a time and used the same mill facility. According to Ruppel (1963), both were worked intermittently from 1897 to 1908 through shafts 100-200 feet deep. During this time, a gravity mill at the site (the upper Buckeye mill) was used to process the ore. The present day volume of dump material indicates more than 8000 feet of workings. Production from the Buckeye since 1902 was 1813 tons of ore yielding 309 oz Au, 18,227 oz Ag, 3425 lbs Cu, 76,590 lbs Pb, and 13,797 lbs Zn (Roby and others, 1960). The volume of tailings observed below the mill suggests that there must have been substantial pre-1902 production. During World War II, a flotation mill was built in the floodplain of Basin Creek to re-treat the gravity tailings from the old mill.

The workings followed a vertical N85W trending shear zone 3-5 feet wide containing veins of quartz, pyrite, arsenopyrite, galena, sphalerite, tourmaline, and arsenopyrite (Ruppel, 1963). The zone is surrounded by a bleached zone of quartz monzonite with quartz-sericite-pyrite alteration products and some gold.

2.11.3 Environmental Condition

The site consists of caved adits, dumps, ore bin, holes, and dismantled buildings on private land (Figure 9). Below the mine area there are pieces of milling equipment on a large tailings pile immediately adjacent to Basin Creek (Figure 10).

2.11.3.1 Site Features - Sample Locations

At present, the mine workings are on private land, while both tailings piles are on DNF lands. All workings are caved, and an acid discharge issues from the Enterprise. Dumps on the site are composed mainly of altered quartz monzonite containing from 5-10% pyrite. Tom Kelley, present owner of the Buckeye, provided some information. The estimated 15,000 tons of dump materials from the Buckeye and Enterprise averaged .066 oz/ton Au and less than 1 oz/ton

Ag. Our own composite sample contained .09 oz/ton Au and 3.02 oz/ton Ag. Only a few pockets of the original gravity tailings remain; these were not sampled. Contaminated soil, of which a composite sample was collected (BBAD20H and BBAD30H), persists at the location of these tails, however. An estimated 16,000 tons of flotation tailings are still present in the Basin Creek floodplain and are cut by Basin Creek. A composite sample of the tailings material ran .098 oz/ton Au, 1.12 oz/ton Ag, and less than 1% base metals.

As mentioned, the Enterprise adit, on the eastern portion of the main workings, discharges water (BBAS10H) to a small pond which then intermittently flows toward Basin Creek; during runoff events, this stream flows directly to the creek. Field parameters indicated poor quality water along the entire length of this stream. A sample was collected just upstream of where it infiltrates the ground surface approximately 100 feet from Basin Creek (BBAS30H). Basin Creek travels along the entire west side of the mine area and tailings area; samples were collected upstream of the site (BBAS20L) and downstream of the tailings-soil wash area (BBAS40L). Throughout the area between the mine and the creek, there are numerous poorly defined seeps; field parameters indicated variable water quality. Since none of the wet areas developed flows, water samples were not collected. There were also several areas between the mine and the creek where waste material had been washed down and mixed with soils; a composite sample was collected from one of the larger areas (BBAD10H).

2.11.3.2 Soil

The tailings cover a rather large area (approximately 4500 square-feet) adjacent to Basin Creek and are being washed into the creek. The high concentrations of arsenic and lead in the soil (Table 17) are reflective of the mineralogy of the mined ore. The milling process increased the concentrations of these constituents nearly two-fold and is severely impacting soils which are washed into the creek during periods of storm and snowmelt runoff.

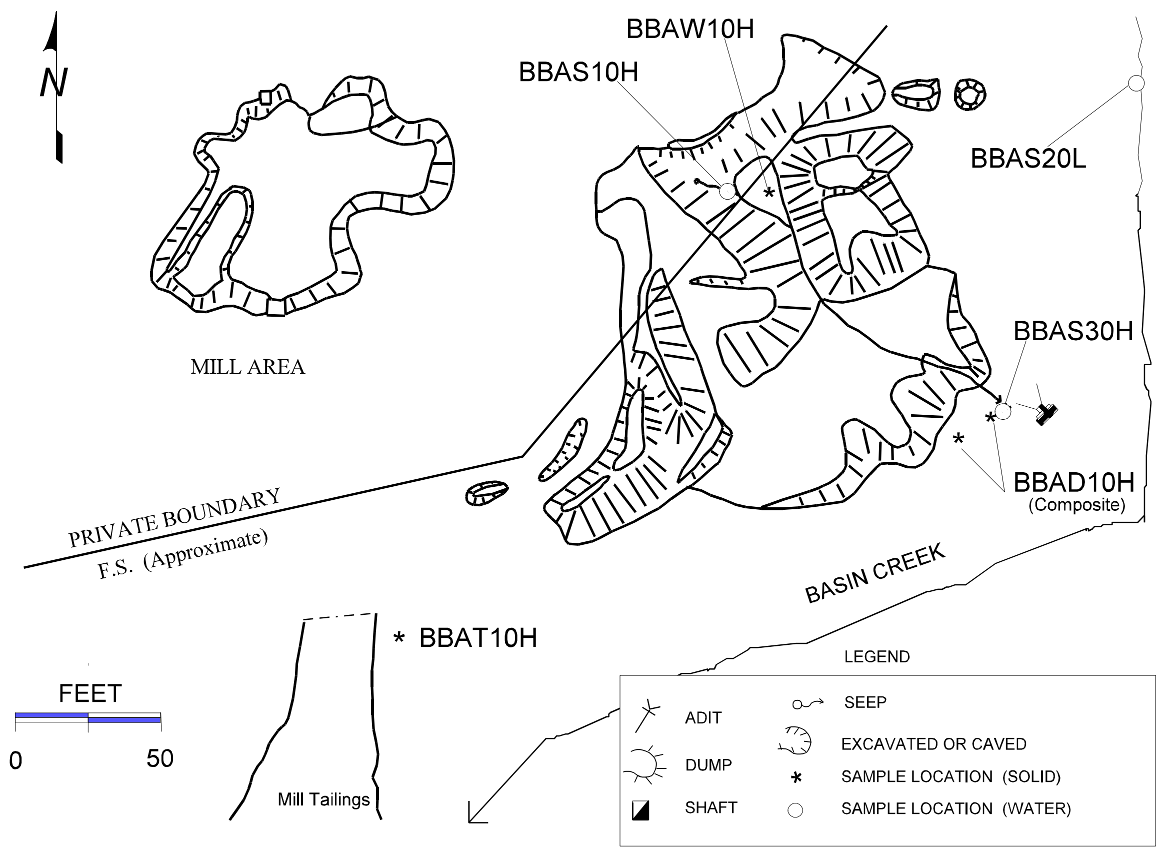

Figure 9 Main development area of the Buckeye - Enterprise mine. Waste material, acid mine drainage, and likely, contaminated ground water have strongly impacted Basin Creek.

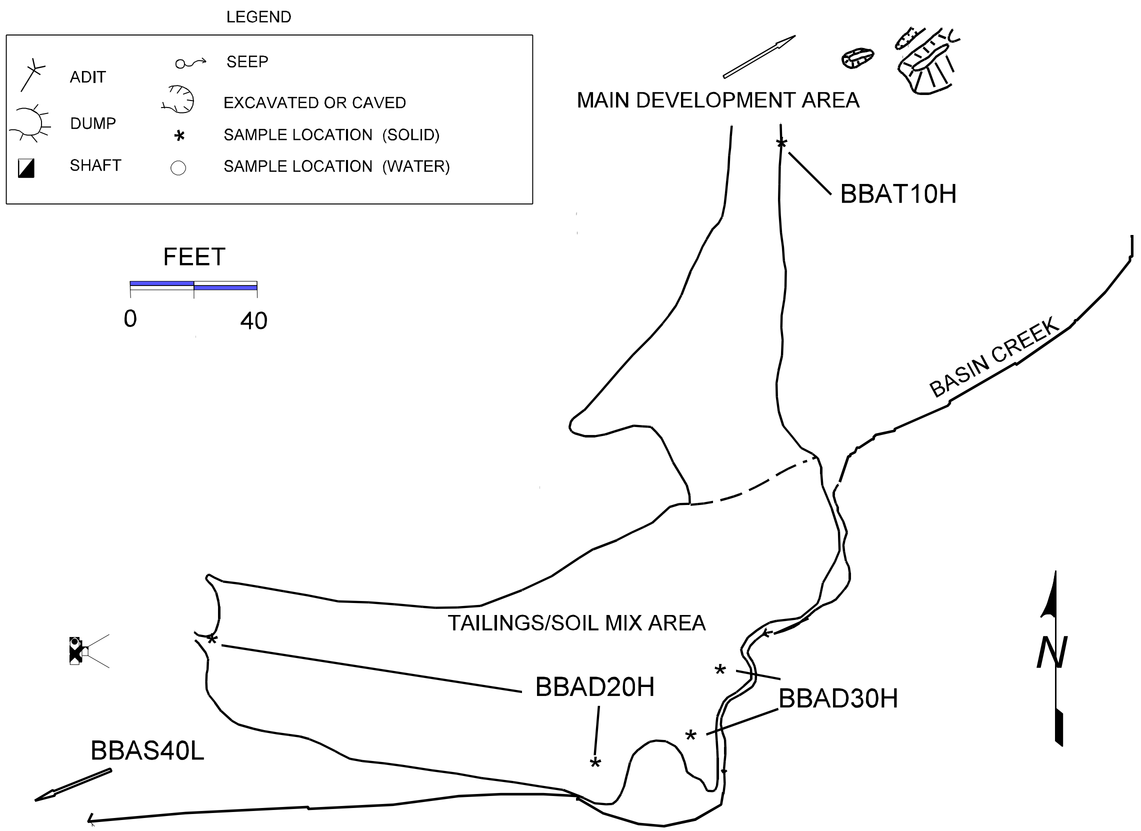

Figure 10 Tailings impundment below main development area. Soils and tailings below the Buckeye - Enterprise Mine have been thoroughly mixed throughout the area. This mixture is easily washed into Basin Creek during periods of runoff.

Figure 10A. Material from the mine area (top) and from the tailings impoundment (bottom) have been washed into the creek. The locations of the photographs are shown in Figure 9 and Figure 10.

Table 17
Soil Sampling Results - Buckeye-Enterprise Mine-Mill
(mg/kg)

Sample Location	As	Cd	Cu	Pb	Zn
Base of main dump (BBAD10H)	4568[1,2]	5.43[1]	238.40[1,2]	4029[1,2]	117.00[1]
Lower tailings wash area (BBAD30H)	7698[1,2]	3.42[1]	149.43[1,2]	5841[1,2]	259.75[1]
Upper tailings wash area (BBAD20H)	9173[1,2]	1.99[1]	95.56[1]	3946[1,2]	137.51[1]

(1) Exceeds one or more Clark Fork Superfund Background Levels (Table 3)
(2) Exceeds Phytotoxic levels (Table 3)
BDL = Below Detection Limit

2.11.3.3 Water

Only aluminum and mercury concentrations exceeded the water-quality standard in the sample collected from Basin Creek above the site; several standards were exceeded in the adit discharge, the seeps at the base of the dumps, and in Basin Creek for quite a distance downstream of the site (Table 18).

Table 18
Water Quality Exceedences at the Buckeye-Enterprise Mine-Mill

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Basin Creek - above mine (BBAS20L)	S C									C									
Adit discharge (BBAS10H)	S A C	P C		P A C		A C	S A	P A C	S				S A C				S		S
Seep below main dump (BBAS30H)	S A C	P C		P A C		S A C	S A	P A C	S	C			S A C				S		S
Basin Creek - below mine and tailings (BBAS40L)	S C					C		A C	S	C			A C						

Exceedence codes:

P - Primary MCL
S - Secondary MCL
A - Aquatic Life Acute
C - Aquatic Life Chronic

Note: The actual analytical results are listed in Appendix V

2.11.3.4 Vegetation

Vegetation in the wash areas below the waste rock dumps was noticeably suppressed. The largest area of impact to vegetation is the tailings area next to Basin Creek which is nearly devoid of vegetation; the area below the mill next to the Buckeye workings is also devoid of vegetation. The lack of vegetation in these areas is consistent with the exceedence of phytotoxic levels for arsenic, lead, and copper.

2.11.3.5 Summary of Environmental Condition

As noted previously, much of the area disturbed by past mining is on private ground; however, surface water and, most likely, ground water discharge onto DNF land. Acid mine discharge did not flow directly into the creek at the time of the visit, but probably does so during spring runoff and larger storm events. Contaminated ground water is almost certain to be discharging from the mine area to the creek. Material from the waste rock dumps is being washed toward and into the creek; the tailings deposits on DNF land, high in arsenic and lead, are also being eroded and washed into the creek. There was some evidence of wind erosion of the tailings in the large flat area below the site.

2.11.4 Structures

There were several collapsed structures on the site, but no complete structures. The largest partial structure observed was the remnants of the mill just below the Buckeye workings; several small ore bins were observed elsewhere. Machinery parts from the second mill were piled next to Basin Creek; debris was scattered throughout the area.

2.11.5 Safety

The site is easily accessible by road from at least one direction. Several ore bins, a dismantled mill, and parts of a second mill as well as several water-filled depressions within the disturbed area contribute to a safety risk.

2.12. DOUBLE SHAFT MINE

2.12.1 Location and Access

The Double Shaft Mine (T7N R5W Section 31) is about one mile upstream of the Buckeye-Enterprise Mine on Basin Creek. The site can be accessed by road from at least two directions on primitive roads.

2.12.2 Site History - Geologic Features

No information was available for the history or production at the Double Shaft Mine. Three caved flooded shafts, one open shaft, and several trenches investigate a northeast-trending breccia zone of quartz, siderite, iron oxides, and a trace of pyrite. Although placer workings below terminate at this site, a select breccia sample had less than .006 oz/ton Au and .38 oz/ton Ag. The dumps are composed mostly of unaltered quartz monzonite. Some plagioclase has altered to montmorillonite, and some mafic minerals to siderite. The open shaft to the northwest appears to be on an east-west structure with high-sulfide vein material more typical of the Boulder batholith.

2.12.3 Environmental Condition

The site consists of shafts with dismantled head-frames, some scattered debris, and waste rock dumps. The site is entirely on DNF lands, but was not mapped. Dumps associated with the flooded shafts contain only quartz, siderite, iron-oxides, and trace amounts of pyrite and are mostly un-altered quartz-monzonite; all of the dumps host heavy vegetation.

2.12.3.1 Site Features - Sample Locations

None of the shafts or trenches were discharging water at the time the site was visited. However, it was apparent that discharges did occur prior to the visit. The dumps associated with the shafts appeared stable and no erosion beyond the base of the dump was apparent.

2.12.3.2 Soil

No soil impacts were apparent; no soil samples were collected

2.12.3.3 Water

The flooded shafts were not readily accessible to collect water samples.

2.12.3.4 Vegetation

Vegetation on the waste dumps was heavy; there was no apparent impact to vegetation in areas adjacent to the waste material.

2.12.3.5 Summary of Environmental Condition

Water quality data were not obtained for this site due to limited access to the shafts; however, there was evidence of discharge. Erosion of the waste material appeared restricted to the disturbed area.

2.12.4 Structures

There were no structures observed on the site; the shaft headframe had been dismantled.

2.12.5 Safety

The flooded shafts are fenced and the waste rock dumps are small; one open shaft northwest of the main area may be of concern with regard to safety as the site is easily accessible by road.

2.13. LADY LEITH (BUTTE AND PHILADELPHIA)

2.13.1 Site Location and Access

The Lady Leith Mine site, on DNF land, is in an area of the upper Basin Creek drainage where extensive mining has occurred. Several patented claims, including the Buckeye-Enterprise site, are within a mile downstream of the site.

2.13.2 Site History - Geologic Features

The mine was worked sporadically from 1890 to 1911, but there was no production (Pardee and Schrader, 1933). Heavy vegetation obscures the bedrock geology, but Ruppel (1963) describes the property as having several N80-85W 65NE trending veins up to 10 feet thick with minor (Knopf,1913) quartz, pyrite, galena, chalcopyrite, sphalerite, chalcocite, tourmaline, siderite, and barite. Numerous cat cuts expose veins intermittently for over 1000 feet to the west of the Lady Leith. A select sample of vein material from the dump contained .182 oz/ton Au, 11.4 oz/ton Ag, .42% Cu, 3% Pb, and .2% Zn. Approximately 1800 tons of dump material are associated with the workings; most of this is altered quartz monzonite with quartz, sericite, and pyrite alteration products.

2.13.3 Environmental Condition

Several short workings, totaling about 900 feet in length and including five caved adits, one open adit, and two caved shafts, are scattered across the property. Two caved adits discharge water. The major features, along with sample locations, are presented in Figure 11.

2.13.3.1 Site Features - Sample Locations

Waste rock dumps associated with the shaft and adits have been eroded and may have deposited sediments in the small stream below the site. Although field pH values were near neutral, SC values for the adit discharge water were elevated in comparison to values from Basin Creek upstream of the site. Water samples were collected upstream (BLLS10L) and downstream (BLLS50L) of the site, at each of the two discharging adits (BLLS20H and BLLS40H), and at a point on Basin Creek between the eastern and western portion of the development area (BLLS30L). Soil samples were collected near the stream where waste material appeared to be washing into the stream (BBLD10H) and at the base of two waste rock dumps (BLLD20H and BLLD30H).

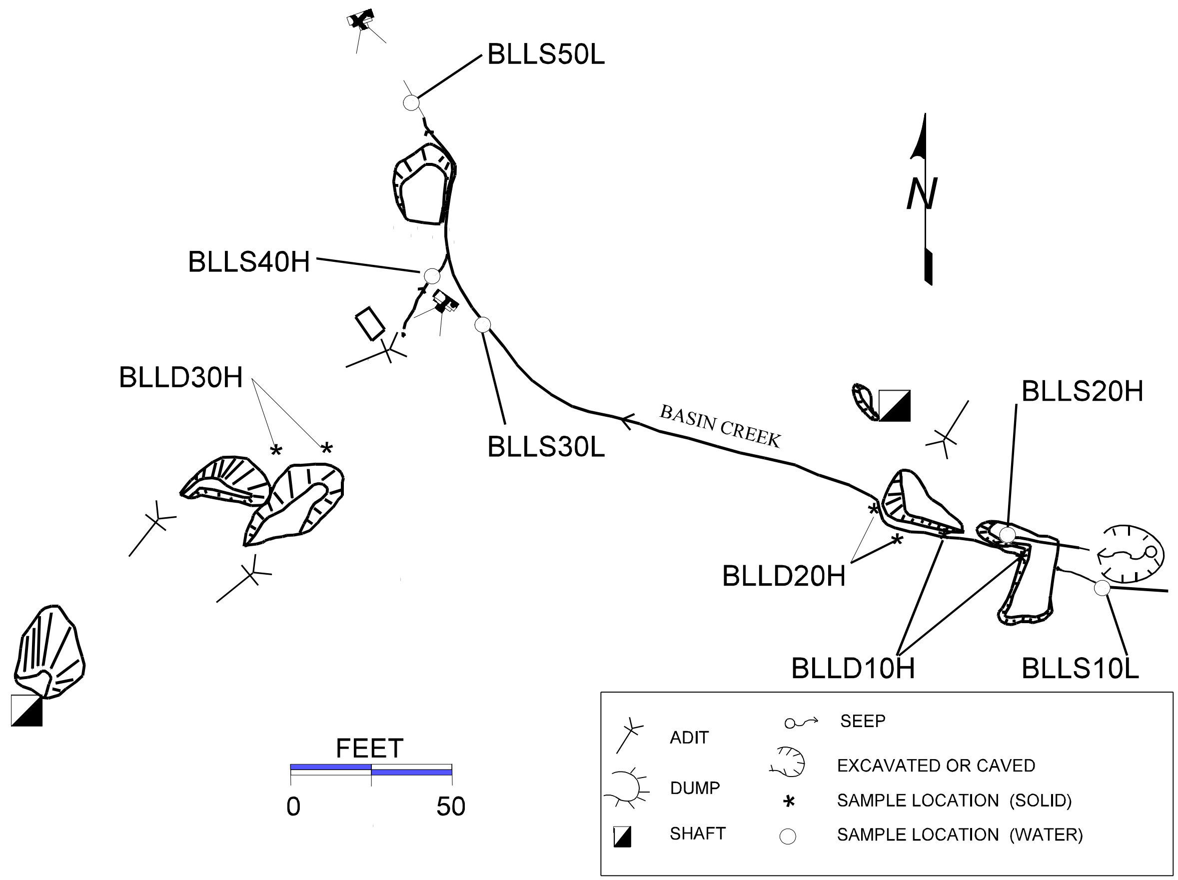

Figure 11 There were two discharging adits at the Lady Lieth Mine. Water and soil samples were selected that would represent the relative impact to the stream by the western and eastern portion of the development area.

Figure 11A. The adit discharge from the lower Lady Leith (left) eventually reaches the creek (right). The locations of the photographs are shown in Figure 11.

2.13.3.2 Soil

Soil samples collected from this area indicated high levels of arsenic, copper, lead, and zinc which exceed phytotoxic levels (Table 19). Given the close proximity of the material to the creek, these contaminants may be of particular concern during storm events and runoff periods.

Table 19
Soil Sampling Results - Lady Leith Mine
(mg/kg)

Sample Location	As	Cd	Cu	Pb	Zn
Base of upper dump (BLLD10H)	264.71[1,2]	1.49[1]	20.78[1]	315.73[1]	190.09[1]
Base of second dump (BLLD20H)	3146[1,2]	4.27[1]	76.68[1]	2404[1,2]	729.80[1,2]
Base of lower dump (BLLD30H)	356.01[1,2]	9.91[1]	294.94[1,2]	166.31[1]	628.49[1,2]

(1) Exceeds one or more Clark Fork Superfund Background Levels (Table 3)
(2) Exceeds Phytotoxic levels (Table 3)
BDL = Below Detection Limit

2.13.3.3 Water

The concentration of metals in the stream above the site is below all considered standards, but exceeds the standards for mercury below the first discharging adit. On the same stream below the site, the concentration of several constituents increases, but only manganese exceeds any criteria (secondary); mercury concentrations are below detection limits. Both adit discharges exceed several standards:

Table 20
Water Quality Exceedences at the Lady Leith Mine

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Basin Creek - above mine (BLLS20L)																			
Adit discharge - east adit (BLLS20H)	S A C			P A C		A C	S A	P A C	S				S A C						
Basin Creek below east adit (BLLS30L)										C									
Adit discharge - west adit (BLLS40H)									S				S A C						
Basin Creek - below mine (BLLS50L)									S										

Exceedence codes:

P - Primary MCL
S - Secondary MCL
A - Aquatic Life Acute
C - Aquatic Life Chronic

Note: The actual analytical results are listed in Appendix V

2.13.3.4 Vegetation

Vegetation appears stressed in the areas where waste material eroded from the dumps has been deposited and mixed with soils. Outside of these areas, along the creek, there appeared to be little impact to vegetation.

2.13.3.5 Summary of Environmental Condition

The impact to water quality is largely restricted to the disturbed area. This may not always be the case, however; there was evidence of erosion and deposition of the waste material with high concentrations of lead and arsenic into Basin Creek.

2.13.4 Structures

There are several cabins and buildings associated with the mining operation across the site. The condition of these structures ranges from poor to dilapidated.

2.13.5 Safety

The site is accessible by road and appeared to have been visited often; the open adit may be a safety concern.

2.14. WINTER'S CAMP MINE

2.14.1 Site Location and Access

The Winter's Camp Mine (T7N R6W Section 9) is just off the Basin Creek road below Joe Bower's Creek. The road lies between the mine site and Basin Creek.

2.14.2 Site History - Geologic Features

Mineralization appears to be primarily a thin quartz-pyrite breccia zone in Elkhorn tuffs and andesites. The zones trend from N57W to N80E. Ruppel (1963) gives a brief description.

2.14.3 Environmental Condition

The site has three caved adits, one locked adit, and one caved shaft on mixed DNF and private lands. Waste rock dumps and a small amount of scattered debris were also observed. As the workings were on private land, no map was constructed.

2.14.3.1 Site Features - Sample Locations

The southeastern adit, on private land, has a discharge which has been developed as a spring. This adit discharges to Basin Creek where a surface water sample was collected (BWCS10L).

2.14.3.2 Soils

There appeared to be no erosion of the dump such that sediments were being deposited on DNF ground or into the creek.

2.14.3.3 Water

Concentrations were below the water-quality criteria for all of the constituents considered.

2.14.3.4 Vegetation

There appeared to be no impact to vegetation caused by the adit discharge. The waste material was supporting some vegetation, but not to the same degree as native soils.

2.14.3.5 Summary of Environmental Condition

The Winter's Camp mine site, with several adits and dumps on private and NFS land appears to have little adverse impact to soils or surface water. Although one of the adits is discharging water to Basin Creek, its quality appeared to be good.

2.14.4 Structures

There were no significant structures on NFS land; there is a well-maintained cabin on private land.

2.14.5 Safety

There appeared to be no significant safety risks associated with the site.

2.15. HECTOR MINE

2.15.1 Site Location and Access

The Hector Mine (T6N R5W Section 7) is in Lily-of-the-West Gulch in the lower Basin Creek drainage below Jack Creek. The only access to the site is a trail from the Lower Hector mine (Section 2.15).

2.15.2 Site History - Geologic Features

Two short open adits on DNF land are spread along a N60W zone in quartz monzonite with kaolinite and pyrite alteration products and containing a few thin chalcedony-pyrite veinlets. The outcrops are badly weathered and covered with manganese oxides. Lily-of-the-West Creek runs across the lowermost and largest dump, which contains about 100 tons of altered wallrock at <.006 oz/ton Au, .48 oz/ton Ag, .17% Cu, .42% Pb, and .55% Zn. The weak mineralization and northeast trend suggest that the mineralization is related to the large breccia zone to the southwest rather than to typical east-west Boulder batholith sheer zones.

2.15.3 Environmental Condition

The Hector Mine consists of two adits and a waste rock dump about 200 feet downstream. Part of the stream flows over the waste rock dump.

2.15.3.1 Site Features - Sample Locations

The adits on the Hector (Figure 12) have standing water but are not flowing. A portion of the stream flows over the waste rock material at the lower end of the site before rejoining the main stream. Samples were collected from the stream above the site (BHFS50L), between the upper and lower portions of the site (BHFS60L), and the stream which flows over the waste rock dump (BHFS30L). A fourth sample (BHFS40L) was collected from the stream below the Hector Mine and above the Lower Hector mine (Section 2.15).

A soil sample was collected at the base of the waste rock dump where material appeared to have been washed into the stream during runoff events (BHFW10H).

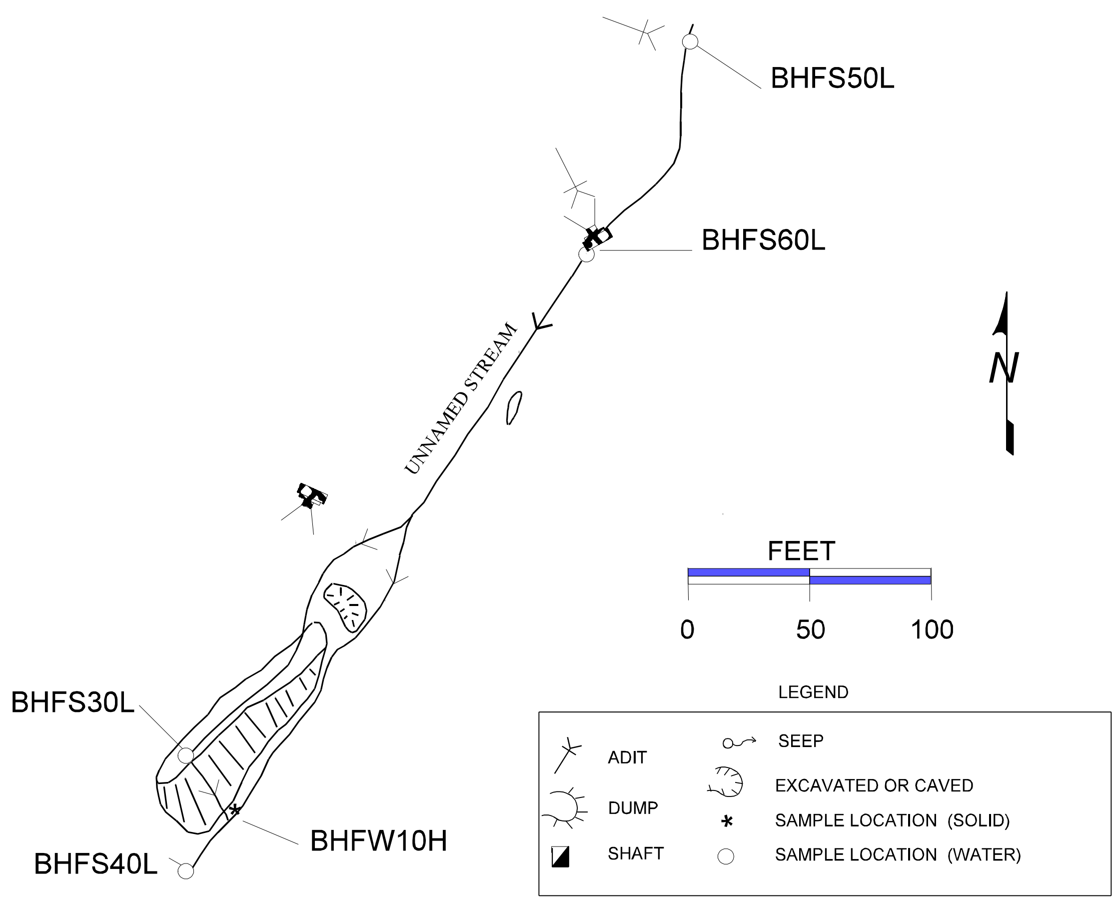

Figure 12 The Hector Mine has two flooded adits. A portion of the stream flows over the waste rock dump at the south end of the site. The Lower Hector Mine is about 1200 feet downstream.

Figure 12A. The Hector mine has dry adits (top) and a stream side dump (bottom); a diversion of the stream flows over the lower dump. The locations of the photographs are shown in Figure 12.

2.15.3.2 Soil

The soil/waste material at the base of the waste rock dump exceeded the upper phytotoxic limits for zinc and nearly exceeded the limits for lead (Table 21). This material is likely to wash into the creek during storm events and runoff.

Table 21
Soil Sampling Results - Hector Mine
(mg/kg)

Sample Location	**As**	**Cd**	**Cu**	**Pb**	**Zn**
Base of upper dump (BHFW10H)	59.21[1]	3.94[1]	89.74[1]	831.79[1]	880.63[1,2]

(1) Exceeds one or more Clark Fork Superfund Background Levels (Table 3)
(2) Exceeds Phytotoxic levels (Table 3)
BDL = Below Detection Limit

A sample of material collected from the waste rock dump was submitted for the acid-rain simulation test (Method 1312) as well as for a standard assay; the results are presented in Table 22. The concentrations of metals in the leachate do not reflect the concentrations found in the water on the site; this is especially true for copper, manganese, and zinc. With the exception of arsenic, the concentrations of metals in the test leachate are all higher than those in the surface water sample; pH was approximately two units lower in the leachate. The lack of correlation between the two results may indicate that leachate on this site is moving more toward the ground water than to the surface water and that buffering and dilution are occurring in the surface water.

Table 22
Acid Rain Leach Test Results

Sample Site	SC1 umhos/cm	SC2 umhos/cm	pH1	pH2	Ag mg/L	As mg/L	Cu mg/L	Hg mg/L	Mn mg/L	Pb mg/L	Zn mg/L
Waste rock (BHEW10H)	28.6	233.0	5.00	4.75	BDL	0.45	8.59	0.08	1461	1.11	2331.1

BDL = Below Detection Limit
SC1/pH1 - values at beginning of test
SC2/pH2 - values at end of test

2.15.3.3 Water

Water quality on the Hector was generally good; only mercury exceeded the aquatic life criteria (chronic) at the upstream sample site and zinc exceeded the aquatic life criteria (acute and chronic) at the downstream sample site (Table 23). As noted, these concentration values do no reflect those obtained from the acid rain simulation test.

Table 23
Water Quality Exceedences at the Hector Mine

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Creek - above mine (BHFS50L)										C									
Creek - below adits (BHFS60L)																			
Creek - on dump (BHFS30L)																			
Creek - below mine (BHFS40L)													A C						

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The actual analytical results are listed in Appendix V

2.15.3.4 Vegetation

There appeared to be little impact from the mine on vegetation outside the disturbed area.

2.15.3.5 Summary of Environmental Condition

The stream adjacent to the Hector Mine shows little impact to water quality. Because of the proximity of stream and waste material, storm events or heavy runoff may cause erosion of the waste material which would contribute to the suspended and dissolved load in the stream.

2.15.4 Structures

No structures were present on the Hector Mine site.

2.15.5 Safety

Steep slopes, open adits, and depressions present at least some hazard on the site. The site is not easily accessed and did not appear to have been visited very often.

2.16. LOWER HECTOR

2.16.1 Site Location and Access

The Lower Hector Mine (T6N R5W Section 7) is in Lily-of-the-West Gulch in the lower Basin Creek drainage below Jack Creek and below the Hector Mine. The site is a few hundred feet up a washed out road that begins off the main road and goes to the Hector Mine.

2.16.2 Site History - Geologic Features

Several small prospects, on DNF land, expose three parallel, N85W 68NE quartz-pyrite veins. The veins are discontinuous and less than one foot thick, but are within wide continuous shear zones in quartz monzonite. The shear zones are iron stained and plagioclase has been altered to kaolinite. A chip sample across a 25 foot wide shear zone here had only .008 oz/ton Au, .40 oz/ton Ag, .025% Cu, .10% Pb, and .18% Cu.

2.16.3 Environmental Condition

The Lower Hector consists of a single, partially caved adit with a small waste rock dump adjacent to the stream. The entire dump is probably less than ten cubic yards, but contained some sulfides and showed signs of erosion and deposition in the stream. No map was constructed for this area.

2.16.3.1 Site Features - Sample Locations

The waste material appears to wash into the creek during runoff events. Surface water samples were collected from the stream immediately above the mine (BHFS10L) and from the same stream below the mine above its confluence with Basin Creek (BHFS20L). A waste rock sample was collected near the base of the dump and the stream.

2.16.3.2 Soils

The phytotoxic limits for copper and lead were exceeded in the waste rock sample Table 24. This represents the material that would wash into the stream during runoff.

Table 24
Soil Sampling Results - Lower Hector Mine
(mg/kg)

Sample Location	**As**	**Cd**	**Cu**	**Pb**	**Zn**
Base of dump (BHFW20H)	61.93[1]	6.39[1]	345.38[1,2]	483.98[1]	1374.15[1,2]

(1) Exceeds one or more Clark Fork Superfund Background Levels (Table 3)
(2) Exceeds Phytotoxic levels (Table 3)
BDL = Below Detection Limit

2.16.3.3 Water

Water quality at each of the sample location points was below all of the criteria considered, with two exceptions. The mercury concentration exceeded the chronic aquatic life criteria upstream of the site and the zinc concentration exceeded the acute and chronic aquatic life standards in the sample collected below the waste rock dump .

Table 25
Water Quality Exceedences at the Lower Hector Mine

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Creek - above adit and dump (BHFS10L)										C									
Creek - below adit and dump (BHFS20L)													A C						

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The actual analytical results are listed in Appendix V

2.16.3.4 Vegetation

Vegetation adjacent to the stream showed no apparent stress; there was no vegetation established on the waste rock dump.

2.16.3.5 Summary of Environmental Condition

The water quality of the stream shows some impact from the waste material washing in. Since it appears to be directly related to the amount of runoff, the impact is likely to be quite variable.

2.16.4 Structures

There were no structures observed on or near the site.

2.16.5 Safety

The site is not accessible by road and did not appear to have been visited often; however, the partially collapsed adit may be a safety concern.

2.17. BASIN BELLE MINE

2.17.1 Site Location and Access

The Basin Belle (T6N R5W Section 7) is on the canyon wall of Basin Canyon in the lower reach of Basin Creek; the mine is high above the creek with the dump extending several hundred feet down to water's edge. The only access to the mine is either overland hiking or by crossing Basin Creek by foot from the main road.

2.17.2 Site History - Geologic Features

Roby and others (1960) provide the only reference to the property. The mine consists of two caved dry adits with about 1000 feet of total workings. Veins are composed of quartz, pyrite, galena, and sphalerite, and produced 107 tons of ore yielding 3.52 oz Au, 1045 oz Ag, 7467 lbs Cu, and 11,867 lbs Zn. Wallrock is quartz monzonite altered to kaolinite and pyrite; this comprises most of the estimated 2000 tons of dump material. Basin Creek is actively eroding this dump. A composite sample of this material carried .016 oz/ton Au, 1.02 oz/ton Ag, .32% Cu, .59% Pb, and .12% Zn, so there are plenty of metals available.

2.17.3 Environmental Condition

The mine consists simply of two dry adits and a large waste rock dump adjacent to Basin Creek. The entire site is on private land.

2.17.3.1 Site Features - Sample Locations

Although the mine is on private ground, the base of the waste rock dump is subject to episodic erosion by Basin Creek. Subsequently, a sample of the waste material at the base of the dump was collected (BBB10H). Surface water samples were collected from Basin Creek at several points including one below the mine. These are discussed in Section 2.19.

2.17.3.2 Soils

The sample of waste material collected at the base of the dump exceeded the limits for phytotoxic concentrations for copper, lead, and zinc (Table 26). This represents the material actively being eroded by Basin Creek.

Table 26
Soil Sampling Results - Basin Belle Mine
(mg/kg)

Sample Location	As	Cd	Cu	Pb	Zn
Base of dump (BBBB10H)	33.31[1]	6.43[1]	1429.23[1,2]	1825.01[1,2]	1312.84[1,2]

(1) Exceeds one or more Clark Fork Superfund Background Levels (Table 3)
(2) Exceeds Phytotoxic levels (Table 3)
BDL = Below Detection Limit

2.17.2.3 Water

Water samples were not collected specifically for this site; a general discussion of the water quality in Basin Creek can be found in Section 2.19.

2.17.3.4 Vegetation

The waste rock dump is generally devoid of vegetation. The base of the dump was being eroded by the creek.

2.17.3.5 Summary of Environmental Condition

The waste rock dump of the Basin Belle is steep and located in an area that is not easily accessible, but is highly visible from the main Basin Creek road. Given the flow rate of Basin Creek at the time of sampling, assessment of the potential for metals loading was not practical.

2.17.4 Structures

There were no structures observed on the site; since the mine is on private land, the condition of the adits was not observed.

2.17.5 Safety

Active erosion of the base of the dump by Basin Creek was apparent; instability and subsequent mass failure may occur in the future.

2.18. DAILY WEST MINE

2.18.1 Site Location and Access

The Daily West Mine is actually split by Basin Creek and the main road; The main development area is on the north side of the creek and a waste rock dump is on the south side of the creek. Access to the main development area is easy; a small road from the main road winds through the site.

2.18.2 Site History - Geologic Features

The Daily West contains two short adits in quartz monzonite and numerous small prospects to the east along a contact with a large breccia zone containing Tertiary quartz latite. The adits crosscut to a N63E 80NW vein with quartz, pyrite, and galena (unpublished information, MBMG files). Seven chip samples across vein material in the now inaccessible workings averaged only .028 oz/ton Au, .37 oz/ton Ag, and 2.0% Pb. The dump size indicates about 200 feet of workings present. Production figures for 1902-1957 (Roby and others, 1960) show only 102 tons of ore yielding 148 oz of Ag, 81 lbs of Cu, 11,457 lbs of Pb, and 12,608 lbs of Zn.

2.18.3 Environmental Condition

The site consists of two dry adits with waste rock dumps, a cement foundation, and scattered debris consisting of car parts and garbage on the north side of Basin Creek and a waste rock dump adjacent to the south side of Basin Creek. Major features and sample locations are presented in Figure 13.

The dump on the south side of the creek, which is being eroded by Basin Creek, contains approximately 300 tons of vein material and mineralized quartz monzonite at .014 oz/ton Au, .62 oz/ton Ag, .072% Cu, 1.76% Pb, and .66% Zn. There are also about 100 tons of unaltered quartz monzonite on the dump.

2.18.3.1 Site Features and Sample Locations

The main Basin Creek road bisects the site near the dry adit which has been covered by a culvert and screen; a second caved adit is east of the closed adit. Since much of the waste rock dumps had been reworked recently, waste rock samples were collected on the main dump associated with the closed adit (BDWW10H) and in the area near the second, caved adit (BDWW20H). A composite of soil at the base of the waste rock dump on the south side of the creek was also collected (BDWD10H). This sample was collected in an area where waste material had been eroded and deposited on the edge of a wetlands area.

2.18.3.2 Soils

The phytotoxic limits for lead were exceeded in samples collected at all three locations. The limits for copper were exceeded at the west and south dumps Table 27).

Table 27
Soil Sampling Results - Daily West Mine
(mg/kg)

Sample Location	As	Cd	Cu	Pb	Zn
Main dump (BDWW10H)	44.13[1]	1.08[1]	89.93[1]	2325.81[1,2]	251.17[1]
West dump (BDWW20H)	111.68[1,2]	0.45[1]	140.75[1,2]	7519.57[1,2]	390.45[1]
South dump soils (BDWD10H)	65.52[1]	0.79[1]	132.5[1,2]	2930.41[1,2]	366.04[1]

(1) Exceeds one or more Clark Fork Superfund Background Levels (Table 3)
(2) Exceeds Phytotoxic levels (Table 3)
BDL = Below Detection Limit

2.18.3.3 Water

Water samples were not collected specifically for this site; a general discussion of the water quality in Basin Creek can be found in Section 2.19.

2.18.3.4 Vegetation

The waste rock dumps are generally devoid of vegetation. The base of the dump on the south side of Basin Creek was actively being eroded by the creek.

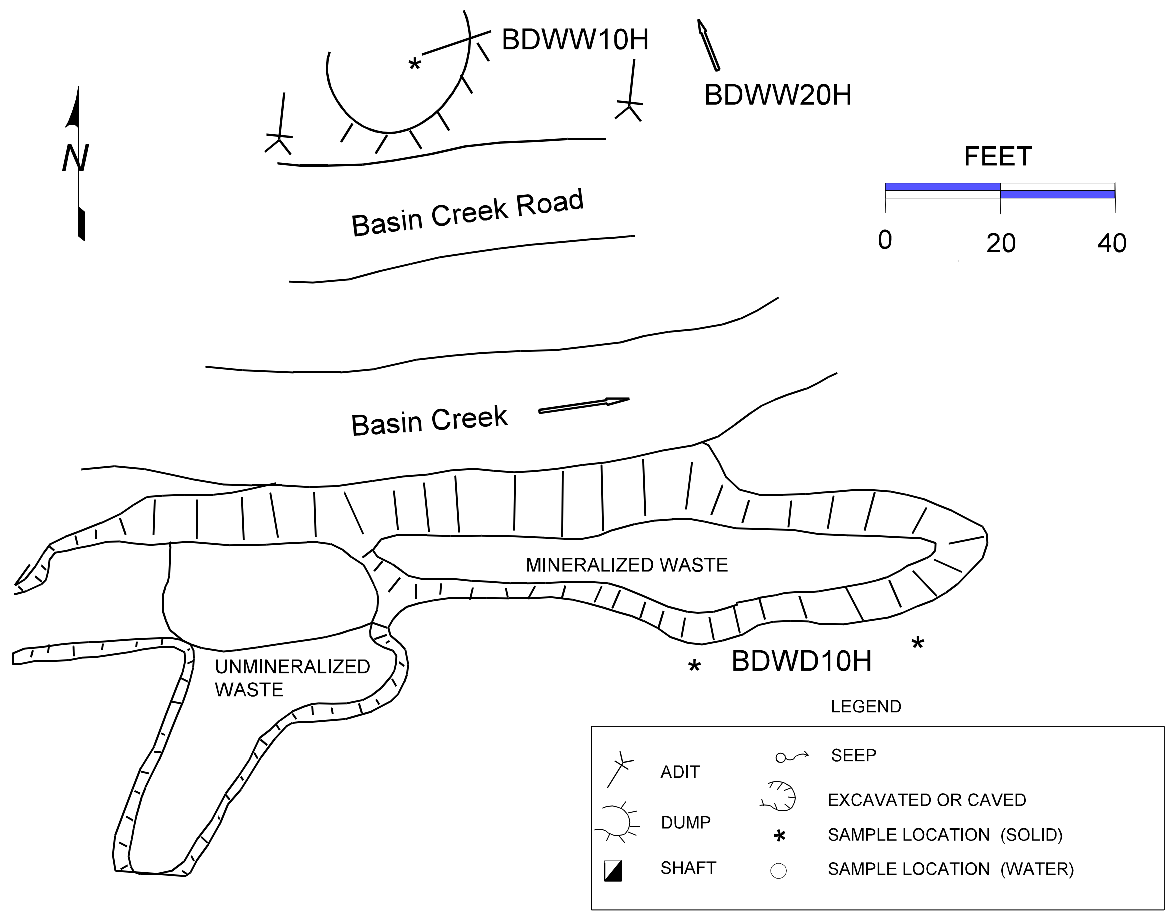

Figure 13 Portions of the Daily West Mine lie on both sides of Basin Creek. The portion on the north side of the creek the site is easily accessible.

2.18.3.5 Summary of Environmental Condition

No adit discharge was evident on the Daily West mine site. Erosion of waste material was minimal on the main portion of the site; however, Basin Creek is cutting into and eroding the waste rock dump on the south side of the creek. Soil samples indicated high concentrations of copper, lead, and zinc.

2.18.4 Structures

The only structure observed was the cement foundation of what may have been a mill; the area had been vandalized.

2.18.5 Safety

The site is located on the main road and is highly visible. It was apparent that the site has been visited often. The dumps containing high levels of lead are easily accessible.

2.19 SUMMARY BASIN MINING DISTRICT - BASIN CREEK DRAINAGE

In addition to the surface water, waste rock, and soil samples collected on or near each mine site in the Basin Creek drainage, surface water samples were collected on Basin Creek at locations best suited to estimate the impact, if any, of mines in Jack Creek, Basin Creek above Jack Creek, and the lower portion of Basin Creek as it exits DNF ground. In particular, samples were collected near the confluence of Basin Creek and Jack Creek, and at the downstream boundary of DNF land on Basin Creek.

With the exception of the sample collected downstream near the town of Basin, all samples collected on Basin Creek and Jack Creek indicated an exceedence of one or more standards (Table 28).

Table 28
Water Quality Exceedences on Basin Creek

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Basin Creek - above Jack Creek (BBCS20L)	S																		
Basin Creek - below Jack Creek (BBCS30L)	S			C						C									
Jack Creek - above Basin Creek (BBCS10L)				C		C				C			A C						
Basin Creek - above Spring Creek (BBCS40L)																			

Exceedence codes:

- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The actual analytical results are listed in Appendix V

As noted, the inspection of mine sites was restricted to sites which are on DNF land, affecting DNF land, or affected by sites on DNF land. Thus, an assessment of the cumulative affect of all mines on the Basin Creek drainage is likewise restricted. With exceptions, the impacts to surface water and soils from past mining activity in the Basin Creek drainage is largely restricted to the mine site or within a few hundred feet of the mine site. The most significant exception is in the Jack Creek drainage.

The group of mines in the Jack Creek drainage appear to have the greatest individual and collective impact of any others in the Basin Creek drainage. The impact is apparent as far downstream as the Jack Creek - Basin Creek confluence as evidenced by the exceedence of water quality criteria for several constituents. This is of special concern in consideration of the proposed sale of housing tracts on the lower reaches of Jack Creek. Ground water as well as surface water development will likely be unsuccessful due to poor water quality. The influence of the poor water quality in Jack Creek is also evident in Basin Creek just below the confluence, but appears non-existent at Spring Creek several miles downstream.

The upper reaches of the Basin Creek drainage also display poor water quality, but as mentioned, most mining impacts are restricted to each mine site. The exceedence of water quality standards for aluminum cannot not be attributed to any particular site or group of sites; this area in particular had mines that were excluded from consideration because of ownership.

It should be noted that much of the sampling at mine sites and the major streams was conducted during a period of several precipitation events. The relative impacts of each mine site on the drainage basin likely changes throughout the year.

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APPENDIX I
ABANDONED INACTIVE MINES PROGRAM
FIELD FORM

PART A

(To be completed for all identified sites)

LOCATION AND IDENTIFICATION

ID# ________________ Site Name(s) ________________________________
FS Tract # ____________________ FS Watershed Code ________________
Forest ____________________ District ____________________
Location based on: GPS___ Field Map___ Existing Info___ Other__________
Lat__________ Long__________ xutm________ yutm________ zutm________
Quad Name ______________________ Principal Meridan ________________
Township __________ Range __________ Section _____ ¼_____ ¼_____ ¼_____
State _____ County __________________ Mining District ________________

Ownership of *all* disturbances:

_____ National Forest (NF)
_____ Mixed private and National Forest (or unknown)
_____ Private.

If private only, impacts from the site on National Forest Resources are
____Visually apparent ____Likely to be significant ____Unlikely or minimal

If all disturbances are private <u>and</u> impacts to National Forest Resources are unlikely or minimal - STOP

PART B

(To be completed for all sites on or likely effecting National Forest lands)

SCREENING CRITERIA

Yes	No	
_____	_____	1. Mill site or Tailings present
_____	_____	2. Adits with discharge or evidence of a discharge
_____	_____	3. Evidence of or strong likelihood for metal leaching, or AMD (water stains, stressed or lack of vegetation, waste below water table, etc.)
_____	_____	4. Mine waste in floodplain or shows signs of water erosion
_____	_____	5. Residences, high public use area, or environmentally sensitive area (as listed in HRS) within 200 feet of disturbance
_____	_____	6. Hazardous wastes/materials (chemical containers, explosives, etc)
_____	_____	7. Open adits/shafts, highwalls, or hazardous structures/debris
_____	_____	8. Site visit *(If yes, take picture of site)*, Film number(s) __________

If yes, provide name of person who visited site and date of visit
Name: ______________________________ Date: ____________
If no, list source(s) of information (If based on personal knowledge, provide name of person interviewed and date):

____

If the answers to questions 1 through 6 are <u>all</u> No - STOP

PART C

(To be completed for all sites not screened out in Parts A or B)

Investigator ______________________________ Date ______________
Weather ____

1. GENERAL SITE INFORMATION

Take panoromic picture(s) of site, Film Number(s) __________
Size of disturbed area(s) __________acres   Average Elevation __________feet
Access: _____No trail   _____Trail   _____4wd only   _____Improved road
_____Paved road
Name of nearest town (by road): ____________________
Site/Local Terrain: _____Rolling or flat   _____Foothills   _____Mesa   _____Mountains
_____Steep/narrow canyon
Local undisturbed vegetation (*Check all that apply*): _____Barren or sparsely vegetated
_____weeds/grasses _____Brush _____Riparian/marsh _____Deciduous trees
_____Pine/spruce/fir
Nearest wetland/bog: ____On site, ____0-200 feet, ____200 feet - 2 miles, ____> 2 miles
Acid Producers or Indicator Minerals: ____Arsenopyrite, ____Chalcopyrite, ____Galena,
____Iron Oxide, ____Limonite, ____Marcasite, ____Pyrite, ____Pyrrhotite,
____Sphalerite, ____Other Sulfide
Neutralizing Host Rock: ____Dolomite, ____Limestone, ____Marble, ____Other Carbonate

2. OPERATIONAL HISTORY

Dates of significant mining activity______________________________

MINE PRODUCTION

Commodity(s)							
Production (ounces)							

Years that Mill Operated______________________________
Mill Process: ____Amalgamation, ____Arrastre, ____CIP (Carbon-in-Pulp), ____Crusher only,
____Cyanidation, ____Flotation, ____Gravity, ____Heap Leach, ____Jig Plant,
____Leach, ____Retort, ____Stamp, ____ No Mill, ____Unknown

MILL PRODUCTION

Commodity(s)							
Production (ounces)							

3. HYDROLOGY

Name of nearest Stream ________________ which flows into ________________
Springs (*in and around mine site*): ___ Numerous ___ Several ___ None
Depth to Groundwater _____ ft, Measured at: ___shaft/pit/hole ___well ___wetland
Any waste(s) in contact with active stream ___Yes ___No

4. TARGETS (*Answer the following based on general observations only*)

Surface Water
Nearest surface water inake _______miles, Probable use ________________
Describe number and uses of surface water intakes observed for 15 miles downstream of site: ________________

____

____

Wells
Nearest well _____miles, Probable use ________________
Describe number and use of wells observed within 4 miles of site:

____

____

____

Population
Nearest dwelling _____miles, Number of months/year occupied _____ months
Estimate number of houses within 2 miles of the site (*Provide estimates for 0-200ft, 200ft-1mile, 1-2miles, if possible*)

____

____

____

Recreational Usage
Recreational use on site: ___High (*Visitors observed or evidence such as tire tracks, trash, graffiti, fire rings, etc.; and good access to site*), __ Moderate (*Some evidence of visitors and site is accessible from a poor road or trail*), __ Low (*Little, if any, evidence of visitors and site is not easily accessible*)
Nearest recreational area _____miles, Name or type of area: ________________

5. SAFETY RISKS

_____Open adit/shaft, _____Highwall or unstable slopes, _____Unstable structures,
_____Chemicals, _____Solid waste including sharp rusted items, _____Explosives

6. MINE OPENINGS

Include in the following chart all mine openings located on or partially on National Forest lands. Also, include mine openings located entirely on private land if a point discharge from the opening crosses onto National Forest land. In this case, enter data for the point at which the discharge flows onto National Forest land; you do not need to enter information about the opening itself.

TABLE 1 - ADITS, SHAFTS, PITS, AND OTHER OPENINGS

Opening Number						
Type of Opening						
Ownership						
Opening Length (ft)						
Opening Width (ft)						
Latitude (GPS)						
Longitude (GPS)						
Condition						
Ground water						
Water Sample #						
Photo Number						

Comments (*When commenting on a specfic mine opening, reference opening number used in Table 1*):

____
____
____
____
____
____

Codes Applicable for all entries: NA= Not applicable, UNK=Unknown, OTHER=Explain in comments, NO=NO or none

Type of opening: ADIT=Adit, SHAFT=Shaft, PIT=Open Pit/Trench, HOLE=Prospect Hole, WELL=Well

Ownership: NF=National Forest, MIX=National Forest and Private (Also, for unknown), PRV=Private

Condition *(Enter all that apply)*: INTACT=Intact, PART=Partially collapsed or filled, COLP=Filled or collapsed, SEAL=Adit plug, GATE=Gated barrier,

Ground water (*Water or evidence of water discharging from opening*): NO=No water or indicators of water, FLOW=Water flowing, INTER=Indicators of intermittant flow, STAND= Standing water only (*In this case, enter an estimate of depth below grade*)

7. MINE/MILL WASTE

Include in the following chart all mine/mill wastes located on or partially on National Forest lands. Also, include mine/mill wastes located entirely on private land if is visually effecting or is very likely to be effecting National Forest resources. In this case enter data for the point at which a discharge from the waste flows onto National Forest land, or where wastes has migrated onto National Forest land; only enter as much information about the waste as relevant and practicable.

TABLE 2 - DUMPS, TAILINGS, AND SPOIL PILES

Waste Number						
Waste Type						
Ownership						
Area (acres)						
Volume (cu yds)						
Size of Material						
Wind Erosion						
Vegetation						
Surface Drainage						
Indicators of Metals						
Stability						
Location with respect to Floodplain						
Distance to Stream						
Water Sample #						
Waste Sample #						
Soil Sample #						
Photo Number						

Codes Applicable for all entries: NA= Not applicable, UNK=Unknown, OTHER=Explain in comments, NO=NO or none

Waste Type: WASTE=Waste rock dump, MILL=Mill tailings, SPOIL=Overburden or spoil pile, HIGH=Highwall, PLACER=Placer or hydraulic deposit, POND=Settling pond or lagoon, ORE=Ore Stockpile, HEAP=Heap Leach

Ownership: NF=National Forest, MIX=National Forest and Private (*Also, for unknown*), PRV=Private

Size of material (*If composed of different size fractions, enter the sizes that are present in significant amounts):* FINE=Finer than sand, SAND=sand, GRAVEL=>sand and <2", COBBLE=2"-6", BOULD=>6"

Wind Erosion, Potential for: HIGH=Fine, dry material that could easily become airborne, airborne dust, or windblown deposits, MOD=Moderate, Some fine material, or fine material that is usually wet or partially cemented; LOW=Little if any fines, or fines that are wet year-round or well cemented.

Vegetation (*density on waste*): DENSE=Ground cover > 75%, MOD=Ground cover 25% - 75%, SPARSE=Ground cover < 25%, BARREN=Barren

Surface Drainage (*Include all that apply*): RILL=Surface flow channels mostly < 1' deep, GULLY=Flow channels >1' deep, SEEP=Intermittant or continuous discharge from waste deposit, POND=Seasonsal or permanent ponds on feature, BREACH=Breached, NO=No indicators of surface flow observe

Indicators of Metals (*Enter as many as exist*): NO=None, VEG=Absence of or stressed vegetation, STAIN=yellow, orange, or red precipitate, SALT=Salt deposits, SULF=Sulfides present

Stability: EMER=Imminent mass failure, LIKE=Potential for mass failure, LOW=mass failure unlikely

Location w/respect to Stream: IN=In contact with normal stream, NEAR=In riparian zone or floodplain, OUT=Out of floodplain

8. SAMPLES

Take samples only on National Forest lands.

TABLE 3 - WATER SAMPLES FROM MINE SITE DISCHARGES

Sample Number						
Date sample taken						
Sampler (*Initials*)						
Discharging From						
Feature Number						
Indicators of Metal Release						
Indicators of Sedimentation						
Distance to stream (ft)						
Sample Latitude						
Sample Longitude						
Field pH						
Field SC						
Flow (*gpm*)						
Method of measurement						
Photo Number						

Comments: *(When commenting on a specfic water sample, reference sample number used in Table 3)*:

____

____

____

____

Codes Applicable for all entries: NA= Not applicable, UNK=Unknown, OTHER=Explain in comments, NO=NO or none

Discharging From: ADIT=Adit, SHAFT=Shaft, PIT=Pit/Trench, HOLE=Prospect Hole, WASTE=Waste rock dump, MILL=Mill tailings, SPOIL=Overburden or spoil pile, HIGH=Highwall, PLACER=Placer or hydraulic deposit, POND=Settling pond or lagoon, WELL=Well

Feature Number: Corresponding number from Table 1 or Table 2 (*Opening Number or Waste Number*)

Indicators of Metal Release (*Enter as many as exist*): NO=None, VEG=Absence of, or stressed vegetation/ organisms in and along drainage path, STAIN=yellow, orange, or red precipitate, SALT= Salt deposits, SULF=Sulfides present, TURB=Discolored or turbid discharge

Indicators of Sedimentation (*Enter as many as exist*): NO=None, SLIGHT=Some sedimentation in channel, banks and channel largely intact, MOD=Sediment deposits in channel, affecting flow patterns, banks largely intact, SIGN=Sediment deposits in channel and/or along stream banks extending to nearest stream

Method of Measurement: EST=Estimate, BUCK=Bucket and time, METER=Flow meter

TABLE 4 - WATER SAMPLES FROM STREAM(S)

Location relative to mine site/features	Upstream (Background)	Downstream		
Sample Number				
Date sample taken				
Sampler (Initials)				
Stream Name				
Indicators of Metal Release				
Indicators of Sedimentation				
Sample Latitude				
Sample Longitude				
Field pH				
Field SC				
Flow (gpm)				
Method of measurement				
Photo Number				

Comments: (*When commenting on a specfic water sample, reference sample number used in Table 4*):

____

____

____

____

Codes Applicable for all entries: NA= Not applicable, UNK=Unknown, OTHER=Explain in comments, NO=NO or none

Indicators of Metal Release (*Enter as many as exist*): NO=None, VEG=Absence of, or stressed streamside vegetation/organisms in and along drainage path, STAIN=yellow, orange, or red precipitate, SALT=Salt deposits, SULF=Sulfides present, TURB=Discolored or turbid discharge

Indicators of Sedimentation (*Enter as many as exist*): NO=None, SLIGHT=Some sedimentation in channel, natural banks and channel largely intact, MOD=Sediment deposits in channel, affecting stream flow patterns, natural banks largely intact, SIGN=Sediment deposits in channel and/or along stream banks extending ½ a mile or more downstream

Method of Measurement: EST=Estimate, BUCK=Bucket and time, METER=Flow meter

TABLE 5 - WASTE SAMPLES

Sample Number				
Date of sample				
Sampler (*Initials*)				
Sample Type				
Waste Type				
Feature Number				
Sample Latitude				
Sample Longitude				
Photo Number				

Comments: (*When commenting on a specfic waste or soil sample, reference sample number used in Table 5*):

____
____
____
____
____

Codes Applicable for all entries: NA= Not applicable, UNK=Unknown, OTHER=Explain in comments, NO=NO or none

Sample Type: SING=Single sample, COMP=composite sample (enter length)

Waste Type: WASTE=Waste rock dump, MILL=Mill tailings, SPOIL=Overburden or spoil pile, HIGH=Highwall, PLACER=Placer or hydraulic deposit, POND=Settling pond or lagoon sludge, ORE=Ore Stockpile, HEAP=Heap Leach

Feature Number: Corresponding number from Table 2 (*Waste Number*)

TABLE 6 - SOIL SAMPLES

Sample Number				
Date of sample				
Sampler (*Initials*)				
Sample Type				
Sample Latitude				
Sample Longitude				
Likely Source of Contamination				
Feature Number				
Indicators of Contamination				
Photo Number				

Comments: (*When commenting on a specfic waste or soil sample, reference sample number used in Table 6*):

Codes Applicable for all entries: NA= Not applicable, UNK=Unknown, OTHER=Explain in comments, NO=NO or none
Sample Type: SING=Single sample, COMP=composite sample (enter length)
Likely Source of Contamination: ADIT=Adit, SHAFT=Shaft, PIT=Open Pit, HOLE=Prospect Hole, WASTE=Waste rock dump, MILL=Mill tailings, SPOIL=Overburden or spoil pile, PLACER=Placer or hydraulic deposit, POND=Settling pond or lagoon, ORE=Ore Stockpile, HEAP=Heap Leach
Feature Number: Corresponding number from Table 1 or 2 (*Opening or Waste Number*)
Indicators of Contamination (*Enter as many as exist*): NO=None, VEG=Absence of vegetation, PATH=Visible sediment path, COLOR=Different color of soil than surrounding soil, SALT=Salt crystals

9. HAZARDOUS WASTES/MATERIALS

TABLE 7 - HAZARDOUS WASTES/MATERIALS

Waste Number				
Type of Containment				
Condition of Containment				
Contents				
Estimated Quantity of Waste				

Comments: (*When commenting on a specfic hazardous waste or site condition, reference waste number used in Table 7*):

____

____

____

____

____

Codes Applicable for all entries: NA= Not applicable, UNK=Unknown, OTHER=Explain in comments, NO=NO or none

Type of Containment: NO=None, LID=drum/barrel/vat with lid, AIR=drum/barrel/vat without lid, CAN=cans/jars, LINE=lined impoundment, EARTH=unlined impoundment

Condition of Containment: GOOD=Container in good condition, leaks unlikely, FAIR=Container has some signs of rust, cracks, damage but looks sound, leaks possible, POOR=Container has visible holes, cracks or damage, leaks likely, BAD=Pieces of containers on site, could not contain waste

Contents: from label if available, or guess the type of waste, e.g., petroleum product, solvent, processing chemical.

Estimated Quantity of Waste: Quantity still contained and quantity released

10. STRUCTURES

For structures on or partially on National Forest lands.

TABLE 8 - STRUCTURES

Type						
Number						
Condition						
Photo Number						

Comments:

____

____

____

Codes Applicable for all entries: NA= Not applicable, UNK=Unknown, OTHER=Explain in comments, NO=NO or none

Type: CABIN=Cabin or community service (*store, church, etc.*), MILL=mill building, MINE=building related to mine operation, STOR=storage shed, FLUME=Ore Chute/flume or tracks for ore transport

Number: Number of particular type of structure all in similar condition or length in feet

Condition: GOOD=all components of structure intact and appears stable, FAIR=most components present but signs of deterioration, POOR=major component (*roof, wall, etc*) of structure has collapsed or is on the verge of collapsing, BAD=more than half of the structure has collapsed

11. MISCELLANEOUS

Are any of the following present? (Check all that apply): ______Acrid Odor, ______Drums, ______Pipe, ______Poles, ______Scrap Metal, ______Overhead wires, ______Overhead cables, ______Headframes, ______Wooden Structures, ______Towers, ______Power Substations, ______Antennae, ______Trestles, ______Powerlines, ______Transformers, ______Tramways, ______Flumes, ______Tram Buckets, ______Fences, ______Machinery, ______Garbage

Describe any obvious removal actions that are needed at this site:

____

____

____

____

General Comments/Observations (not otherwise covered)

____

____

____

____

____

____

____

12. SITE MAP

Prepare a sketch of the site. Indicate all pertinent features of the site and nearby environment. Include all significant mine and surface water features, access roads, structures, etc. Number each important fearue at the mine site and use these number throughout this form when referring to a particular feature (Tables 1 and 2). Sketch the drainage routes off the site into the nearest stream.

13. RECORDED INFORMATION

Owner(s) of patented land
Name: ______________________________
Address: ______________________________
Telephone Number: ______________________________

Claimant(s)
Name: ______________________________
Address: ______________________________
Telephone Number: ______________________________

Surface Water (*From water rights*)
Number of Surface Water Intakes within 15 miles downstream of site used for:
_____Domestic, _____Municipal, _____Irrigation, _____Stock,
_____Commerical/Industrial, _____Fish Pond, _____Mining,
_____Recreation, _____Other

Wells (*From well logs*)
Nearest well _____miles
Number of wells within _____0-¼ miles _____¼-½ miles _____½-1 mile _____1-2 miles
_____2-3 miles _____3-4 miles of site

Sensitive Environments
List any sensitive environments (as listed in the HRS) within 2 miles of the site or along receiving stream for 15 miles downstream of site (*wetlands, wilderness, national/state park, wildlife refuge, wild and scenic river, T&E or T&E habitat, etc*):

____
____
____

Population (*From census data*)
Population within _____0-¼ miles _____¼-½ miles _____½-1 mile _____1-2 miles
_____2-3 miles _____3-4 miles of site

Public Interest
Level of Public Interest: _____Low, _____Medium, _____High
Is the site under regulatory or legal action? _____Yes, _____No

Other sources of information (MILs #, MRDS #, other sampling data, etc):

____
____
____
____
____

APPENDIX II

ABANDONED - INACTIVE MINE SITES
WITH POTENTIAL TO AFFECT
THE DEERLOGE NATIONAL FOREST

CODE	MINE NAME	QUADRANGLE
V	16:1	DELMOE LAKE
X	2 PERCENT	PHILIPSBURG
X	2ND CHANCE ORE	MAXVILLE
U	6354	DELMOE LAKE
X	A&B	LOCKHART MEADOWS
V	A&M PROSPECT	MAXVILLE
V	ABBOT	SILVER LAKE
V	ADA	BASIN
V	ADELAIDE	BASIN
S	ADIT	MOUNT HUMBUG
S	AIREDALE PROSPECT	WHETSTONE RIDGE
V	AJAX	RATIO MOUNTAIN
V	ALBION MINE	PIKES PEAK
S	ALDER GULCH PLACER	ALDER GULCH
X	ALGONGUIN	PHILIPSBURG
V	ALLPORT	BISON CANYON
U	ALTURAS	SILVER LAKE
X	AM SELEY MINE	ALDER GULCH
V	AMAZON	POZEGA LAKES
S	AMERICAN BEAUTY	PIKES PEAK
S	AMERICAN FLAG	FRED BURR LAKE
S	AMETHYST PROSPECT	PIKES PEAK
X	ANACONDA QUARRIES	WEST VALLEY
X	ANACONDA QUARRIES	WEST VALLEY
U	ANDERSON PROSPECT	WHETSTONE RIDGE
S	ANNIE	HENDERSON MOUNTAIN
V	ANTELOPE	WEST VALLEY
X	ANTELOPE CHROMITE	PONY
X	ANTONIOTI QUARRY	TUCKER CREEK
X	APEX	SILVER LAKE
X	APEX #2	WICKIUP CREEK
V	APOLLO	MOUNT THOMPSON
V	APRIL	SHEEPSHEAD MOUNTAIN
V	AQUIRIUS	BASIN
S	ARCHEGAN	MAXVILLE
S	AREA NORTH	WEST VALLEY
V	ARGO	SPINK POINT
V	ARGUS	BAGGS CREEK
S	ARROWHEAD & SOUTH AMERICA	MOUNT POWELL
V	ATLANTIC AND PACIFIC MINE	PONY
V	ATLANTIC AND PACIFIC TAILINGS	PONY
V	ATTOWA	RATIO MOUNTAIN
V	AURORA	BASIN
X	AUTUMN PLACER	SILVER LAKE
X	B GROUP	SILVER LAKE
V	B&H	OLD BALDY MOUNTAIN
V	B&H TAILINGS	OLD BALDY MOUNTAIN
X	BAIER	PHILIPSBURG
V	BAKAMA	MOUNT THOMPSON
U	BALLARAT	PIPESTONE PASS
S	BALLARD	ROCK CREEK LAKE
V	BANKER CLAIM	MAXVILLE
V	BANKER GROUP	LOCKHART MEADOWS
V	BANNER MINE	MOOSE LAKE
S	BANNER TAILINGS	MOOSE LAKE
S	BARBARA ANN	CARPP RIDGE
U	BARICH MINE	PIKES PEAK
X	BARRY DEAN	SUGARLOAF MOUNTAIN
V	BASIN	PHILIPSBURG
S	BASIN BELL	BASIN
S	BASIN CREEK PLACER	BASIN
U	BASIN CREEK PLACER	MOUNT HUMBUG
V	BASIN GOLD & SILVER	BASIN
X	BASIN GOLDFIELDS	BASIN
X	BASIN JIBE MINE	BASIN
X	BASIN QUARRY	BASIN
S	BASIN TOWNSITE	BASIN
U	BATTERTON BAR	ROCK CREEK LAKE
S	BAYARD	WATERLOO
S	BEAL LODE	DICKIE PEAK
U	BEAR & FLOAT	HENDERSON MOUNTAIN
S	BEAR CAT	PIPESTONE PASS
S	BEAR CREEK PLACER	MOUNT HUMBUG
S	BEAR GULCH PLACER	OLD BALDY MOUNTAIN
V	BEAVER PLACER	RATIO MOUNTAIN
X	BEE BEE	MAUKEY GULCH
V	BEEF STRAIGHT	DELMOE LAKE
V	BEEF STRAIGHT NORTH	DELMOE LAKE
S	BELL	BAGGS CREEK
S	BELLAIRE MINE	DUNKLEBERG CREEK
X	BELLEFLOWER MINE	HENDERSON MOUNTAIN
X	BELLUM	PHILIPSBURG
U	BEN HARRISON FRACTURE	PONY
V	BENTZ	MAUKEY GULCH
X	BERG	SILVER LAKE
S	BERKIN FLAT	THUNDERBOLT CREEK
X	BERNICE	LOCKHART MEADOWS
V	BERTHA MAY	BAGGS CREEK
V	BI-METALLIC	FRED BURR LAKE
V	BIELENBERG LAKE PROSPECT	PIKES PEAK
X	BIESNAHAN & FENNER	WEST VALLEY
X	BIG & LITTLE GOLDIE	BOULDER EAST
V	BIG BEAR	WEST VALLEY
S	BIG BILL	FRED BURR LAKE
S	BIG BILL PROSPECT	PIKES PEAK
U	BIG CHIEF	DELMOE LAKE
X	BIG EXPECTATION	FRED BURR LAKE
V	BIG FOOT	RATIO MOUNTAIN
S	BIG FOOT CREEK PLACER	RATIO MOUNTAIN
V	BIG FOUR	RATIO MOUNTAIN
V	BIG MAJOR - NEW BALD EAGLE	BOULDER WEST
S	BIGFOOT CREEK PLACER	BOULDER WEST
V	BILLIE GOAT	FRED BURR LAKE
V	BILLIE T.	MOUNT THOMPSON
X	BIMETALLIC TUNNEL	PHILIPSBURG
V	BISHOP IRON	WEST VALLEY
S	BISMARK IRON PROPERTY	POZEGA LAKES
V	BISMARK MINE	NOBLE PEAK
V	BISMARK TAILINGS	NOBLE PEAK
V	BISON CANYON MINE	BISON CANYON
V	BLACK BEAR	MOUNT THOMPSON
X	BLACK CHIEF IRON	WEST VALLEY
U	BLACK EAGLE	FRED BURR LAKE
X	BLACK MOON	SILVER LAKE
S	BLACK SHIRT	SILVER LAKE
V	BLACK-EYED MAY	BAGGS CREEK
S	BLACKBIRD CLAIM	ELKHORN
X	BLACKMAIL	PHILIPSBURG
X	BLER	WEST VALLEY
V	BLOOMINGTON	PIKES PEAK
V	BLOOMINGTON MILL	PIKES PEAK
S	BLUE BIRD MINE	PIKES PEAK
V	BLUE BOTTLE	WEST VALLEY
V	BLUE DIAMOND	MOUNT THOMPSON
S	BLUE DIAMOND PROSPECT	PIKES PEAK
V	BLUE ROCK LODE	DELMOE LAKE
V	BLUE-EYED NELLIE	WEST VALLEY
V	BLUEBELL - MARSH	DELMOE LAKE
X	BLUEBELL HEALTH	BASIN
S	BLUEBIRD	CARPP RIDGE
V	BLUEBIRD	PIKES PEAK
S	BLUEBIRD CLAIM PROSPECT	PIKES PEAK
S	BLUESTREAK	PIKES PEAK
S	BM COR	PIKES PEAK
X	BOAZ	CHESSMAN RESERVOIR
X	BOB EVANS MINE	GEORGETOWN LAKE
U	BOB LODE - 1KM	ELKHORN
X	BOMES MINE	MAXVILLE
V	BONANZA	BAGGS CREEK
X	BONANZA	HENDERSON MOUNTAIN
X	BONANZA JACK	BASIN
X	BONANZA MINE	MANHEAD MOUNTAIN
V	BOULAWAY - BULWER	ELKHORN
V	BOULDER	BASIN
U	BOULDER	BOULDER WEST
V	BOULDER CHIEF	MOUNT THOMPSON
V	BOULDER COBALT	NOBLE PEAK
V	BOULDER COBALT SHAFT	NOBLE PEAK
V	BOULDER COBALT WEST	OLD BALDY MOUNTAIN
S	BOULDER CREEK	MAXVILLE
U	BOULDER CREEK	PIKES PEAK
S	BOULDER CREEK GRAPHITE	POZEGA LAKES
X	BOULDER IRON	TACOMA PARK
X	BOULDER RIVER PLACER	BASIN
S	BOURARD LODE	DUNKLEBERG CREEK
U	BRONZE LODE	SILVER LAKE
V	BROOKLYN MILL TAILINGS	PIKES PEAK
V	BROOKLYN MINE	PIKES PEAK
V	BROOKS	PIPESTONE PASS
X	BROWN PROSPECT	TUCKER CREEK
S	BROWNS QUARRY	WEST VALLEY
X	BRYAN	PHILIPSBURG
V	BUCKEYE	THREE BROTHERS
V	BULL ELK	WEST VALLEY
V	BULLION	BASIN
X	BUNKER HILL	HENDERSON MOUNTAIN
X	BUSTER	BASIN
U	BUTTE & PHILADELPHIA	SHEEPSHEAD MOUNTAIN
U	BUTTE - ELK PARK or EUREKA	SHEEPSHEAD MOUNTAIN
U	BUTTE TUNGSTEN	ELK PARK PASS
V	C&D	ELKHORN
X	CABE	SILVER LAKE
S	CABLE MINE	SILVER LAKE
S	CABLE PLACER	SILVER LAKE
X	CADGIE TAYLOR	PHILIPSBURG
X	CALCABE	SILVER LAKE
X	CALVIN MINE	BASIN
X	CAMBELL PROSPECT	SILVER LAKE
S	CAMERON	WEST VALLEY
V	CAMP VERDE PLACER	ROCK CREEK LAKE
S	CARBONATOR	WEST VALLEY
V	CARLA, PAULINE, & FAITH GROUP	SHEEPSHEAD MOUNTAIN
X	CARLESON MINE	BASIN
S	CARLSON MINE	THREE BROTHERS
S	CARMICHAEL CLAIMS	PONY
X	CARMODY GROUP	ELKHORN
S	CAROLINE & WILLIAM COLEMAN	SUGARLOAF MOUNTAIN
S	CAROLINE CLAIM	MAXVILLE
V	CASCADE	BISON CANYON
V	CASTLE ROCK	NOBLE PEAK
V	CATORACT	MOUNT THOMPSON
S	CATORACT CREEK PLACER	MOUNT THOMPSON
V	CATORACT TAILINGS	MOUNT THOMPSON
V	CETO	STORM LAKE
V	CHAMPION MILL TAILINGS	LOCKHART MEADOWS
V	CHAMPION MINE	LOCKHART MEADOWS
V	CHAMPION PASS PROSPECT	LOCKHART MEADOWS
S	CHAMPION SHAFT	LOCKHART MEADOWS
U	CHIEF JOSEPH COPPER - 1KM	ELKHORN
X	CHINESE DIGGINGS	BOULDER WEST
X	CLIFF	PHILIPSBURG
U	CLIFF	WEST VALLEY
X	CLIFF GULCH	PHILIPSBURG
X	CLIMAX	PHILIPSBURG
X	CLIMAX	TUCKER CREEK
X	CLIMAX GROUP	TUCKER CREEK
S	CLIPPER	KELLY LAKE
S	CLIPPER	PIKES PEAK
X	CLIPPER	WICKIUP CREEK
V	COAL CREEK	OLD BALDY MOUNTAIN
S	COBERLY SYNCLINE	PIKES PEAK
V	COLUMBIA	SHEEPSHEAD MOUNTAIN
X	COLUMBIA	WICKIUP CREEK
V	COLUMBUS	BASIN
X	COMANCHE EXT	PHILIPSBURG
V	COMBINATION MILL TAILINGS	BLACK PINE RIDGE

CODE	MINE NAME	QUADRANGLE
S	COMET	PIKES PEAK
S	COMINCO PHOSPHATE	MAXVILLE
V	CONGDON MINE	MOUNT EMERINE
V	CONNIE JOE	DELMOE LAKE
U	CONSTELLATION VERMICULITE	PONY
V	CONTACT #1	PIKES PEAK
U	COPPER CLIFF	BAGGS CREEK
V	COPPER CREEK	MAXVILLE
X	COPPER JACK	PHILIPSBURG
U	COPPER LODE	MAXVILLE
S	COPPER LODE	MOUNT POWELL
S	COPPER MTN LODE	KELLY LAKE
U	COPPER QUEEN	BLACK PINE RIDGE
S	COPPER RIDGE PROSPECTS	PIKES PEAK
X	COPPER STATE MINE	BLACK PINE RIDGE
S	COPPER STATE MINE	HENDERSON MOUNTAIN
S	COSMOPOLITAN	ROCK CREEK LAKE
V	COTTONWOOD MINE	LOCKHART MEADOWS
S	COUGAR	ROCK CREEK LAKE
X	COYLE	PHILIPSBURG
V	CRACKER	MOUNT THOMPSON
V	CRAIG PROSPECT	NOBLE PEAK
U	CREDIN MINES?	BASIN
V	CRESCENT	CHESSMAN RESERVOIR
U	CRYSTAL BUTTE	NOBLE PEAK
V	CRYSTAL MINE	BASIN
S	CULUER MINE	DUNKLEBERG CREEK
V	CURLY BILL	NOBLE PEAK
V	CURLY GULCH ADITS	MOUNT HUMBUG
V	CUSTER	MOUNT THOMPSON
V	DAILY WEST MINE	BASIN
X	DALY GULCH	SILVER LAKE
X	DALY PLACER	SILVER LAKE
V	DANIELSVILLE	POZEGA LAKES
V	DARK HORSE	MOUNT POWELL
V	DARK HORSE MILL	MOUNT POWELL
S	DAUGHTERS PROSPECT	PIKES PEAK
X	DAY & HARVEY	MOUNT HUMBUG
V	DEAD COW ADIT	OROFINO MOUNTAIN
S	DEAD END	THUNDERBOLT CREEK
U	DECIEVER	ROCK CREEK LAKE
S	DEER HUNTER PROSPECT	HENDERSON MOUNTAIN
V	DEER LODGE BASIN PROSPECTS	PIKES PEAK
S	DELTA	SILVER LAKE
V	DENNY PROSPECT	PIPESTONE PASS
X	DERBY MORNING	PHILIPSBURG
S	DEWEY PROSPECT	PIKES PEAK
U	DG CLAIMS	POZEGA LAKES
V	DIAMOND CITY	RATIO MOUNTAIN
X	DIAMOND PLACER	ANACONDA NORTH
V	DING BAT & BLUE-EYED MAGGIE	BAGGS CREEK
V	DING BAT - BLUE EYED MAGGIE	SUGARLOAF MOUNTAIN
X	DISSETT MINE	PHILIPSBURG
S	DOLE PROSPECT	ROCK CREEK LAKE
U	DORA LEIGH & MCCAULEY LEAD	WILSON PARK
U	DORA LEIGH & MCCAULEY LEAD	WILSON PARK
V	DORIS	BASIN
V	DOUBLE EAGLE PROSPECT	BLACK PINE RIDGE
V	DOUGHERTY MILL	SILVER LAKE
X	DOUGLAS CREEK	PHILIPSBURG
S	DOUGLAS CREEK SYNCLINE	MAXVILLE
V	DOUGLAS MILL	HENDERSON MOUNTAIN
V	DOUGLAS MINE	HENDERSON MOUNTAIN
V	DRY BOULDER IRON	NOBLE PEAK
X	DRY COTTONWOOD CREEK	OROFINO MOUNTAIN
S	DRY GULCH PLACER	MOUNT POWELL
X	DUMAS	GRACE
V	DUMERTIORITE PROSPECT	BASIN
U	DUNKLEBERG	DUNKLEBERG CREEK
X	DUNSTONE	ELKHORN
X	DURAND	MAXVILLE
X	DURANGO	PHILIPSBURG
X	DURANGO & MOONLIGHT GROUP	PHILIPSBURG
U	E.X.L.	PIPESTONE PASS
V	EAGER	WICKIUP CREEK
X	EAGLE BUTTE MINE	ELKHORN
S	EAGLE CLAIM	HENDERSON MOUNTAIN
U	EAGLE HILL & IRON BAR LODES	ELKHORN
V	EAST MOUNTAIN LION	MAXVILLE
S	EAST RIDGE GROUP	ELK PARK PASS
X	EAST SOAP GULCH IRON	WICKIUP CREEK
U	ECLIPSE CLAIM	ELKHORN
X	EDNA - KIBLER PROSPECT	PIPESTONE PASS
S	EDWIN E. GRAUPHER PROSPECT	PIKES PEAK
V	ELDERADO	PIKES PEAK
X	ELIZABETH	PHILIPSBURG
V	ELIZABETH - LITTLE EMERY	BAGGS CREEK
X	ELIZABETH SHAFT	PHILIPSBURG
V	ELKHORN BUCKHORN	MOUNT HUMBUG
S	ELKHORN CREEK PLACER	TACOMA PARK
X	ELKHORN MINE	ELKHORN
V	ELKHORN PEAK IRON	ELKHORN
S	ELKHORN QUEEN	TACOMA PARK
X	ELKHORN RIDGE PROSPECT	ELKHORN
V	ELMER	BASIN
V	EMERY	SUGARLOAF MOUNTAIN
S	EMERY RIDGE PROSPECT	ROCK CREEK LAKE
V	EMMA DARLING	BAGGS CREEK
V	ENTERPRISE	THREE BROTHERS
V	ERUBSTAKE	DELMOE LAKE
S	EUREKA	BISON CANYON
V	EVA MAY	MOUNT THOMPSON
V	EVA MAY TAILINGS	MOUNT THOMPSON
U	EVENING STAR & GOLDEN ASSETS M	BASIN
X	FAST KATIE	BASIN
X	FIELD	PHILIPSBURG
X	FIELDS	MAXVILLE
S	FINLAY BASIN PROSPECT	POZEGA LAKES

CODE	MINE NAME	QUADRANGLE
S	FIRST SHOT-LAST SHOT	BASIN
V	FISH CREEK MINE	MOUNT HUMBUG
S	FISH CREEK PLACERS	PIPESTONE PASS
X	FLAGSTAFF HILL	PHILIPSBURG
S	FLEECER MTN AREA	DEWEY
S	FLINT CREEK	SILVER LAKE
X	FLORENCE	WHITEHALL
V	FLUME GULCH MINE	OROFINO MOUNTAIN
V	FOREST ROSE MILL TAILINGS	DUNKLEBERG CREEK
V	FOREST ROSE MINE	DUNKLEBERG CREEK
V	FOX	WEST VALLEY
V	FRANKLIN	THUNDERBOLT CREEK
X	FRANKLIN HILL IRON	PHILIPSBURG
S	FRANZ	HARVEY POINT
V	GALENA GULCH MINE	BOULDER WEST
S	GARDINER	KELLY LAKE
S	GARNTY HILL AREA	WEST VALLEY
V	GARRETT	SILVER LAKE
U	GENERAL JACKSON MINE	NOBLE PEAK
X	GENERAL WHASHINGTON PLACER	HENDERSON MOUNTAIN
V	GEORGE	WEST VALLEY
X	GEORGETOWN PLACERS	SILVER LAKE
X	GERMAN GULCH	DICKIE PEAK
X	GERTRUDE	PHILIPSBURG
V	GIANT	OLD BALDY MOUNTAIN
S	GILT EDGE PROSPECT	PIKES PEAK
X	GIRD CREEK	MAXVILLE
X	GIRD CREEK SYNCLINE	MAXVILLE
S	GMLC FRIDAY	SPINK POINT
S	GOAT MOUNTAIN	PIKES PEAK
S	GOLD CREEK SYNCLINE	PIKES PEAK
X	GOLD DUST	MOUNT HUMBUG
V	GOLD HILL	MOUNT HUMBUG
V	GOLD HILL MILL	MOUNT HUMBUG
X	GOLD HILL MINES	WHITEHALL
V	GOLD KING MINE	MAXVILLE
V	GOLD LEAF	WHETSTONE RIDGE
U	GOLD PRINCE	MAUKEY GULCH
V	GOLD REEF MINE	MAXVILLE
X	GOLDEN CURRY MINE	ELKHORN
V	GOLDEN EAGLE	SILVER LAKE
V	GOLDEN GIRL #4	WHITETAIL PEAK
V	GOLDEN GLOW	THREE BROTHERS
V	GOLDEN JUBILEE	FRED BURR LAKE
V	GOLDEN MOSS MINE	ELKHORN
U	GOLDEN SURPRISE	MOUNT HUMBUG
X	GOLDEN VALLEY/MINNIE WILSON	DELMOE LAKE
V	GOSPEL HILL ADIT	LOCKHART MEADOWS
S	GOULD CARRY LODE	FRED BURR LAKE
V	GRANITE	FRED BURR LAKE
X	GRANITE BELL	FRED BURR LAKE
S	GRANITE CREEK PROSPECT	POZEGA LAKES
V	GRANITE RUBY SHAFT	FRED BURR LAKE
X	GRANITE TAILING	PHILIPSBURG
X	GRAVEL PIT	PHILIPSBURG
V	GRAY LEAD	MOUNT THOMPSON
X	GRAY ROCK / BUNG YOUR EYE	WEST VALLEY
V	GREAT EASTERN	ANACONDA NORTH
S	GREAT SHIELD URANIUM	MOUNT THOMPSON
X	GREAT WEST/SHOOFLY	PHILIPSBURG
V	GREATER NEW YORK	FRED BURR LAKE
V	GROUSE MINE	OLD BALDY MOUNTAIN
S	GRUBSTAKE	SILVER LAKE
X	GYP PROSPECT	SILVER LAKE
X	H & H CLAIM	PHILIPSBURG
S	H.O. GROUP	PIKES PEAK
V	HALFWAY PARK PLACER	WHITETAIL PEAK
S	HAM GULCH	MAXVILLE
S	HAMILTON	OLD BALDY MOUNTAIN
V	HANNA	FRED BURR LAKE
V	HANNA	MOUNT THOMPSON
V	HANNA TAILINGS	FRED BURR LAKE
V	HANNON - CLAY CHARLIO	SILVER LAKE
V	HANSON MELOY SILVER MOSS	SILVER LAKE
X	HARDCASH	ELKHORN
S	HARRY MILLER CLAIM	MAXVILLE
S	HATTA MINE & MAGNET MINES	DUNKLEBERG CREEK
V	HATTIE FERGUSON	MOUNT THOMPSON
V	HAWKEYE	THREE BROTHERS
X	HEADLIGHT	PHILIPSBURG
X	HEAGAN	ELKHORN
V	HEANEY MINE	WHETSTONE RIDGE
V	HECTOR	BASIN
X	HEILMAN CLAIM	MAXVILLE
X	HELEHAN PROSPECT	DEWEY
S	HELL'S CANYON PLACER	TABLE MOUNTAIN
V	HELPER MINE	BASIN
X	HENDERSON CREEK	HENDERSON MOUNTAIN
X	HENDERSON MINE	HENDERSON MOUNTAIN
V	HENRY	DUNKLEBERG CREEK
U	HENRY THOMAS	GRIFFIN CREEK
V	HERCULESE	BAGGS CREEK
X	HESPARIA & MINORIA	WEST VALLEY
V	HIDDEN LAKE TAILINGS	SILVER LAKE
S	HIDDEN LAKE TUNGSTEN	KELLY LAKE
V	HIDDEN TREASURE	BASIN
V	HIGH UP	ELKHORN
V	HIGHLAND	BASIN
V	HIGHLAND	MOUNT HUMBUG
S	HIGHLAND MARY PROSPECT	MANHEAD MOUNTAIN
S	HIGHLAND MOUNTAINS AREA	MOUNT HUMBUG
V	HIGHLAND TAILINGS	MOUNT HUMBUG
V	HIGHLAND VIEW	PIPESTONE PASS
V	HLM	SILVER LAKE
U	HOBO GULCH PROSPECT	ELKHORN
V	HOBO/T HAYES	PHILIPSBURG
X	HOLDFAST	SILVER LAKE
S	HOMER CLAIM	MAXVILLE

CODE	MINE NAME	QUADRANGLE
V	HOMESTAKE	PIKES PEAK
V	HOMESTAKE	WEST VALLEY
X	HONORAH G	SILVER LAKE
U	HOPE	BISON CANYON
X	HOPE HILL	PHILIPSBURG
X	HOPE KATIE, KATIE EXT	BASIN
V	HORSHOE BEND	SILVER LAKE
X	HORTON & SANDERS	PHILIPSBURG
X	HOWARD CLAIM	MAXVILLE
X	HUFFFMAN	PHILIPSBURG
V	HUGHES	PIKES PEAK
U	HUMBOLT	WHITETAIL PEAK
X	IB	PHILIPSBURG
V	IDA M.	MOUNT THOMPSON
V	IDA MAY	CHESSMAN RESERVOIR
X	ILLGON	PHILIPSBURG
S	INCLINE	BAGGS CREEK
V	INDEPENDENCE	PIKES PEAK
V	INDIAN HEAD ROCK DEPOSITS	BASIN
A	INDIANA PROSPECT	WHETSTONE RIDGE
X	INDUSTRIAL SILICA	MOUNT THOMPSON
V	INFINITE	THUNDERBOLT CREEK
V	INHA PROSPECT	NOBLE PEAK
X	IRON AGE MINE	PHILIPSBURG
V	IRON CLIFF	PIPESTONE PASS
X	IRON KING	WHITEHALL
S	IRON MOUNTAIN	THUNDERBOLT CREEK
S	IRON MOUNTAIN PLACER	TABLE MOUNTAIN
X	ISABELLA	PHILIPSBURG
X	ISABELLE	SILVER LAKE
U	IVANHOE LAKE	KELLY LAKE
S	IVANHOE MINE	PIKES PEAK
U	JACK CREEK	WILSON PARK
S	JACK CREEK RIDGE	BASIN
U	JACK MINE	RATIO MOUNTAIN
S	JACK MTN IRON	BASIN
X	JACQUELINE	DICKIE PEAK
X	JAMES R. KEENE	ELKHORN
S	JASPER & MATTHICH	WARREN PEAK
V	JEFFERSON	MAXVILLE
V	JESSIE	BASIN
X	JETTY MINE	WEST VALLEY
X	JIB SHAFT	BASIN
V	JIM JR.	WHITETAIL PEAK
X	JOE HANKS CLAIM	HENDERSON MOUNTAIN
X	JOE METESH LESSEE	BASIN
V	JOHN G. CARLISLE	PIKES PEAK
V	JOHN T.	MOUNT THOMPSON
S	JOHNSON CLAIM	HENDERSON MOUNTAIN
V	JOKER PROSPECT	WHETSTONE RIDGE
S	JOLEAN PROSPECT	PIKES PEAK
S	JOSEPHINE	THREE BROTHERS
S	JP PROSPECT	WHETSTONE RIDGE
V	JULIA LEE	TABLE MOUNTAIN
V	JUMBO	MOUNT THOMPSON
X	JUPITER	DELMOE LAKE
X	KASERMAN	WICKIUP CREEK
V	KELLERS HEM DEPOSIT	BASIN
S	KELLY & IRVING PITS	ROCK CREEK LAKE
X	KENNEDY MINE	MAUKEY GULCH
V	KENT	MOUNT EMERINE
U	KENTUCKY IRISHMAN	DELMOE LAKE
X	KING & QUEEN CLAIMS	WICKIUP CREEK
V	KING MINE	DELMOE LAKE
V	KIRKENDAL / KOSKI	PIKES PEAK
V	KIT CARSON	SHEEPSHEAD MOUNTAIN
V	KLONDYKE	MOUNT THOMPSON
S	KOHRS & BIELENBERG PIT	ROCK CREEK LAKE
S	KOHRS & BIELENBERG PLACER	ROCK CREEK LAKE
X	KRUEGER	OLD BALDY MOUNTAIN
S	KURT PEAK OCCURRENCE	STORM LAKE
X	L. FROST CREEK	PHILIPSBURG
S	LADY HENNESY	THREE BROTHERS
V	LADY LEITH	THREE BROTHERS
S	LAKE VIEW PROSPECT	ROCK CREEK LAKE
S	LANCASTER PROSPECT	PIKES PEAK
V	LARK	POZEGA LAKES
X	LAST CHANCE	BASIN
X	LAST CHANCE	HENDERSON MOUNTAIN
S	LAST CHANCE MINE	HENDERSON MOUNTAIN
S	LAST CHANCE PROSPECT	WHETSTONE RIDGE
S	LEAD STREAK	MAXVILLE
V	LEADVILLE	SUGARLOAF MOUNTAIN
U	LEROY QUARTZ LODE	TACOMA PARK
S	LETUS	FRED BURR LAKE
X	LEVI BURR	PHILIPSBURG
X	LIMESTONE	DICKIE PEAK
S	LIMESTONE PROSPECTS	SILVER LAKE
V	LIMESTONE QUARRY	PIPESTONE PASS
X	LITTLE DANDY	PHILIPSBURG
S	LITTLE DARLING	OROFINO MOUNTAIN
X	LITTLE EMMA & HOMESTEAD	PHILIPSBURG
S	LITTLE GOLD CREEK PLACER	PIKES PEAK
S	LITTLE JOE	CARPP RIDGE
S	LITTLE WONDER PROSPECT	WHETSTONE RIDGE
V	LIZZIE OSBORNE	MOUNT THOMPSON
V	LOG CABIN	WHETSTONE RIDGE
V	LOIS	PIKES PEAK
X	LONDON BERRY	MAXVILLE
S	LOOKOUT	WARREN PEAK
S	LOOKOUT PROSPECT	HENDERSON MOUNTAIN
X	LOST CREEK PLACER	ANACONDA NORTH
X	LOTTA	BASIN
V	LOUISE	BASIN
S	LOUISE MINE	ELKHORN
V	LOWER BROOKLYN	MAXVILLE
V	LOWER BUCKEYE MILL TAILINGS	THREE BROTHERS
X	LOWER GEORGETOWN	GEORGETOWN LAKE
V	LOWER HATTIE FERGUSON	MOUNT THOMPSON
V	LOWER HIDDE HAND	BAGGS CREEK
V	LOWER VERA & MARIE	MOUNT THOMPSON
V	LOWER WHITE CHIEF	MANHEAD MOUNTAIN
V	LUCKY ARROWHEAD	WEST VALLEY
X	LUCKY BLUE	SILVER LAKE
S	LUCKY SEVEN	CARPP RIDGE
U	LUCKY STRIKE	MOOSE LAKE
X	LUCY	PHILIPSBURG
S	LUKE	WARREN PEAK
S	LUKE SI QUARRY	WEST VALLEY
V	LULA BELL	THREE BROTHERS
X	LUXANBURG	ELKHORN
X	LUXEMBURG	SILVER LAKE
S	LYON PLACER	MAXVILLE
V	M&M PLACER	PIKES PEAK
V	M&T + MYERS	MOOSE LAKE
V	M. FK. DOUGLAS CREEK PHOSPHATE	PIKES PEAK
S	MACFARLAND PLACER	PIKES PEAK
S	MAIN RANGE BERYL	MOUNT EVANS
X	MAMMOTH MINE	MANHEAD MOUNTAIN
V	MANHATTAN	MOUNT THOMPSON
V	MANTLE & S. MANTLE	MOUNT THOMPSON
V	MARGUERITE	BASIN
X	MARIE CLAIM	PHILIPSBURG
X	MARONEY CLAIM	PHILIPSBURG
S	MARY ANN	MOUNT HUMBUG
V	MARY ANNE	BASIN
X	MARY B	PHILIPSBURG
X	MARY FRANCIS CLAIM	TUCKER CREEK
V	MASCOT	DELMOE LAKE
V	MASCOT EXTENSION	DELMOE LAKE
S	MASTER MINE	PIKES PEAK
V	MATHESON	BAGGS CREEK
X	MAXVILLE TAILINGS	MAXVILLE
V	MAY DAY	BOULDER WEST
S	MAY LITTY	THREE BROTHERS
X	MAYFLOWER / GOLD CROWN	WEST VALLEY
S	MAYFLOWER LODE	KELLY LAKE
S	MAYFLOWER PROSPECT	WHETSTONE RIDGE
V	MAYFLOWER VEIN	MAXVILLE
S	MAYVILLE PHOSPHATE	MAXVILLE
S	MAYWOOD PLACER	MAXVILLE
X	MCDONALD MINE	MAUKEY GULCH
U	MCKAY ADIT	SILVER LAKE
V	MEMPHIS	SHEEPSHEAD MOUNTAIN
X	MERRY WIDOW	MOUNT THOMPSON
X	MIDDLE OF THE ROAD PYRENEES	SILVER LAKE
V	MIDNIGHT	NOBLE PEAK
V	MIKE	MOUNT THOMPSON
V	MILLERS PROSPECT	WHETSTONE RIDGE
X	MINE	ALDER GULCH
S	MINER'S GULCH PLACER	ALDER GULCH
U	MINERAL HILL	PONY
X	MINNCHAHA & HORSHOE GROUP	SILVER LAKE
V	MINNEAPOLIS	MOUNT THOMPSON
V	MINNIE LEE	STORM LAKE
X	MITCHELL	PHILIPSBURG
U	MOCCASON	BASIN
S	MODESTY CREEK	MOUNT POWELL
V	MODOC	FRED BURR LAKE
V	MOGULLIAN	NOBLE PEAK
V	MOHAWK	WEST VALLEY
V	MONARCH MINE	DUNKLEBERG CREEK
S	MONITOR MINE	DUNKLEBERG CREEK
S	MONK - HEADACHE	STORM LAKE
V	MONTANA MINE	FRED BURR LAKE
X	MONTANA MINE	SILVER LAKE
V	MONTREAL STAR	ELK PARK PASS
S	MOONDYNE	PIKES PEAK
S	MOONEY CLAIM - UR	BUXTON
S	MOONLIGHT	SILVER LAKE
S	MOOSE CREEK	MOUNT HUMBUG
S	MOOSE FISH CREEK TRAVERSE	PIPESTONE PASS
V	MOOSE LAKE TAILINGS	MOOSE LAKE
S	MOOSE TRAIL	MAUKEY GULCH
X	MOREAU	ELKHORN
V	MORGAN EVANS	WEST VALLEY
V	MORNING GLORY	MOUNT THOMPSON
V	MORNING GLORY TAILINGS	MOUNT THOMPSON
V	MORNING MARIE	MOUNT THOMPSON
V	MORNING MINE	BASIN
V	MORNING STAR	PIKES PEAK
V	MORNING STAR MINE?	BASIN
X	MOSCOW MINE	GRACE
S	MOTHER VEIN CLAIM	HENDERSON MOUNTAIN
X	MOUNTAIN BOY	MANHEAD MOUNTAIN
S	MOUNTAIN CHIEF	DUNKLEBERG CREEK
V	MOUNTAIN LION MINE	MAXVILLE
S	MOUNTAIN PARK TUNGSTEN	PIKES PEAK
V	MOUNTAIN QUEEN	RATIO MOUNTAIN
S	MOUNTAIN TOP CLAIMS	PIKES PEAK
U	MOUNTAIN VIEW COPPER	HENDERSON MOUNTAIN
V	MT THOMPSON	MOUNT THOMPSON
X	MTN BOY & WEHGER #2	PHILIPSBURG
V	MTN CHIEF	MOUNT THOMPSON
X	MTN VIEW	GEORGETOWN LAKE
S	MUDHOLE	PIKES PEAK
X	MULLEN & LITTLE GEM	PHILIPSBURG
S	MULONEY BASIN PROSPECT	CARPP RIDGE
S	MULONEY MINE	CARPP RIDGE
V	MYSTERY	OROFINO MOUNTAIN
X	MYSTERY NG	PHILIPSBURG
V	McPHAIL	PIPESTONE PASS
U	N462741	BASIN
S	NANCY LEE PROSPECT	WHETSTONE RIDGE
S	NATIONAL TUNGSTEN & SILVER CO	POZEGA LAKES
S	NE SEC 7 GIRD CREEK PROS	MAXVILLE

V: Visited X: On DNF land - no effects S: Screen in office U: Location in

CODE	MINE NAME	QUADRANGLE
X	NEEDLE GUN CLAIM	FRED BURR LAKE
V	NELLIE BARNES	MAXVILLE
U	NELSON PROSPECT	SUGARLOAF MOUNTAIN
S	NEVADA	OROFINO MOUNTAIN
X	NEW HOPE	SILVER LAKE
X	NEW HOPE CLAIM	PHILIPSBURG
U	NEW MORNING MINE	BOULDER WEST
X	NEW SEATTLE	MAXVILLE
V	NEW YEAR	SILVER LAKE
S	NEW YORK	PIKES PEAK
X	NEWCOMB	DICKIE PEAK
S	NFK FLINT CREEK PLACER	SILVER LAKE
V	NICHOLSON	NOBLE PEAK
U	NICKELODEON	BOULDER WEST
S	NIKI	ELK PARK PASS
S	NILES GULCH PLACER	ALDER GULCH
V	NINETEEN HUNDRED	FRED BURR LAKE
V	NON-PARIEL MILL TAILINGS	MAXVILLE
X	NORTH ATLANTIC	SILVER LAKE
V	NORTH BOULDER LEAD	THUNDERBOLT CREEK
S	NORTH FORK GRANITE CREEK	PIKES PEAK
U	NORTH LOUISE PROJECT	ELKHORN
V	NORTH STAR	MAXVILLE
V	NORTHERN CROSS (CARLIN ONE DIL	POZEGA LAKES
S	NUGGET	PIKES PEAK
V	O'BRIEN	WHETSTONE RIDGE
X	OBELISLE	MOUNT THOMPSON
V	OHIO LODE MINE	WATERLOO
S	OHIO PROSPECT	WHETSTONE RIDGE
S	OKOREOKA	SILVER LAKE
X	OLD BONANZA	SILVER LAKE
V	OLD CABIN PROSPECT	NOBLE PEAK
V	OLD DOMINION MINE	MOOSE LAKE
V	OLD DOMINION TAILINGS	MOOSE LAKE
X	OLD KENTUCK	PHILIPSBURG
S	OLSON GULCH	WEST VALLEY
S	OLYMPIC MINE	POZEGA LAKES
S	ONE HUNDRED ACRE MEADOW PROSPE	STORM LAKE
X	ONTARIO	GEORGETOWN LAKE
U	OPHIR	PIKES PEAK
U	ORAFINE CREEK PLACER	SUGARLOAF MOUNTAIN
U	OROFINE CREEK PLACER	LOCKHART MEADOWS
U	ORPHAN BOY	ROCK CREEK LAKE
X	ORPHAN BOY - OROFINO	SILVER LAKE
V	OVERLAND CREEK MINE	CHESSMAN RESERVOIR
V	OVERLOOK	PIPESTONE PASS
V	OVERLOOK MILL	PIPESTONE PASS
V	OZARK	PIPESTONE PASS
X	PANDORA	WICKIUP CREEK
V	PARK CREEK TAILINGS	MANHEAD MOUNTAIN
X	PARNELL	PHILIPSBURG
X	PATSY ANN MINE	DICKIE PEAK
V	PAY DAY	WEST VALLEY
X	PAYOFF	SILVER LAKE
V	PEACOCK GROUP	HENDERSON MOUNTAIN
X	PEARL	PHILIPSBURG
V	PEARL	THREE BROTHERS
S	PEARL MINE	DUNKLEBERG CREEK
V	PEN YAN	MOUNT THOMPSON
S	PERRY PARKS PLACER	THREE BROTHERS
V	PETE & JOE	OLD BALDY MOUNTAIN
V	PETERSON MEADOW PROSPECT	GEORGETOWN LAKE
V	PHANTOM	MOUNT THOMPSON
X	PHILLIPSBURG AREA	PHILIPSBURG
S	PHOSPHATE PROSPECT UPPER	POZEGA LAKES
V	PIERMONT NO. 1 EAST	BASIN
S	PINEAU MINE	PIKES PEAK
S	PIONEER GULCH	ROCK CREEK LAKE
X	PLACER FIRE CLAY PIT	ANACONDA NORTH
X	PLEIDUS	SILVER LAKE
U	POHNDERF DEPOSIT - GEMS	MOUNT HUMBUG
X	POHNDORF AMETHYST	GRACE
S	POLLOCK	SUGARLOAF MOUNTAIN
X	POLO	PHILIPSBURG
X	POMEROY	SILVER LAKE
U	PONY VERMICULITE	PONY
V	PORCUPINE	SILVER LAKE
X	PORNELL GROUP	HENDERSON MOUNTAIN
X	PORPHRYRY DIKE	THREE BROTHERS
V	PORT ROYAL	PIKES PEAK
V	PORT ROYAL MILL	PIKES PEAK
V	PORT ROYAL TAILINGS	PIKES PEAK
V	PORTER	FRED BURR LAKE
V	POTOSI	PIKES PEAK
S	POWDER GULCH - RE PLACER	BUXTON
S	PRICE PLACER - RE	BUXTON
S	PRICES GULCH - RE PLACER	BUXTON
V	PRINCESS	LOCKHART MEADOWS
V	PRINCETON MINE	MAXVILLE
S	PRINCETON PLACER	MAXVILLE
S	PROSPECT	BOULDER WEST
S	PROSPECTS	MOUNT HUMBUG
S	PROSPECTS	MOUNT THOMPSON
X	PURITAN	FRED BURR LAKE
X	PURITAN	PHILIPSBURG
X	PYRITE	SILVER LAKE
V	QUARTZ CITY PROSPECT	NOBLE PEAK
V	QUARTZ CREEK	THREE BROTHERS
S	QUEEN	PIKES PEAK
V	QUEEN ANN CLAIM	ELKHORN
S	RACETRACK CREEK IRON	POZEGA LAKES
S	RAINBOW PASS OCCURENCE	STORM LAKE
S	RAINBOW PROSPECT	MOOSE LAKE
U	RANDY	WEST VALLEY
V	READY CASH	PIPESTONE PASS
V	RED LION	FRED BURR LAKE
V	RED LION MILL	FRED BURR LAKE
S	RED ROCK CREEK	BASIN

CODE	MINE NAME	QUADRANGLE
V	RED ROCK MINE	BASIN
X	RED ROSE	SILVER LAKE
V	RED WING	PIPESTONE PASS
V	REDEEMER	BAGGS CREEK
X	REDEMPTION	PHILIPSBURG
X	REDFERN	MOUNT HUMBUG
X	RELIANCE	SILVER LAKE
U	RELIEF	ELKHORN
X	REVENUE	SILVER LAKE
S	RICH STRIKE	WEST VALLEY
S	RICHMOND OR ONTARIO	SILVER LAKE
X	RIDGEWAY	PONY
S	RISING STAR	SILVER LAKE
V	ROBINSON MINE	SILVER LAKE
V	ROCK CREEK CLAIM	SUGARLOAF MOUNTAIN
X	ROCK CREEK MINE JILL MILL	PHILIPSBURG
X	ROCK CREEK PROPERTY	MAUKEY GULCH
S	ROCK CREEK PROSPECTS	PIKES PEAK
S	ROCK RABBIT & SUNBEAM	WARREN PEAK
V	ROCKER	MOUNT THOMPSON
V	ROCKER EXTENSION	MOUNT THOMPSON
V	ROMBAUER	PIKES PEAK
V	ROSE	MOUNT THOMPSON
V	ROYAL GOLD MILL	PIKES PEAK
X	ROYAL METALS TUNNEL	FRED BURR LAKE
V	RUBY	SHEEPSHEAD MOUNTAIN
V	RUBY MINE	LOCKHART MEADOWS
X	RUMSEY MILL	PHILIPSBURG
X	RUSSEL	HENDERSON MOUNTAIN
V	RUTH	MOUNT THOMPSON
X	RUTH & COPPER	WICKIUP CREEK
V	RYAN MINE	PIKES PEAK
X	S. BOULDER RIVER PLACERS	MANHEAD MOUNTAIN
S	S. CLIPPER	KELLY LAKE
S	S. FK ROCK CREEK PLACER	WHETSTONE RIDGE
X	S. FRANK HILL	PHILIPSBURG
X	S. HIDDEN LAKE PROSPECT	ELKHORN
V	SABBATH	BAGGS CREEK
U	SAGER-MURPHY	WEST VALLEY
V	SALLIE MELLEN	HENDERSON MOUNTAIN
V	SALLY ELLEN	PIKES PEAK
X	SALMON	PHILIPSBURG
S	SAMUEL	DUNKLEBERG CREEK
S	SAMUEL LODE	DUNKLEBERG CREEK
X	SAN FRANCISCO	PHILIPSBURG
V	SARANAC	MAXVILLE
V	SARATOGA	THUNDERBOLT CREEK
V	SATURDAY NIGHT	BASIN
X	SAUNDERS	PHILIPSBURG
S	SAWPIT GULCH PLACER	ALDER GULCH
U	SCENIC	PIPESTONE PASS
S	SCHERMERHORN GULCH PLACER	ROCK CREEK LAKE
S	SCHRAMM	ROCK CREEK LAKE
X	SCRATCH ALL	PHILIPSBURG
S	SE SECTION 5	MAXVILLE
V	SEATTLE	MOUNT THOMPSON
V	SEC 36 SHAFT	DELMOE LAKE
V	SECTION 18 PROSPECT	OROFINO MOUNTAIN
V	SECTION 8 SHAFT	LOCKHART MEADOWS
V	SENATE	KELLY LAKE
S	SEPTEMBER SNOW	PIKES PEAK
V	SHAMROCK	PIKES PEAK
X	SHAPLEIGH	PHILIPSBURG
V	SHEILA	SILVER LAKE
V	SHORT STUFF	STORM LAKE
X	SHOULETOWN	PHILIPSBURG
S	SILEA BUTTE	TABLE MOUNTAIN
U	SILVER BELL	RATIO MOUNTAIN
V	SILVER CHAIN	WEST VALLEY
X	SILVER CHIEF	PHILIPSBURG
V	SILVER GLANCE	MOUNT HUMBUG
V	SILVER HEART	SILVER LAKE
S	SILVER HILL	SILVER LAKE
V	SILVER KING	WEST VALLEY
V	SILVER KING PLACER	PIPESTONE PASS
V	SILVER PROSPECT	WEST VALLEY
V	SILVER QUEEN	DELMOE LAKE
V	SILVER QUEEN	WEST VALLEY
X	SILVER REEF	SILVER LAKE
X	SILVER SPIKE	PHILIPSBURG
V	SILVERSMITH	BISON CANYON
V	SIRIUS	MOUNT THOMPSON
V	SIXTEEN TO ONE CLAIM	PIKES PEAK
V	SKYLINE MINE/LESLIE LAKE GROUP	ELKHORN
U	SMITH PROSPECT	WEST VALLEY
V	SNOW BUNNY	PIKES PEAK
S	SNOW WHITE QUARRY	ANACONDA NORTH
S	SNOW WHITE QUARRY	MOUNT POWELL
V	SNYDER'S MINE	NOBLE PEAK
V	SOLAR MINE	THREE BROTHERS
U	SOLEDADA & IRON CROWN CLAIMS	WEST VALLEY
V	SOUTH BOULDER MILL	MAXVILLE
V	SOUTH FORK STATE CREEK MINE	RATIO MOUNTAIN
V	SOUTH SILVERSMITH	BISON CANYON
V	SOUTH SUICIDE CABIN MINE	DELMOE LAKE
X	SOUTHERN CROSS	SILVER LAKE
S	SPARKLING WATER	BASIN
V	SPORT LODE (LAME BEAR)	ELKHORN
S	SPRING HILL	SILVER LAKE
V	SPRINGTIME	BOULDER WEST
S	SQUARE GULCH PIT	ROCK CREEK LAKE
V	ST MARY'S	BAGGS CREEK
V	ST. ANTHONY	RATIO MOUNTAIN
V	ST. LAWRENCE	BASIN
V	ST. NICK	BASIN
V	ST. THOMAS	FRED BURR LAKE
X	STAR POINT	PHILIPSBURG
V	STARLIGHT	PIKES PEAK

CODE	MINE NAME	QUADRANGLE
V	STATE	FRED BURR LAKE
V	STATE	RATIO MOUNTAIN
V	STERRETT	BAGGS CREEK
S	STEVE CLAIM	ELKHORN
X	STEVEN'S PLACER	MAUKEY GULCH
S	STORM LAKE DEPOSITS	STORM LAKE
S	STORM LAKE TUNGSTEN	STORM LAKE
V	STORMWAY	WEST VALLEY
U	STRAW HAT	WEST VALLEY
X	STRAWN MILL	WATERLOO
X	STRAWN MINE	WATERLOO
X	STRIP MINE	PHILIPSBURG
S	STUCKY RIDGE	ANACONDA NORTH
V	STUMPTOWN SMELTER	WEST VALLEY
V	SUICIDE CABIN MINE	DELMOE LAKE
V	SULTANA	NOBLE PEAK
S	SUMMIT MINE	DUNKLEBERG CREEK
U	SUMMIT MINE	THUNDERBOLT CREEK
S	SUMMIT PLACER	WEST VALLEY
S	SUN MINE	DUNKLEBERG CREEK
V	SUNDAY	PIKES PEAK
V	SUNDAY EXTENSION	PIKES PEAK
V	SUNDAY MILL	PIKES PEAK
V	SUNLIGHT - COPPER QUEEN	PIKES PEAK
V	SUNRISE MINE	HENDERSON MOUNTAIN
X	SUNSET	MOUNT HUMBUG
V	SUNSET MINE	DUNKLEBERG CREEK
V	SUNSET PLACER	MAXVILLE
X	SURPRISE MINE	WHITEHALL
V	SWAMP GULCH AMAGALMATION MILL	MAXVILLE
S	SWAMP GULCH PROSPECTS	FRED BURR LAKE
X	SWEETHORN	PHILIPSBURG
X	SWISSMONT	ELKHORN
V	SYLVAN	BASIN
V	T MCKAY/HOBO	PHILIPSBURG
S	TACOMA	TACOMA PARK
S	TAMARACK LAKE	CARPP RIDGE
V	TEMPLEMAN	PIPESTONE PASS
S	THOMPSON LAKE PROSPECT	PIKES PEAK
X	THREE METALS	FRED BURR LAKE
S	THUNDERBOLT MOUNTAIN PROSPECT	THUNDERBOLT CREEK
V	THURSDAY FRIDAY MINE	PIKES PEAK
S	TIBBET PLACER	PIKES PEAK
V	TIBBETTS	PIKES PEAK
V	TIM THIRD CHANCE	STORM LAKE
V	TIP TOP	SILVER LAKE
S	TITANIUM PLACER	MOUNT EMERINE
S	TMT PROSPECT	WHETSTONE RIDGE
S	TODD PROSPECT	WHETSTONE RIDGE
V	TOLL MTN LODE-WAR EAGLE-LENY	PIPESTONE PASS
S	TOMMY PROSPECT	SILVER LAKE
S	TOURMALINE QUEEN MINE	ELKHORN
V	TOWNSEND PLACER	WHETSTONE RIDGE
V	TOWNSEND PROSPECT	WHETSTONE RIDGE
X	TREVILLION - JOHNSON	GRACE
V	TRIGGER	SILVER LAKE
X	TRIGGER MILL	SILVER LAKE
X	TRILBY CHAMPAIGN	SILVER LAKE
X	TROUT	PHILIPSBURG
X	TRUE	PHILIPSBURG
S	TUCKER CREEK	MOUNT HUMBUG
S	TUNGSTEN MINES	POZEGA LAKES
S	TUSCAVORA PROSPECT	WHETSTONE RIDGE
V	TUSSLE MINE	PIKES PEAK
X	TWILIGHT	SILVER LAKE
X	TWILIGHT CYANIDE PLANT	GEORGETOWN LAKE
X	TWIN BUTTES	MAXVILLE
S	TWIN PEAKS PROSPECT	FRED BURR LAKE
V	TWOHY	RATIO MOUNTAIN
V	UNAMED BEAR GULCH ADIT CLUSTER	OLD BALDY MOUNTAIN
V	UNCLE SAM	BASIN
V	UNION	ELKHORN
X	UNKNOWN	DRY MOUNTAIN
V	UNKNOWN LOWLAND	SHEEPSHEAD MOUNTAIN
S	UNKNOWN MILL CREEK MINE	MANHEAD MOUNTAIN
U	UNNAMED	BAGGS CREEK
X	UNNAMED	BUXTON
S	UNNAMED	ELK PARK PASS
S	UNNAMED	MANHEAD MOUNTAIN
V	UNNAMED	MOUNT HUMBUG
V	UNNAMED	MOUNT THOMPSON
V	UNNAMED	MOUNT THOMPSON
V	UNNAMED	MOUNT THOMPSON
V	UNNAMED	MOUNT THOMPSON
X	UNNAMED	WHITEHALL

CODE	MINE NAME	QUADRANGLE
U	UNNAMED QUARTZ	RATIO MOUNTAIN
U	UNNAMED RE	BUXTON
X	UNNAMED SMOKEY QUARTZ PROSPECT	RATIO MOUNTAIN
S	UNNAMED URANIUM	BISON CANYON
S	UNNAMED URANIUM	THREE BROTHERS
X	UNNAMMED	PONY
V	UPPER BUCKEYE MILL TAILINGS	THREE BROTHERS
S	UPPER GRANITE PROSPECT	PIKES PEAK
V	UPPER MTN LION	PIKES PEAK
V	UPPER WHITE CHIEF PROSPECT	NOBLE PEAK
S	UPPER WILLOW CREEK PLACER	BLACK PINE RIDGE
V	VALLEY VIEW	MOUNT POWELL
V	VAN DORSTEN	MOUNT HUMBUG
V	VELLEJO	SILVER LAKE
S	VENUS	THREE BROTHERS
V	VERA & MARIE	MOUNT THOMPSON
V	VIKING WESTERN PACIFIC	PONY
V	VINDICATOR	BASIN
X	W. GRANITE STAFF	PHILIPSBURG
V	WAKE UP JIM	BAGGS CREEK
U	WAR EAGLE	GEORGETOWN LAKE
S	WARREN PEAK PROSPECT	WARREN PEAK
X	WARREN PROSPECT	TUCKER CREEK
V	WASA	PIKES PEAK
V	WATER GULCH PROSPECT	BOULDER WEST
V	WELCH QUARRY	DELMOE LAKE
V	WELCOME HILL	SILVER LAKE
V	WELCOME LODE	SILVER LAKE
X	WEST EXP. MN PROS & LAMONT	FRED BURR LAKE
V	WEST GALENA GULCH	BOULDER WEST
V	WEST STORMWAY	WEST VALLEY
X	WHITE	PHILIPSBURG
U	WHITE SWAN MINE	LOCKHART MEADOWS
V	WHITETAIL PARK VEIN	WHITETAIL PEAK
X	WIGHT MN MINE	MAXVILLE
U	WILD CAT	MOUNT HUMBUG
U	WILLIAM BARTH	WHITETAIL PEAK
S	WILSON CREEK PLACER	BOULDER WEST
V	WINTERS CAMP	BASIN
U	WJ BRYAN	MAXVILLE
X	WOODROW WILSON	THREE BROTHERS
U	WOODVILLE DEPOSIT	ELK PARK PASS
X	YELLOW JACKET	OROFINO MOUNTAIN
U	YELLOW MODUL	FRED BURR LAKE
S	YOUNG AMERICAN	PHILIPSBURG
X	ZEUS	PHILIPSBURG
V	ROCKER GULCH	SUGARLOAF MT.
S	CATLSON & BERKIN FLAT	THUNDERBOLT CREEK
V	HIDDEN HAND	BAGGS GREEK
S	CARPP	CARPP RIDGE
V	ELDORADO & PLATEAU	CHESSMAN RESERVOIR
V	NELLIE-MASCOT	HOMESTAKE
V	MONTANA	HOMESTAKE
V	GOLD BUG	HOMESTAKE
S	PAY ROCK	HOMESTAKE
S	GLOWING STAR PLACER	HOMESTAKE
S	HOMESTAKE CREEK PLACER	HOMESTAKE
V	HARRIET	HOMESTAKE
V	NORTH HARRIET	HOMESTAKE
S	FLAG PLACER	HOMESTAKE
S	MOUNTAIN CHEIF	HOMESTAKE
S	NAMMIE BROWN	HOMESTAKE
S	IRENE	HOMESTAKE
S	EVENING STARE	HOMESTAKE
S	THOMPSON PARK	HOMESTAKE
V	DELAWARE	MAXVILLE
V	SNOW CAP	MAXVILLE
V	BARNES	MAXVILLE
V	NELLIE	MAXVILLE
V	MOONLIGHT	MAXVILLE
V	TRAVONIA	MAXVILLE
V	NON PAREIL	MAXVILLE
V	MOFFET JOHNSON	OLD BALDY MTN.
V	LOWER COAL CREEK	OLD BALDY MTN.
V	QUARTZETTE	PIKES PEAK
V	SUNSHINE	STORM LAKE
V	DOUBLE SHAFT	THREE BROTHERS
V	MONTANA PRINCES	WHETSTONE RIDGE
V	JIB MILL TAILINGS	BASIN
V	UPPER BULLION MILL TAILINGS	BASIN
V	BULLION TAILINGS ADIT	BASIN
V	SMELTER CREEK ADIT	BASIN
V	JACK CREEK MILL TAILINGS	BASIN
V	JOE'S BOWER'S MINE	BASIN
V	MORNING STAR	BASIN

APPENDIX III

MINE AND MILL SITES VISITED
IN THE BASIN CREEK DRAINGE
FOR WHICH NO IMPACTS WERE EVIDENT

Additional mines that were visited by the geologist because of lack of information are discussed below. These sites were either not visited upon recommendation of the geologist or visited by the hydrogeologist and determined not to require samples. Field SC, pH and temperature of waters associated with a site may have been measured and are included in the field notes for the site.

<u>Adelaide</u>

Two dry caved adits and several prospect pits follow a N86W near vertical vein in quartz monzonite with considerable quartz, sericite, and pyrite alteration products. The size of the dumps indicates approximately 900 feet of total workings. The dumps are comprised of mostly altered wallrock; no vein is present. A composite sample of the main dump ran <.006 oz/ton Au, .02 oz/ton Ag, .018% Cu, .32% Pb, and .18% Zn. The site is on DNF land.

<u>Aurora</u>

Two dry caved adits with less than 2000 feet of total workings remain at the site. Ruppel (1963) gives a fairly complete description. The mine examines a vein 2 to 10 feet thick with a N80W 60-85NE attitude in Elkhorn Volcanics andesite. The vein dies to the east in quartz monzonite, and is cut off by a north-striking fault on the west. Quartz vein on the dump has a very high sulfide content of pyrite, galena, and sphalerite. A select sample of this material contained .274 oz/ton Au, 5.06 oz/ton Ag, .35% Cu, 6.80% Pb, and 6.67% Zn. Total production was probably less than 3000 tons (Ruppel, 1963; Roby and others, 1960). The site is on DNF land.

<u>Columbus</u>

Three short, dry, caved adits on private land follow quartz-pyrite-galena veinlets and crosscut to a N60W vertical bull quartz vein with no visible sulfides. Most of the quartz monzonite wall rock is completely unaltered, and the small dumps are heavily vegetated as a result. All workings are on private land.

<u>Dumortierite Prospect</u>

Dumortierite occurs within an east-striking shear zone in veinlets and fibrous aggregates within welded tuff of the Elkhorn Mountain Volcanics (Ruppel, 1963). The workings, on a dry hillside, are now covered by talus, although a few specimens of dumortierite can still be found.

Golden Glow-Lula Bell

At the Golden Glow, two short caved shafts and a short caved crosscut examine a N80E 75SE vein in quartz monzonite. The Lula Bell is a prospect several hundred feet west on the same vein. Vein minerals in order of abundance are quartz, black chalcedony, tourmaline, pyrite, galena, sphalerite, and arsenopyrite (?). A select sample of this material ran .184 oz/ton Au, 2.82 oz/ton Ag, .077% Cu, 3.67% Pb, and 2.28% Zn. The vein apparently is not extensive, as trenches to the east encounter only iron stained aplite dikes, and the Lula Bell dump contains only some quartz monzonite in which the plagioclase is altered to kaolinite. At the crosscut, a creek runs adjacent to a vegetated dump of unaltered wallrock, but no environmental problems should result. The site is on DNF land.

Highland

The Highland mine, on private ground, is comprised of 5 short adits, one of which is open, that trace a west-trending structure containing breccia of chalcedony, iron oxides, and quartz. Host rock is altered (to kaolinite) volcanic tuff which Ruppel (1963) mapped as of Tertiary Lowland Creek age. This site appears to be related to the Boulder vein and associated Tertiary dike to the west.

Joe Bower's Mine

A large locked adit trends S80W in apparently unaltered, unmineralized Elkhorn Mountain tuffs. The dump has been entirely removed (for road fill?). Although this adit discharges water, the unmineralized nature of the rock keeps the pH high and the metal content low. This is private land.

Morning Star

Three caved adits follow parallel N60W quartz-pyrite breccia zones in layered porphyritic tuff of Elkhorn Mountain Volcanics age. Pardee and Schrader (1933) and Ruppel (1963) also reported minor galena, sphalerite, arsenopyrite, tetrahedrite, and chalcopyrite, although base metals yielded from the 65 tons of ore produced (Roby and others, 1960) indicate that these minerals must be minor constituents indeed. A select sample of pyrite-rich breccia ran .048 Au, 2.14 Ag, .021% Cu, .20 % Pb, and .034% Zn. Knopf (1913) related that the richest part of the vein was a 2.5 inch streak of mainly galena that carried 40 oz/ton Ag, 3.80 oz/ton Au, and 50% Pb. This site is on a dry hillside on private land.

Solar-Pearl

Both Roby and others (1960) and Ruppel (1963) provide descriptions of these mines. The Solar workings consist of one caved shaft about 140 feet deep with two levels totaling 500 feet along a N70-80E steeply north dipping vein with quartz, pyrite, tourmaline galena, tetrahedrite, arsenopyrite, and chalcopyrite. The early ores mined reportedly contained up to 3 oz Au and 300 oz Ag per ton, but production since 1902 has been 251 tons of ore from which 166 oz Au, 10,048 oz Ag, 245 lbs Cu, and 6142 lbs of Pb were recovered. Our own select sample of vein material ran .058 oz/ton Au, 3.32 oz/ton Ag, .035% Cu, .51% Pb, and .068% Zn. The dump is comprised of quartz monzonite, about 10% of which has been altered to a quartz-sericite-pyrite rock. A caved adit trending N85W with a dump of unaltered vegetated quartz monzonite is also present.

The Pearl explores the same vein well to the west with one short, caved, flooded shaft. Mineralogy of the vein is similar to that of the Solar. Both sites are on DNF land.

APPENDIX IV

ASSAY DATA
BASIN CREEK DRAINAGE

Deerlodge National Forest
Basin Creek Drainage
Assay Results

Sample ID	Location	Description (Field Observation)	Au oz/ton	Ag oz/ton	Cu %	Pb %	Zn %
JJNA1	North Ada, Jefferson Co., Trench	Composite mixture of overburden and old mine dumps stirred together.	.008	.60	.230	.370	.070
JAJS1	North Ada, Jefferson Co., Dump	Vein material selected. Sulfide-rich (up to 40%) py-sph-gal-cor, qtz-sid	.076	8.58	.810	2.850	2.480
RJBU1	Bullion vein	Select	.268	15.80	.200	7.740	.900
RJBU2	Upper Bullion Mine, Jefferson Co., Tailings	Composite	.028	1.10	.023	.410	.037
RJBU3	Upper Bullion Mine, Jefferson Co., Tailings	Composite	.030	1.02	.035	.350	.029
RJBU4	Unknown Adit above upper Bullion Tailing	Composite of sulfide dump	.010	.08	.012	.047	.050
RJBD1	Un-Named adit main Bullion, NW Dump	Dump composite	.006	.24	.005	.006	.020
RJBD2	Un-Named adit main Bullion, SE Dump	Dump composite	.006	.02	.006	.007	.013
RJBD3	Un-Named adit main Bullion, SE Dump	Dump composite	.030	1.66	.190	.120	1.210
RJBC1	Bullion Creek Un-Named #1 Jefferson Co.	Composite of dump	.010	1.28	.066	1.080	.110
JJLB1	Lower Bullion Mill, Jefferson Co., Tailings	Composite of mostly unox tailings; qtz+ser? + unidentified dark minerals	.028	2.28	.021	.620	.047
JVJS1	Vindicator, Jefferson Co., Upper Trench	Comp. of"best"material from trench; alt Fe-stained wallrock&sparse chalcedony vein	.160	.26	.015	.048	.056
JVJS2	Vindicator, Jefferson Co., Caved Slope	Rep. thicks sf, best part of zone, Chip channel, 3' of discontinuous vein(qtz-chal-py w/minor sph,gal,tet)&70	.048	7.80	.049	1.190	.500
JVJS3	Vindicator, Jefferson Co., North Dump	Dump composite, mainly Fe-stained wallrock w/some qtz-py(50%) vein	.060	.72	.022	.220	.070
JVJS4	Vindicator, Jefferson Co., Main Cut	Chip channel,5', several .5-1" channel vein w?2' silicified zone & kaol, wallrock	.014	.02	.008	.011	.022
JVJS5	Vindicator, Jefferson Co., Main Cut	Chip channel, 5', 18" vein & wallrock w/ser-qtz-dissem py in sheer zone	.016	.48	.036	.350	.410
JVJS6	Vindicator, Jefferson Co., Main Dump	Composite of entire 'disturbed' dump	.012	.18	.026	.072	.084
JMJS1	Morning, Jefferson Co., Main Dump	Vein material; qtz-py (up to 50%) with some sph & gal	.120	19.10	.590	5.720	2.190
JMJS2	Morning, Jefferson Co., Main Dump	Composite of entire dump; Fe-stained ox wallrock & clays	.034	1.98	.075	.780	.068
JHJS1	Hawkeye, Jefferson Co., Upper Dump	Partly ox bk py-chal w/bk sooty sph(?). Select from dump	.032	1.76	.240	.140	.055
JHJS2	Hawkeye, Jefferson Co., Lower Dump	Select of vein from ore bin area. Qtz, chal, py, gal, sph, Fe-carb	.030	7.64	.570	1.330	.180
JJAE1	Adelaide, Jefferson Co., Main Dump	Composite of ox Fe-stained alt (kaol+ser-qtz) wallrock	.006	.02	.018	.320	.180
JJHE1	Hector, Jefferson Co., Main Vein	25' CC across vein area & altered wallrock	.008	.40	.025	.100	.180
JJHC1	Hector Mine, Jefferson Co., Dump	Composite of mineralized portions of dump. Kgm alt to kaol-py tr qtz-pyun	.006	.48	.170	.420	.550
JJBU1	Buckeye, Jefferson Co., Main Dump	Composite of main dump, kgm alt to ser-qtz-ab py	.090	3.02	.013	1.910	.110
JJBU2	Buckeye, Jefferson Co., Lower Tailings	Composite of ox & unox, stained tailings; mostly qtz	.098	1.12	.025	.390	.062
JJBU3	Buckeye, Jefferson Co., Upper Dump	Composite; mostly unox ser-qtz-py wallrock (kgm)	.036	.94	.024	.580	.078
JJLL1	Lady Leith, Jefferson Co., Main Dumps	Select of vein; Li-sulfide (py, ab gal)	.182	11.40	.420	3.100	.200
JJLL2	Double Shaft, Jefferson Co., Trenches	Samples oxidized Fe-stained siliceous breccia from 2 trenches	.006	.38	.000	.000	.000
JJGG1	Golden Glow, Jefferson Co., Dump	Select of vein from upper dump. Qtz, bk chal, tour, py, gal, aspy(?), trsph.	.184	.28	.077	3.670	2.280
JJMS1	Morning Star, Jefferson Co., Dump	Select of silicified qtz-py breccia	.048	2.14	.021	.200	.034
JJSO1	Solar, Jefferson Co., Dump	Select sample of vein; hi sulfide (50%) w/ab py & 10% fet, ab tour, qtz	.058	3.32	.035	.510	.068
JJJE1	Jessie Mine, Jefferson Co., Dump	Select of vein material on dump	.040	2.30	.048	.270	.680
JJBB3	Basin Bell, Jefferson Co., Dump	Composite of main dump - some vein (qtz-50% py-sph), mostly kgm alt to kaol	.016	1.02	.320	.590	.120
JJAU1	Aurora Mine, Jefferson Co., Dump	Select of vein from dump. Hi sulfide - 50% py, 10% gal, sm sph	.274	5.06	.350	6.800	6.670
JJDW1	Daily West, Jefferson Co., Dump	Comp. of main sect. of dump-ox+unox vein(qtz-py)+kgm alt to qtz-ser-py+kaol-py	.014	.62	.072	1.760	.660

APPENDIX V

WATER QUALITY AND SOIL CHEMISTRY DATA TABLES
BASIN CREEK DRAINAGE

US FOREST SERVICE - DEERLODGE NATIONAL FOREST
BASIN CREEK DRAINAGE

Water Quality Results - Dissolved Concentrations

BULLION MINE

Mine/ Sample ID	Lab ID	Sample Site Location	pH (field)	Fe (mg/l)	Mn (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3 (mg/l)	F (mg/l)	Al (ug/l)	Ag* (ug/l)	As* (ug/l)	Ba* (ug/l)	Cd* (ug/l)	Cr* (ug/l)	Cu* (ug/l)	Hg* (ug/l)	Ni* (ug/l)	Pb* (ug/l)	Zn* (ug/l)
BBUS10M	92Q339	Unnamed #1, abv. conf. w/Jack Cr.	6.96	.046	.800	.2	45.8	-.10	.15	39.0	-.60	1.44	18.64	22.71	-.90	44.8	.07	5.43	.50	1968.0
BBUS20L	92Q338	Jack Cr. abv. conf. w/Unnamed #1	8.04	.033	-.002	.2	8.4	-.10	.13	27.0	-.60	4.83	10.10	-.60	-.90	3.6	.05	-2.40	.94	12.3
BBUS30M	92Q337	Jack Cr. downstream conf. w/ unnamed #1	7.47	.059	.182	.2	16.9	-.10	.17	49.0	-.60	2.56	15.64	3.98	-.90	21.7	.10	-2.40	-.40	373.3
BBUS40L	92Q309		7.09	.060	.002	.2	6.3	-.10	.11	62.6	-.60	2.22	19.87	-.60	-.90	4.9	.14	-2.40	1.21	31.7
BBUS50H	92Q308	Drainage from adit	2.58	129.0	23.2	-10.0	934.0	-.25	.64	17720.0	-.60	166.22	20.27	397.32	2.45	4698.0	.14	41.49	167.58	28230.0
BBUS60M	92Q316	Unnamed Cr. immed. below site	6.56	.231	1.0	.2	49.0	-.10	.12	86.0	-.60	1.30	14.05	20.55	-.90	71.9	.12	4.99	.53	2216.0
BBUS70M	92Q317	Mill site, downstream of caved adit	6.93	2.5	.533	.2	14.4	-.10	.39	59.0	-.60	2.34	41.37	-.60	-.90	-1.4	.12	-2.40	-.40	13.0
BBUS80L	92Q315	2nd Unnamed Cr., abv. site	6.87	.033	.004	.2	7.8	-.10	.10	83.0	-.60	1.23	34.95	-.60	-.90	2.5	.19	-2.40	-.40	17.0
BBUS90M	92Q318	Below caved adit, above mill site	7.36	.038	-.002	.2	7.8	-.10	.21	41.0	-.60	.92	31.24	-.60	-.90	-1.4	.15	-2.40	-.44	6.7
BBUSA0M	92Q340	Unnamed #2, downstream of smelter site	9.04	.031	.004	-.2	7.5	-.10	.20	31.0	-.60	1.35	37.49	-.60	-.90	-1.4	.15	-2.40	-.40	5.5
BBUSB0L	92Q341	Duplicate of Jack Cr. downstream(BBUS30M)	7.47	.054	.180	.2	17.1	-.10	.14	58.0	-.60	3.11	18.75	4.64	-.90	27.4	.07	1.42	-.40	442.8
BBUS10M-A	92Q421	Unnamed #1, abv. conf. w/Jack Cr.	6.96	.020	.860	-1.0	47.0	-.10	.07	28.0	-.60	.93	14.80	20.25	-.90	39.2	.05	5.20	-.40	1892.3
BBUS20L-A	92Q418	Jack Cr. abv. conf. w/Unnamed #1	7.63	.024	.002	-1.0	8.8	-.10	.06	45.0	.64	6.61	14.57	-.60	1.18	4.4	-.05	-2.40	.82	23.6
BBUS30M-A	92Q419	Jack Cr. downstream conf. w/ unnamed #1	7.48	.042	.168	-1.0	16.2	-.10	.06	34.0	-.60	2.83	18.74	3.83	-.90	22.8	-.05	-2.40	-.40	365.0
BBUS40L-A	92Q414	Above adit discharge	7.37	.022	.002	-1.0	6.5	-.10	.07	78.0	-.60	2.89	23.19	-.60	1.54	4.3	-.05	-2.40	1.40	28.3
BBUS60M-A	92Q413	Unnamed Cr. immed. below site	6.27	.751	1.1	-1.0	55.6	-.10	.12	38.0	-.60	1.72	25.57	74.49	-.90	141.2	-.05	7.64	1.05	2685.0
BBUS80L-A	92Q415	2nd Unnamed Cr. abv. site	7.58	.009	-.002	-1.0	7.8	-.10	.08	36.0	-.60	1.35	44.64	-.60	-.90	-1.4	-.05	-2.40	.72	6.0
BBUS90M-A	92Q420	Below caved adit, above mill site	7.60	.025	.002	-1.0	7.9	-.10	.06	19.0	-.60	1.11	35.92	-.60	-.90	-1.4	-.05	-2.40	-.40	11.5
BBUSA0M-A	92Q416	Unnamed #2, downstream of smelter site	7.58	.016	.002	-1.0	8.1	-.10	.06	39.7	-.60	1.58	42.33	-.60	-.90	-1.4	-.05	-2.40	-.40	8.7
BBUSB0L-A	92Q417	Duplicate of Jack Cr. downstream(BBUS30M-A)	7.48	.025	.173	-1.0	16.1	-.10	.08	50.0	-.60	3.18	22.14	4.45	-.90	24.9	-.05	-2.40	-.40	413.6
NO. EXCEEDED CWA-PRIMARY			-	-	-	-	-	0	0	-	-	1	0	5	0	-	0	0	1	-
NO. EXCEEDED CWA-SECONDARY			3	3	10	0	1	-	0	8	0	-	-	-	-	1	-	-	-	1
NO. EXCEEDED AQLC-ACUTE (1)			-	2	-	-	-	-	-	1	0	0	-	8/5	0	9/5	0	0	1/0	9/9
NO. EXCEEDED AQLC-CHRONIC (1)			-	-	-	-	-	-	-	1	0	0	-	9/9	0	9/9	13	0	1/1	9/9

NORTH ADA-PIERMONT

Mine/ Sample ID	Lab ID	Sample Site Location	pH (field)	Fe (mg/l)	Mn (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3 (mg/l)	F (mg/l)	Al (ug/l)	Ag* (ug/l)	As* (ug/l)	Ba* (ug/l)	Cd* (ug/l)	Cr* (ug/l)	Cu* (ug/l)	Hg* (ug/l)	Ni* (ug/l)	Pb* (ug/l)	Zn* (ug/l)
BNAS10H	92Q271	Downstream of shaft	3.14	15.5	3.1	-.1	164.0	-.05	.11	1880.0	.94	59.05	31.63	68.41	1.59	463.4	-.10	12.09	101.42	7596.0
BNAS20H	92Q276	Upstream of main dist. area (background)	6.56	.028	-.002	.2	3.2	-.05	.06	-50.0	-.60	1.43	8.25	-.60	-.90	-1.4	-.10	-2.40	.44	5.6
BNAS30H	92Q277	Below dump on Basin Creek side	3.70	4.2	.218	.2	43.2	-.05	.07	1130.0	-.60	15.40	8.41	6.08	1.00	93.7	-.10	2.71	4.32	700.5
BNAS40H	92Q278	Shaft, 10 ft. below water surface	3.92	1.300	.079	.2	25.8	-.05	.04	154.0	-.60	27.38	13.58	4.14	-.90	40.5	-.10	4.85	75.04	495.7
NO. EXCEEDED CWA-PRIMARY			-	-	-	-	-	0	0	-	-	1	0	2	0	-	0	0	2	-
NO. EXCEEDED CWA-SECONDARY			3	3	3	0	0	-	0	3	0	-	-	-	-	0	-	-	-	1
NO. EXCEEDED AQLC-ACUTE (1)			-	3	-	-	-	-	-	2	0	0	-	3/1	0	3/3	0	0	1/0	3/3
NO. EXCEEDED AQLC-CHRONIC (1)			-	-	-	-	-	-	-	3	1	0	-	3/3	0	3/3	+	0	3/2	3/3

MORNING MINE

Mine/ Sample ID	Lab ID	Sample Site Location	pH (field)	Fe (mg/l)	Mn (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3 (mg/l)	F (mg/l)	Al (ug/l)	Ag* (ug/l)	As* (ug/l)	Ba* (ug/l)	Cd* (ug/l)	Cr* (ug/l)	Cu* (ug/l)	Hg* (ug/l)	Ni* (ug/l)	Pb* (ug/l)	Zn* (ug/l)
BMOS10M	92Q275	Upper adit	6.31	.030	.008	.2	10.7	-.05	.05	-50.0	-.60	10.28	6.33	4.20	-.90	77.6	-.10	-2.40	-.40	384.9
BMOS20M	92Q274	Lower adit	6.31	.480	.480	.1	27.7	-.05	.05	-50.0	-.60	9.69	16.02	8.86	-.90	253.9	-.10	2.40	-.40	1277.0
NO. EXCEEDED CWA-PRIMARY			-	-	-	-	-	0	0	-	-	0	0	1	0	-	0	0	0	-
NO. EXCEEDED CWA-SECONDARY			2	1	1	0	0	-	0	0	0	-	-	-	-	0	-	-	-	0
NO. EXCEEDED AQLC-ACUTE (1)			-	0	-	-	-	-	-	0	0	0	-	2/1	0	2/2	0	0	0	2/2
NO. EXCEEDED AQLC-CHRONIC (1)			-	-	-	-	-	-	-	0	+	0	-	2/2	0	2/2	+	0	0	2/2

US FOREST SERVICE - DEERLODGE NATIONAL FOREST
BASIN CREEK DRAINAGE

Water Quality Results - Dissolved Concentrations

Mine/ Sample ID	Lab ID	Sample Site Location	pH (field)	Fe (mg/l)	Mn (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3 (mg/l)	F (mg/l)	Al (ug/l)	Ag* (ug/l)	As* (ug/l)	Ba* (ug/l)	Cd* (ug/l)	Cr* (ug/l)	Cu* (ug/l)	Hg* (ug/l)	Ni* (ug/l)	Pb* (ug/l)	Zn* (ug/l)
VINDICATOR MINE																				
BVIS10M	92Q264	Adit discharge, sidehill	7.37	.072	.052	.2	13.9	.06	.14	61.5	-.60	1.88	2.81	4.69	-.90	44.3	-.10	-2.40	5.57	293.0
BVIS40M	92Q265	Flow from upper mine area to lower area	7.28	.019	-.002	.2	30.7	.06	.11	23.5	-.60	4.98	4.59	1.14	-.90	2.5	-.10	-2.40	-.40	162.3
BVIS50M	92Q266	Below falls, disch. below main workings	7.90	.384	.144	.2	20.9	-.05	.12	47.1	-.60	29.29	15.10	-.60	1.11	1.7	-.10	1.31	1.45	23.8
BVIS60M	92Q267	Duplicate of BVIS50M	7.90	.344	.141	.2	21.1	-.05	.15	35.0	-.60	26.71	15.42	-.60	-.90	2.1	-.10	2.67	1.46	22.2
NO. EXCEEDED CWA-PRIMARY			-	-	-	-	-	0	0	-	-	0	0	0	0	-	0	0	0	-
NO. EXCEEDED CWA-SECONDARY			0	2	3	0	0	-	0	1	0	-	-	-	-	0	-	-	-	0
NO. EXCEEDED AQLC-ACUTE (1)			-	0	-	-	-	-	-	0	0	0	-	1/0	0	1/1	0	0	0	2/1
NO. EXCEEDED AQLC-CHRONIC (1)			-	-	-	-	-	-	-	0	+	0	-	2/1	0	1/1	+	0	1/0	2/1
HAWKEYE MINE																				
BHES10L	92Q307	Seepage above mine workings	6.87	.063	.012	.2	17.0	.46	.14	33.3	-.60	2.78	8.18	.78	-.90	-1.4	.10	-2.40	1.59	58.2
BHES20L	92Q299	Jack Cr. abv. mine site	7.80	.028	.004	.2	7.0	-.05	.05	36.8	-.60	2.73	8.40	.60	-.90	5.5	.14	-2.40	-.40	31.1
BHES30M	92Q298	Seepage at base of main dump	6.99	.247	3.7	5.0	21.9	.47	.09	34.0	-.60	11.09	36.92	-.60	3.53	-1.4	.12	6.43	.49	152.0
BHES40L	92Q300	Jack Cr. below site	7.85	.025	.007	.2	9.1	-.05	.05	-50.0	-.60	3.56	8.49	-.60	-.90	4.1	-.05	-2.40	.42	11.6
NO. EXCEEDED CWA-PRIMARY			-	-	-	-	-	0	0	-	-	0	0	0	0	-	0	0	0	-
NO. EXCEEDED CWA-SECONDARY			0	0	1	0	0	-	0	0	0	-	-	-	-	0	-	-	-	0
NO. EXCEEDED AQLC-ACUTE (1)			-	0	-	-	-	-	-	0	-	0	-	0	0	0	0	0	0	1/0
NO. EXCEEDED AQLC-CHRONIC (1)			-	-	-	-	-	-	-	0	+	0	-	0	0	0	3	0	0	1/0
BUCKEYE-ENTERPRISE																				
BBAS10H	92Q346	Adit discharge, eastern part of site	3.18	137.0	28.1	5.4	678.0	-.10	.46	12270.0	-.60	3438.05	22.24	119.50	2.79	609.0	-.05	19.40	1173.66	15020.0
BBAS20L	92Q345	Basin Cr. upstream of mine site	6.71	.071	.005	.2	1.5	-.10	.08	158.0	-.60	2.36	12.62	-.60	-.90	3.7	.18	-2.40	-.40	10.7
BBAS30H	92Q344	Conf sml seeps-base of main wste rock dump	2.77	48.9	36.6	4.2	645.0	-.10	.49	40000.0	.72	235.31	10.31	156.82	2.36	1879.0	.18	15.41	128.37	15730.0
BBAS40L	92Q355	Basin Cr. @bridge bel. lrg.tailings wash	7.87	.164	.165	.4	8.1	.05	.08	183.0	-.60	20.16	12.59	1.54	-.90	12.9	.11	2.37	11.20	152.5
NO. EXCEEDED CWA-PRIMARY			-	-	-	-	-	0	0	-	-	2	0	2	0	-	0	0	2	-
NO. EXCEEDED CWA-SECONDARY			2	2	3	0	2	-	0	4	0	-	-	-	-	1	-	-	-	2
NO. EXCEEDED AQLC-ACUTE (1)			-	2	-	-	-	-	-	2	0	1	-	2/2	0	2/2	0	0	2/1	3/2
NO. EXCEEDED AQLC-CHRONIC (1)			-	-	-	-	-	-	-	4	0	2	-	3/2	0	3/3	3	0	3/3	3/2
LADY LEITH MINE																				
BLLS10L	92Q358	Unnamed Cr upstrm eastern portion site	6.82	.011	-.002	.3	4.9	.03	.06	-20.0	-.60	3.81	6.66	-.60	-.90	-1.4	-.05	-2.40	.54	5.7
BLLS20H	92Q362	Adit seepage, eastern portion site	3.35	2.0	1.3	-1.0	101.5	-.10	.14	2170.0	-.60	2.08	16.13	14.42	-.90	37.1	-.05	8.82	218.24	1282.0
BLLS30L	92Q359	Unnamed Cr dwnstrm E part & up W part	7.94	.013	.007	.4	6.2	.05	.04	38.2	-.60	5.10	9.65	-.60	-.90	-1.4	.06	-2.40	1.08	37.2
BLLS40H	92Q360	Adit seepage, W part of mine site	3.34	.122	.813	.2	41.5	-.05	.07	-20.0	-.60	10.80	8.35	-.60	-.90	-1.4	-.05	1.43	-.40	312.6
BLLS50L	92Q361	Unnamed Cr dwnstrm of mine site	7.69	.029	.021	-.5	6.9	-.05	.04	41.5	-.60	4.60	8.01	-.60	-.90	-1.4	-.05	-2.40	3.19	33.0
NO. EXCEEDED CWA-PRIMARY			-	-	-	-	0	0	0	1	0	0	0	1	0	-	0	0	1	-
NO. EXCEEDED CWA-SECONDARY			2	1	2	0	-	-	0	-	-	-	-	-	-	0	-	-	-	0
NO. EXCEEDED AQLC-ACUTE (1)			-	1	-	-	-	-	-	1	0	0	-	1/1	0	1/1	0	0	1/1	2/2
NO. EXCEEDED AQLC-CHRONIC (1)			-	0	-	-	-	-	-	1	0	0	-	1/1	0	1/1	+	0	1/1	2/2

BASIN CREEK DRAINAGE

Water Quality Results - Dissolved Concentrations

WINTER CAMP

Mine/ Sample ID	Lab ID	Sample Site Location	pH (field)	Fe (mg/l)	Mn (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3 (mg/l)	F (mg/l)	Al (ug/l)	Ag* (ug/l)	As* (ug/l)	Ba* (ug/l)	Cd* (ug/l)	Cr* (ug/l)	Cu* (ug/l)	Hg* (ug/l)	Ni* (ug/l)	Pb* (ug/l)	Zn* (ug/l)
BWCS10L	92Q431	Joe Bowers Creek below adit discharge	7.34	.016	.003	-.1	9.7	-.10	.04	30.0	-.60	.97	16.19	-.60	-.90	2.1	-.05	-2.40	1.23	14.1
NO. EXCEEDED CWA-PRIMARY			-	-	-	-	-	0	0	-	-	0	0	0	0	-	0	0	0	-
NO. EXCEEDED CWA-SECONDARY			0	0	0	0	0	-	0	0	0	-	-	-	-	0	-	-	-	0
NO. EXCEEDED AQLC-ACUTE (1)			-	0	-	-	-	-	-	0	0	0	-	0	0	0	0	0	0	0
NO. EXCEEDED AQLC-CHRONIC (1)			-	-	-	-	-	-	-	0	0	0	-	0	0	0	+	0	0	0

HECTOR MINE

Mine/ Sample ID	Lab ID	Sample Site Location	pH (field)	Fe (mg/l)	Mn (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3 (mg/l)	F (mg/l)	Al (ug/l)	Ag* (ug/l)	As* (ug/l)	Ba* (ug/l)	Cd* (ug/l)	Cr* (ug/l)	Cu* (ug/l)	Hg* (ug/l)	Ni* (ug/l)	Pb* (ug/l)	Zn* (ug/l)
BHFS10L	92Q432	Unnamed Cr upstrm of mine site	8.43	.004	-.002	1.0	46.1	-.10	.17	-20.0	-.60	1.04	17.95	.61	-.90	-1.4	.09	-2.40	-.40	103.5
BHFS20L	92Q433	Unnamed Cr dwnstrm of two upstream adits	8.41	.009	.003	1.1	46.1	-.10	-.10	-20.0	-.60	1.11	23.18	.77	-.90	1.8	-.05	-2.40	.66	87.1
BHFS30L	92Q434	Unnamed Cr flow over waste rock dump	8.50	.009	.004	1.1	26.5	-.10	-.10	-20.0	-.60	.91	43.48	-.60	-.90	1.1	-.05	-2.40	-.40	8.1
BHFS40L	92Q435	Unnamed Cr dwnstrm where Cr branches join	7.81	.008	.028	1.1	44.8	-.10	-.10	-20.0	-.60	-.70	24.93	.94	-.90	1.9	-.05	-2.40	-.40	168.7
BHFS50L	92Q436	Southern end site, upstrm wste dump & adit	8.15	.006	.002	1.0	25.3	-.10	.24	21.0	-.60	1.18	59.90	-.60	-.90	.7	-.05	-2.40	-.40	8.1
BHFS60L	92Q437	Unnamed Cr ddwnstrm of wste dump & adit	8.21	.007	.002	1.1	26.2	-.10	.22	24.0	-.60	.80	53.23	-.60	-.90	.7	-.05	-2.40	-.40	29.2
BHFS70L	92Q438	Duplicate of BHFS60L	8.21	.004	-.002	1.1	26.1	-.10	.22	-20.0	-.60	.63	54.82	-.60	-.90	-1.4	-.05	-2.40	-.40	6.1
NO. EXCEEDED CWA-PRIMARY			-	-	-	-	-	0	0	-	-	0	0	0	0	-	0	0	0	-
NO. EXCEEDED CWA-SECONDARY			0	0	0	0	0	-	0	0	0	-	-	-	-	0	-	-	-	0
NO. EXCEEDED AQLC-ACUTE (1)			-	0	-	-	-	-	-	0	0	0	-	0	0	0	0	0	0	1/0
NO. EXCEEDED AQLC-CHRONIC (1)			-	-	-	-	-	-	-	0	0	0	-	0	0	0	1	0	0	1/0

BASIN CREEK

Mine/ Sample ID	Lab ID	Sample Site Location	pH (field)	Fe (mg/l)	Mn (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3 (mg/l)	F (mg/l)	Al (ug/l)	Ag* (ug/l)	As* (ug/l)	Ba* (ug/l)	Cd* (ug/l)	Cr* (ug/l)	Cu* (ug/l)	Hg* (ug/l)	Ni* (ug/l)	Pb* (ug/l)	Zn* (ug/l)
BBCS10L	92Q463	Jack Cr upstrm conf with Basin Cr	7.79	.067	.094	-1.0	17.0	-.10	.16	48.0	-.60	4.95	25.86	3.72	-.90	16.4	.07	-2.40	-.40	205.6
BBCS20L	92Q461	Basin Cr upstrm of conf with Jack Cr	7.81	.076	.004	3.5	6.2	-.10	.14	65.0	-.60	8.43	20.41	-.60	-.90	2.9	-.05	-2.40	1.00	17.1
BBCS30L	92Q462	Basin Cr below conf with Jack Cr	7.38	.073	.035	2.1	10.2	-.10	.12	55.0	-.60	6.58	22.58	1.33	-.90	8.9	.12	-2.40	.64	98.4
BBCS40L	92Q464	Basin Cr abv conf Spring Cr,abv Basin	7.82	.222	.021	1.2	8.9	-.10	.14	44.0	-.60	14.51	21.88	.84	-.90	7.8	-.05	-2.40	.92	54.7
NO. EXCEEDED CWA-PRIMARY			-	-	-	-	-	0	0	-	-	0	0	0	0	-	0	0	0	-
NO. EXCEEDED CWA-SECONDARY			0	0	0	0	0	-	0	2	0	-	-	-	-	0	-	-	-	0
NO. EXCEEDED AQLC-ACUTE (1)			-	0	-	-	-	-	-	0	0	0	-	0	0	0	0	0	0	1/0
NO. EXCEEDED AQLC-CHRONIC (1)			-	-	-	-	-	-	-	0	0	0	-	2/1	0	1/1	2	0	0	1/1

A minus (-) sign before a number means the concentration is less than the Method Detection Limit (MDL), for that analyte.
Value shown is the MDL, per SOW 200.8.

* Critical elements, lab data has been qualified according to QAPP.

(1) Where two values are listed, criteria is hardness dependent.
Values are calculated on hardness of 100 and 200 mg/l, respectively.

\+ MDL is above Chronic Aquatic Life Criteria.

US FOREST SERVICE - DERRLODGE NATIONAL FOREST
BASIN CREEK DRAINAGE

Soil Analyses - Lab Qualified
(Concentrations mg/kg)

Mine/ Sample ID	Lab ID	Ag	C	Q	As	C	Q	Ba	C	Q	Cd	C	Q	Cr	C	Q	Cu	C	Q	Hg	C	Q	Ni	C	Q	Pb	C	Q	Zn	C	Q
VINDICATOR MINE																															
BVID10M	92S268	.89	B		25.87			24.76	B		1.47	B		4.04	B		38.00	B		.45			3.86	B		97.27			151.04		
BVID20M	92S269	.84	B		175.71			7.42	B		1.41	B		.00	U		26.71	B		.45			2.97	B		107.83			94.28		
NORTH ADA-PIERMONT																															
BNAD10H	92S280	3.40	B		1780.00			27.11	B		.31	B		2.78	B		56.59			.45			.00	U		1673.00			154.50		
BNAD10H	92S281	.00	U		.00	U		.00	U		.56	B		.00	U		.00	U		.19	B		.00	U		.00	U		14.94	B	
HAWKEYE MINE																															
BHED10M	92S304	.43	B		36.21			40.60	B		1.40	B		4.73	B		29.57	B		.26	B		7.87	B		42.08			134.53		
BHED20M	92S303	1.61	B		97.62			22.82	B		3.21	B		3.55	B		61.84			.50			6.07	B		123.22			309.57		
BULLION MINE																															
BBUD10H	92S311	30.92			7835.00			53.66	B		8.90	B		2.70	B		309.47			2.37			2.01	B		5356.00			1937.00		
BBUD20H	92S312	5.14	B		794.20			40.94	B		1.30	B		.00	U		49.19	B		.70			1.37	B		504.37			86.56		
BBUD30L	92S320	33.56		N	10979.29			85.00	B	N	8.13	B	N	4.07	B	N	398.73		N	1.71			1.23	B	N	2445.77			1055.62		
BBUD40L	92S321	.00	U	N	5.82	B		.00	U	N	.51	B	N	.00	U	N	.00	U	N	.21	B		.94	B	N	3.27	B		.00	U	
BBUD50L	92S322	.00	U	N	.00	U		.00	U	N	.58	B	N	.00	U	N	.00	U	N	.25	B		.00	U	N	.00	U		6.92	B	
BUCKEYE-ENTERPRISE																															
BBAD10H	92S347	58.66		N	4568.00			140.98	B	N	5.43	B	N	2.40	B	N	238.40		N	.68			.00	U	N	4029.00			117.00		
BBAD20H	92S356	28.17		N	7698.00			59.93	B	N	3.42	B	N	5.95	B	N	149.43		N	1.10			3.86	B	N	5841.00			259.75		
BBAD30H	92S357	22.22		N	9173.00			63.20	B	N	1.99	B	N	4.02	B	N	95.56		N	.83			2.82	B	N	3946.00			137.51		
LADY LEITH MINE																															
BLLD10H	92S364	3.02	B	N	264.71			47.78	B	N	1.49	B	N	4.42	B	N	20.78	B	N	.54			4.30	B	N	315.73			190.09		
BLLD20H	92S363	16.14	B	N	3146.00			29.73	B	N	4.27	B	N	1.33	B	N	76.68		N	.63			5.16	B	N	2404.00			729.80		
BLLD30H	92S365	.00	U	N	356.01			77.84	B	N	9.91	B	N	8.91	B	N	294.94		N	.65			4.01	B	N	166.31			628.49		
BASIN BELLE MINE																															
BBB10H	92S428	12.22	B	N	33.31			72.06	B	N	6.43	B	N	4.18	B	N	1429.32		N	.96	B		3.15	B	N	1825.01			1312.84		
HECTOR MINE																															
BHFW10H	92S429	.00	U	N	59.21			24.41	B	N	3.94	B	N	2.82	B	N	89.74		N	1.59			2.30	B	N	831.79			880.63		
BHFW20H	92S467	9.99	B	N	61.93			27.34	B	N	6.39	B	N	2.58	B	N	345.38		N	1.49			.52	U	N	483.98			1374.15		
BHFW30L	92S430	.00	U	N	.00	U		.00	U	N	.00	U	N	.48	U	N	.00	U	N	.40			.00	U	N	.00	U		1.59	U	
DAILY WEST MINE																															
BDWD10H	92S468	.00	U	N	44.13			47.70	B	N	1.08	B	N	2.74	B	N	89.83		N	1.02			.00	U	N	2325.81			251.17		
BDWW20H	92S469	4.11	B		65.52			28.00	B		.79	B		1.12	U	N	132.50		N	1.21			.00	U	N	2930.41			366.04		
BDWD20H	92S470	5.44	B		111.68			73.79	B		.45	B	N	1.87	B		140.75			.55			.00	U		7519.57			390.45		

APPENDIX VI

DATABASE FIELDS
MBMG-USFS AIM PROGRAM

Sites Table
Id Number
Name
Alt Name
Mine District
County
Mrds #
Amli#
Mils#
Latitude
Longitude
Township
Range
Section
Tract
Utm Northing
Utm Easting
Utm Zone
Average Elevation
Elevation Units
Land Owner
1:250 Map
!:100 Map
!:24 Map
Property Type
Disturbance Type
Current Status
Mine Method
Map
Scale
Year of Production
Process Method
Process Capacity
Published Reserves
Measured
Published Reserves
Indicated
Published Reserves
Geological
Description of Workings
Depth of Workings
Width of Workings
Length of Workings
Disturbed Area of
Workings
Surface Map
Surface Agency
Surface Address
Surface City
Surface Zip
Underground Map
Underground Agency
Underground Address
Underground City
Underground Zip
Date of Update
Longview
Plan View
Bibliography

Mines Table
Id
Type Opening
Latitude
Longitude
Utm Northing
Utm Easting
Utm Zone
Waste Production Rate
Ore Production Rate
Opening Type
Condition
Size Open Length
Sixe Open Width
Status Rank
Elevation
Elevation Unit

Mine Open Table
Id
Type
Condition
Ground Water
Photo
Ownership
Comments

Wastes Table
Id
Type Waste
Rock Type
Au Oz
Ag Oz
Cu Lb
Pb Lb
Zn Lb
As Lb
Tons
Mineralized

Agency Table
Id
Agency
Division
District/Area
Ftract
Fwatershed Code
Forest
District
Owner
Own Impacts
Report

Forest Table
Id
Investigator
Date
Photos
Access
Nearest Wetlands
Drainage Basin
Waste Contact Stream
Nearest Surface Intake
Num of Surface Intakes
Uses of Surface Intake
Nearest Well
Number of Wells 4 Mi
Uses of Wells
Nearest Dwelling
Number Months Occupied
Number Houses 2 Miles
Recreational Usage
Nearest Rec Area
Name of Area
Hmo Adit
Hmo Wall
Hmo Struct
Hmo Chem
Hmo Solid
Hmo Explosives
Sensitive Enviornments
Pop Within .25 Miles
Pop Within .5 Miles
Pop Within 1 Miles
Pop Within 2 Miles
Pop Within 3 Miles
Pop Within 4 Miles
Public Interest

Fwastes Table
Id
Type
Wind Erosion
Vegitation
Surface Drainage
Stability
Location / Floodplain
Distance to Stream
Photos

Fcontamination
Id
Type of Contamination
Estimated Quantity

Fstructure
Id
Type
Condition

Samples
Id
Sample Id
pH
Sc
Temp
Flow Rate
Flow Units
Flow Method
Soil Interval
Remarks

Water
Id
Sample Id
Source
Date
Sampler
Location Rel Stream
Stream
Sedimentation
Photo
Indicators of Metal

Soil
Id
Sample Id
Type
Sampler
Sample Type
Source
Indicator of
Contamination
Photos