Montana Bureau of Mines and Geology
MBMG No. 379

Abandoned/Inactive Mines of the Southern Beaverhead-Deerlodge National Forest

by

MBMG
Richard K. Marvin
Phyllis A. Hargrave
Jeff D. Lonn
Ginette N. Abdo
John J. Metesh

USFS
Katie Bump

September 1998

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

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. The Montana Bureau of Mines and Geology (MBMG), a research department of Montana Tech of The University of Montana, collects and distributes information about the geology, mineral resources, and ground water of Montana. The USFS and 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.

The first Forest inventoried was the Deerlodge National Forest. The results of this inventory are presented in five volumes: Volume I - Basin Creek, Volume II - Cataract Creek, Volume III - Flint Creek and Rock Creek, Volume IV - Upper Clark Fork River, and Volume V - Jefferson River. The second Forest inventoried was the Helena National Forest. The results of this inventory are presented in Volume I - Upper Missouri River and Volume II - Blackfoot and Little Blackfoot River Drainages. The third Forest inventoried was the Beaverhead National Forest, which now has been combined with the Deerlodge National Forest to the north to form the Beaverhead-Deerlodge National Forest. The results of the inventory for the Beaverhead National Forest are presented in this single volume titled Southern Beaverhead-Deerlodge National Forest.

1.1 PROJECT OBJECTIVES

In 1992, the USFS and MBMG entered into an agreement to identify and characterize abandoned and inactive mines on or affecting National Forest System lands in Montana. The objectives of the 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 have 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 therefore can 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 (MCA 20-25-212), 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 purpose of this study, mines, mills 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 ground water, 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 (ground-water discharges or surface runoff) either by being dissolved, suspended, or carried as part of the bedload. When sulfides are present, acid can form which 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 *et al.* (1975) identified six components that govern the formation of metal-laden acid mine waters:

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 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 is formed by the oxidation and dissolution of sulfides, particularly pyrite (FeS_2) and pyrrhotite ($Fe_{1-x}S$). Other sulfides play a minor role in acid generation. Oxidation of iron sulfides forms sulfuric acid (H_2SO_4), sulfate ($SO_4^{=}$), and reduced iron (Fe^{2+}). Mining of sulfide-bearing rock exposes the sulfide minerals to atmospheric oxygen and oxygen-bearing water. Consequently, the sulfide minerals are oxidized and acid mine waters are produced.

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 marcasite (FeS_2 - a dimorph of pyrite).

Once formed, the acid can dissolve other sulfide minerals such as arsenopyrite (FeAsS), chalcopyrite ($CuFeS_2$), galena (PbS), tetrahedrite [$(Cu,Fe)_{12}Sb_4S_{13}$], and sphalerite [(Zn,Fe)S] to produce high concentrations of copper, lead, zinc, and other metals. Also, aluminum can be leached by the dissolution of aluminosilicate minerals common in soils and rock.

1.3.2 Solubility of Selected Metals

The solubility of a metal is governed by the solubility products of the minerals in which the metal occurs and by the pH and redox potential (Eh) of the solution. Other factors affecting the concentration of a metal may include biochemical processes, sorption-desorption properties, presence of colloids, and concentration of complexing ions. A brief discussion on the occurrence and solubility of selected metals is presented below.

Aluminum is one of the most common elements in rock-forming minerals such as feldspars, micas, and clays. Its solubility in acidic water usually can be calculated using the solubility product of alunite [$KAl_3(SO_4)_2(OH)_6$] or gibbsite [$Al(OH)_3$], depending on sulfate concentration and pH. Water having a pH below 4.0 may contain several hundred to several thousand milligrams of aluminum per liter. At near-neutral pH, water usually contains less than 1.0 mg/L aluminum.

Arsenic is a nonmetallic element often associated with sulfide ore deposits. Common sulfide minerals containing arsenic include arsenopyrite (FeAsS), enargite (Cu_3AsS_4), and/or tennantite ($Cu_{12}As_4S_{13}$). It 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.

Cadmium is often associated with zinc and copper ore minerals. The equilibrium solubility of the carbonate species octavite ($CdC0_3$) was suggested by Hem (1972) as a possible limit for concentrations in natural water, but values observed are usually well below saturation. Cadmium nay be coprecipitated with manganese oxide or adsorbed on mineral surfaces. In water with low partial pressures of H_2S, $CdCO_3$ is easily reduced to CdS.

Copper is present in many ore minerals, including chalcopyrite ($CuFeS_2$), bornite (Cu_5FeS_4), chalcocite (Cu_2S), and tetrahedrite ($Cu_{12}Sb_4S_{13}$). It also occurs as free native metal. Its solubility in natural waters is controlled primarily by the carbonates malachite [$Cu_2(OH)_2CO_3$] and azurite[($Cu_3(OH)_2(CO_3)_2$] when CO_3 is available in sufficient concentrations. Copper concentrations may be as large as several hundred milligrams per liter in acid mine drainage.

Iron is the second most abundant metallic element in the Earth's outer crust. Minerals with high iron content include pyrite (FeS_2), pyrrhotite ($Fe_{1-x}S$), hematite (Fe_2O_3), magnetite (Fe_3O_4), siderite ($FeCO_3$), olivine [$(Mg,Fe)_2SiO_4$], biotite [$K(Mg, Fe)_3(Al,Fe)Si_3O_{10}(OH,F)_2$], and the pyroxene and amphibole groups. Iron also is present in oxyhydroxide precipitates such as limonite that often form brown-orange coatings on streambeds in areas affected by AMD. The solubility of iron depends strongly on the redox potential and pH of the water. High concentrations of dissolved iron can occur when ferric oxyhydroxides are reduced or ferrous sulfides are oxidized. The solubility of iron increases as pH decreases. If present, other metals such as copper, lead, cadmium, zinc, and aluminum often co-precipitate or adsorb onto ferric oxyhydroxide surfaces (Stumm and Morgan 1981).

Lead occurs in the common ore mineral galena (PbS) and also is present in anglesite ($PbSO_4$) and cerrusite ($PbCO_3$). The principal dissolved inorganic forms of lead are the free ion Pb^{2+}, hydroxide complexes, and carbonate and sulfate ion pairs (Hem, 1985). As with other metals, concentrations in solution increase with decreasing pH. In the western United States, lead concentrations in surface water are typically less than 1µg/L except in urban and mining lead concentrations in surface water are typically less than 1µg/L except in urban and mining impacted areas.

Manganese is a common metal in the Earth's crust and often substitutes for iron, magnesium, or calcium in silicate minerals. Minerals with high manganese content include pyrolusite (MnO_2), manganite [MnO(OH)], and rhodochrosite ($MnCO_3$). The chemistry of manganese is somewhat like that of iron in that both metals participate in redox processes. In natural-water systems, dissolved manganese is typically in the form Mn^{2+}. The complex ion $MnHCO_3^+$ can be important in solutions having bicarbonate concentrations near 1,000 mg/L as HCO3; the $MnSO_4$(aq) ion pair may be important in solutions in which sulfate activity is greater than a few hundred milligrams per liter. When water bearing high concentrations of dissolved manganese mixes with normal stream water, much of the manganese precipitates and forms a black oxide coating on the streambed.

Mercury is found as cinnabar (HgS) in low temperature hydrothermal ores and as native mercury in areas where it was used in the processing of gold ores. It readily vaporizes under atmospheric conditions and thus is most often found in concentrations well below the 25 µg/L equilibrium concentration. Mercury may form chloride or hydroxide complexes depending on pH and total chloride concentration. Organic complexes such as methyl mercury, $HgCH_3^+$, can be produced by methane-generating bacteria in contact with native mercury in stream and lake sediments (Wood *et.al* 1968). In this form the element can become concentrated in successive steps up the food chain so that fish that live in mildly contaminated environments may contain too much mercury to be used safely for food.

Silver substitutes for other cations in common ore minerals such as tetrahedrite and galena and is found in the sulfide minerals argentite (Ag_2S), pyrargyrite (Ag_3SbS_2), and proustite (Ag_3AsS_3). Metallic silver and silver chloride or sulfide solids usually limit the solubility of silver to much less than 10 µg/L in most natural water.

Zinc occurs in the sulfide mineral sphalerite (ZnS). It has only one significant oxidation state, Zn^{2+}, and tends to be very soluble in natural water. The solubility is controlled by the formation of zinc hydroxide and zinc carbonate. At pH greater than 8, the equilibrium concentration of zinc in waters with a high bicarbonate content is less than 100 µg/L. At pH less than 5, the solubility is strongly affected by sulfate concentrations. Thus, production of sulfate from AMD may ultimately control solubility of zinc in water affected by mining. Streams affected by AMD commonly have zinc concentrations higher than 100 µg/L.

(General references: Hem 1985; Lindsay 1979; Mottana *et. al* 1978; Stumm and Morgan 1981)

1.3.3 Use of pH and SC to Identify Problems

In many mine evaluation studies, pH and specific conductance (SC) have been used to distinguish "problem" mine sites from those that have no adverse water-related impacts. The distinguish "problem" mine sites from those that have no adverse water-related impacts. The general assumptions are that low pH (<6.8) and high SC indicate a problem and that neutral or higher pH and low SC indicate no problem.

Limiting data collection only 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 high pH (>7), and its concentration is strongly dependent on the presence of dissolved iron. Cadmium and lead also may exceed standards in waters with pH values within acceptable limits.

Reliance on SC as an indicator of site conditions also can lead to erroneous conclusions. SC is a measure of overall ion concentration in the water; it is not specific to just heavy metals. Further, without having a “statistically significant” amount of SC data for a study area, it is hard to define what constitutes a high or low SC value.

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-metal 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 the inventory effort by completing a literature search for all known mines in Montana. The MBMG plotted the published locations of the mines on USFS maps. From the maps, the MBMG developed an inventory of all known mines that are on or could affect National Forest System lands in Montana. The following data sources were used:

1) the Mineral Industry Location System (MILS) database compiled by the U.S. Bureau of Mines,
2) the Mineral Resource Data Systems (MRDS) database compiled by the 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,
6) recent USGS/USBM mineral resource potential studies of proposed wilderness areas, and
7) MBMG mineral property files.

In addition, during field reconnaissance trips, 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

The MBMG and USFS developed screening criteria (table 1.1) that they used to determine if a site had the potential to release hazardous substances or posed other environmental or safety hazards. When possible, the screening criteria table was filled out in the office based on personal knowledge of the site or published information. If any of the answers to the criteria were "yes" or unknown, the site was visited. If all of the answers were no, then the site was screened out.

Only lode-type metal mines and their associated mills were screened for this inventory. Placer mines, coal mines, gravel pits, limestone and building stone quarries, and phosphate mines generally were excluded. Placer deposits are generally oxidized and not likely to contain high concentrations of heavy metals. Limestone and building stone quarries, gravel pits, and phosphate mines also were considered to be free of anomalous concentrations of hazardous substances.

Table 1.1 Screening criteria for the abandoned/inactive mines program.

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

Note: The screening criteria table is the first page of the inventory Field Form (appendix I).

1.4.3 Field Screening

All sites that could not be screened out, as described above, were visited by an MBMG geologist. All visits were conducted in accordance with a Health and Safety Plan which was developed for each Forest. The geologist gathered information on environmental degradation, hazardous mine openings, presence of historic structures, and land ownership.

The geologist also defined the site location using conventional field methods. The latitude/longitude and township-range-section-tract coordinates of the site were determined from a 7.5-minute quadrangle map. Tract was assigned using a sequence of four letters (A, B, C, and D) to denote quadrants within a section (figure 1.1). The first letter denotes the 160-acre tract; the second, the 40-acre tract; the third, the 10-acre tract; and the fourth, the 2.5-acre tract. The letters are assigned in a counterclockwise direction, beginning in the northeast quadrant. If two or more sites were located within the same 2.5-acre tract, numbers were assigned as suffixes. It is important to note that the order of quarter-tract designations is exactly reversed from that commonly used by surveyors; here the order begins with the largest quarter and progresses to the smallest.

At sites for which little geologic or mining data existed, the geologist characterized the geology, collected samples for geochemical analysis, evaluated the deposit, and described workings and processing facilities present. At this point, if the site had no potential environmental problems, a brief summary statement was prepared (see appendix III), and the site was not investigated further.

However, if a potential adverse environmental impact to Forest Service-administered land was noted, the geologist went on to map the site with a tape and compass. The map showed locations of the workings, exposed geology, dumps, tailings, surface water, and geologic sample locations. The map and a brief description of the site were then submitted to a hydrogeologist who collected water and soil samples to evaluate the environmental impact of the site.

1.4.3.1 Geologic Samples

When the geologist visited a site, samples often were collected to characterize the economic geology of the deposit and to examine the value and metal content of dumps and/or tailings. 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.

Assay results are presented in appendix IV. Note that samples were taken only to provide some information on the types of metals present and to give a rough indication of their concentrations. Too few samples were collected to provide reliable estimates of tonnages, grades, or economic value of recoverable metals.

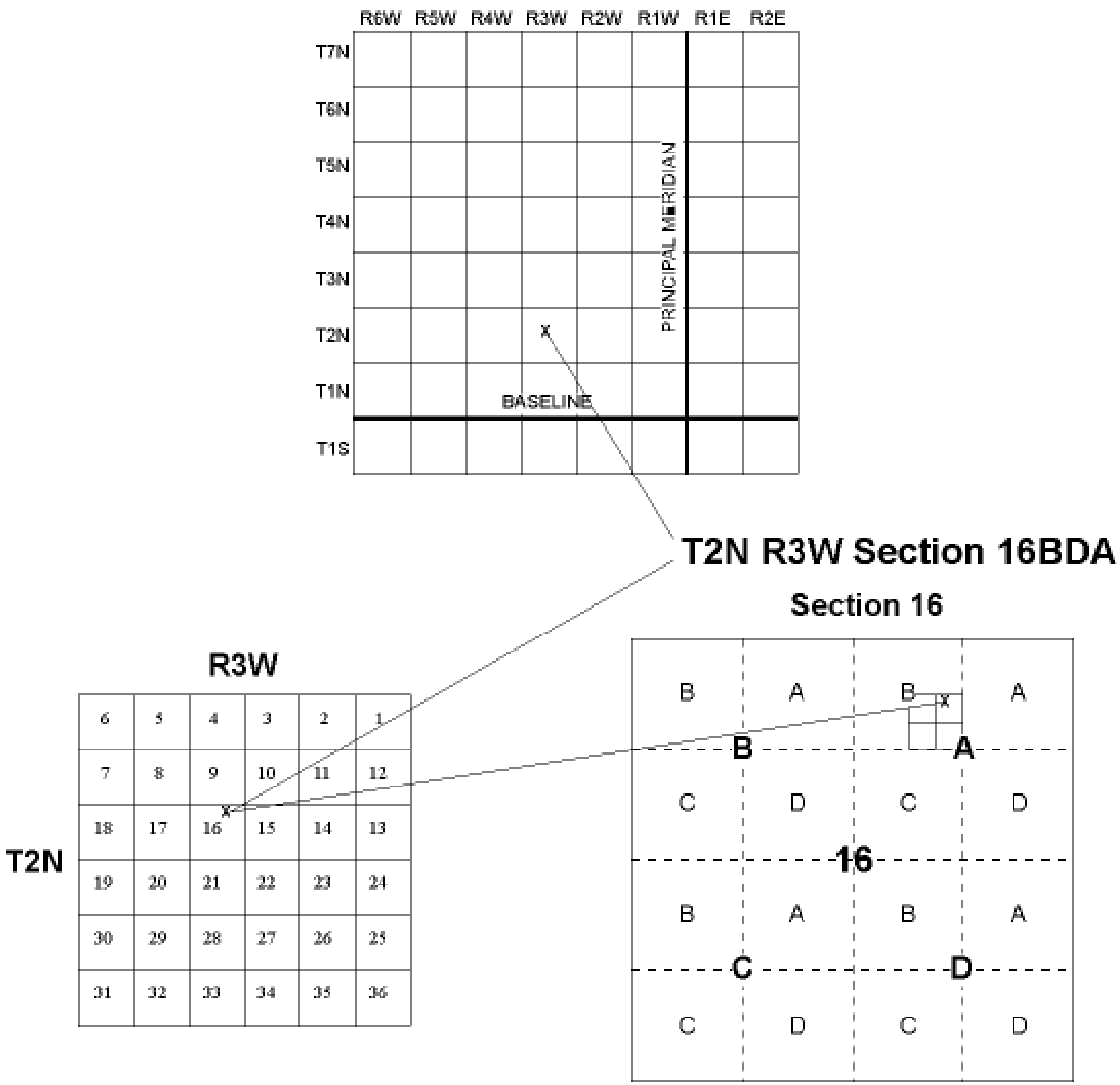

Figure 1.1 Explanation of township-range-section-tract.

1.4.4 Assessment of Environmental Impacts

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 there was a potential for significant environmental problems. The hydrogeologist then determined whether sampling was warranted and, if so, selected soil and water sampling locations.

1.4.4.1 Selection of Sample Sites

The hydrogeologist selected and marked water and soil sampling locations based on field parameters (SC, pH, Eh, etc.), observations (e.g. erosion and staining of soils/streambeds), and property ownership. Sample locations were chosen 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 and downstream of the site and at any discharge points associated with the site. Soil sample locations were selected in areas where waste material was obviously impacting undisturbed materials. In most cases, a composite sample was collected across a soil/waste mixing area. All sample sites were located so as to assess conditions on National Forest System lands; therefore, sample sites were located on NFS lands to the extent that ownership boundaries were known. Impacts on private land were only assessed visually.

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 on a topographic map and described in the SAP; each sample site was given a unique seven character identifier based on its location, sample type, interval and relative concentration of dissolved constituents. The characters were defined 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 observations.

1.4.4.3 Collection of Water and Soil Samples

Sampling crews collected soil and water samples and took field measurements (e.g. pH, flow rate) 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 this project. The project hydrogeologist determined the validity of such data.

1.4.5 Analytical Methods

The MBMG Analytical Division performed the laboratory analyses 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

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

1.4.6.1 Water-Quality Standards

The Safe Drinking Water Act (SDWA) directs the 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 water-quality standards (acute and chronic) 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 1.2. Most standards are based on total-recoverable rather than dissolved metal concentrations. However, because total recoverable concentrations are difficult to reproduce and highly variable depending on flow conditions, this investigation used dissolved metal concentrations for evaluating water quality unless otherwise noted.

Table 1.2 Water-quality standards developed by the EPA.

ANALYTE	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 (dissolved)		0.05-0.2	0.75	0.087
Arsenic	0.05		0.36	0.19
Barium	2			
Cadmium	0.005		0.0039/0.0086[6]	0.0011/0.0020[6]
Chromium	0.1		1.7/3.1[6,7]	0.21/0.37[6,7]
Copper		1	0.018/0.034[6]	0.012/0.012[6]
Iron		0.3	1	
Lead	0.05		0.082/0.2[6]	0.0032/0.0077[6]
Manganese		0.05		
Mercury	0.002		0.0024	0.000012
Nickel	0.1		1.4/2.5[6]	0.16/0.28[6]
Silver		0.1	0.0041[8]	0.000012[8]
Zinc		5	0.12/0.21[6]	0.11/0.19[6]
Chloride		250		
Fluoride	4	2		
Nitrate	10 (as N)			
Sulfate	500[9]	250		
Silica		250		
pH (Standard Units)		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 MCL will be superseded.

1.4.6.2 Soil Standards

There are no federal standards for concentrations of metals and other constituents in soils. Acceptable limits for metals often are based on human and/or environmental risk assessments for an area. Because no assessments of this kind have been done in the National Forests of Montana, concentrations of metals in soils were compared to the limits proposed by the EPA and the Montana Department of Environmental Quality [formerly Department of Health and Environmental Sciences (MDHES)] for sites within the Clark Fork River basin in Montana. The proposed upper range for lead in soils is 1,000 to 2,000 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 1.3.

Table 1.3 Clark Fork Superfund background levels for metals in soils (mg/kg).

Reference	As	Cd	Cu	Pb	Zn
U.S. Mean Soil	6.7	0.73	24.0	20.0	58
Helena Valley Mean Soil	16.5	0.24	16.3	11.5	46.9
Missoula Lake Bed Sediments	-	0.2	25.0	34.0	105
Blackfoot River	4.0	<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 the environment and human health. Selected results for each site are presented in the discussion; a complete listing of water-quality and soil chemistry results are presented in appendix IV.

All data for this project were collated with existing data and were incorporated into a new MBMG abandoned/inactive mines database. The database will eventually include mines and prospects throughout Montana. It 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 V and are compatible with the ARC/INFO Geographical Information System (GIS).

1.5 BEAVERHEAD NATIONAL FOREST

In 1995, the Beaverhead National Forest was combined with the Deerlodge National Forest to the north to form the Beaverhead-Deerlodge National Forest. Throughout this report, the southern portion of the Beaverhead-Deerlodge National Forest will be referred to by its former designation, the Beaverhead National Forest (BNF).

The BNF is administered by the U.S. Forest Service and covers over 2.1 million acres in southwest Montana (figure 1.2). Portions of the Lee Metcalf Wilderness area east of the Madison River, and the Anaconda Wilderness area northwest of the Big Hole River are included as part of the Forest. The BNF lies within portions of Beaverhead, Deer Lodge, Madison, and Silver Bow counties. The regional USFS office is located in Missoula. Dillon is the site of the BNF supervisor's office as well as a district office. Other district offices are located in Wisdom, Wise River, and Ennis (Madison) with a work center in Sheridan.

The Dillon, Butte, Bozeman, Dubois, and Ashton 1° x 2° quadrangles provide map coverage of the area. Topography is typical of southwestern Montana's basin and range physiographic province, grading from semi-arid grass/sagebrush vegetated valleys to coniferous forests and alpine peaks above timberline. Major mountain chains within the BNF include the Anaconda-Pintler Range, the Beaverhead Mountains, the Gravelly Range, the Madison Range, the Pioneer Mountains, the Snowcrest Range, the Tendoy Range, and the Tobacco Root Mountains. The highest peaks in these ranges typically have elevations over 10,000 ft. The broad basins between the mountain chains have elevations on the order of 5,000 to 6,500 feet.

1.5.1 History of Mining

Some knowledge of the local mining history is helpful in understanding the problems created by abandoned/inactive mines in the area. Significant amounts of placer gold were first discovered along Grasshopper Creek near Bannack in 1862 (Lyden 1948). After this deposit had played out, attention shifted to Alder Gulch, near Virginia City. Associated lode deposits were located soon thereafter, including mines in the Vipond area (1867), the Tidal Wave district (1864), and Hecla (1872) . According to Sahinen (1959), the majority of the lode mines were in their heyday prior to the turn of the century and have been worked sporadically since then. The tungsten and molybdenum deposits of Calvert Hill, Lost Creek/Rock Creek and Vipond were explored later in the 20th century as their commodities became more in demand.

The Beaverhead National Forest includes all or parts of more than 15 mining districts as defined by Sahinen (1935), Loen and Pearson (1989), and Winters *et al.* (1994). In Beaverhead County, the larger districts include Bald Mountain, Ajax, Beaverhead, Bryant (Hecla), Calvert, Elkhorn, Lost Creek/Rock Creek, Polaris and Utopia (Birch Creek). In Madison County, districts (mostly associated with the Tobacco Root Mountains) include Norwegian Creek, upper and lower Hot Springs (Norris), Washington, Pony (Mineral Hill), Sheridan, Meadow Creek, and

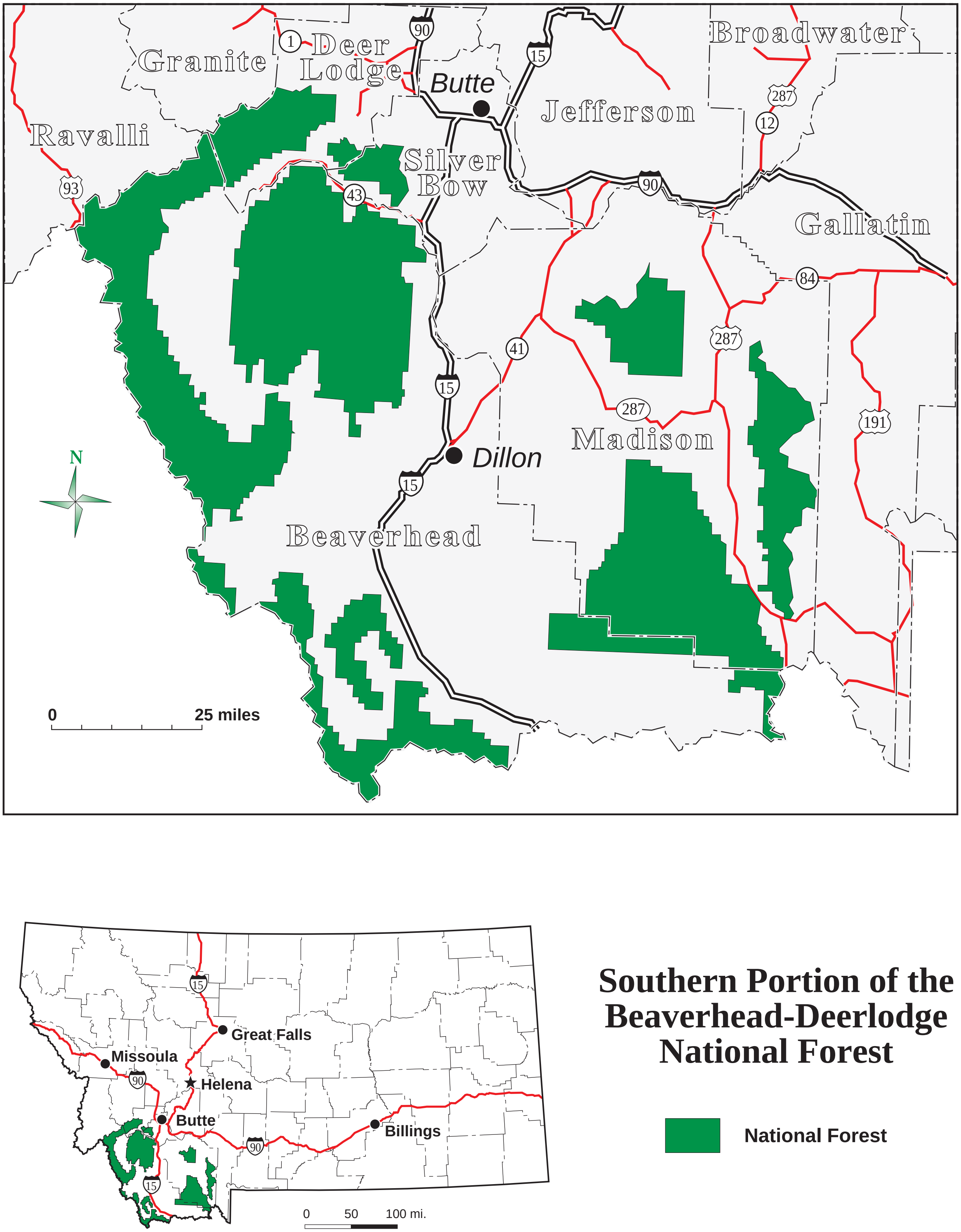

Figure 1.2 Map of the southern portion of the Beaverhead-Deerlodge National Forest.

Tidal Wave. The Beaverhead National Forest report has been organized by drainage basins to include those mines which are not located in traditional mining districts.

It is difficult to estimate an exact amount of production from the Beaverhead National Forest itself, but the more important districts are summarized in table 1.4 taken from Loen and Pearson (1989). The table ranks the relative importance of areas based on production and commodities produced. Loen and Pearson (1989), Geach (1972) and Lorain (1937) give a more detailed break-down of what and how much each district or area produced.

Table 1.4 Production from mining areas in the Beaverhead National Forest.

	Au (oz)	Ag (oz)	Cu (lbs)	Pb (lbs)	Zn (lbs)
Baldy Mountain	348	60,418	4,986	80,901	6,700
Beaverhead Mtns area	1,088	10,470	127,819	243,107	-----
Birch Creek district	308	43,744	1,771,824	5,464	-----
Elkhorn district	1,184	208,593	383,580	857,679	4,800
Hecla district	18,250	13,384,722	8,271,136	112,482,388	3,831,254
Pioneer Mtns area	944	1,392	421	-----	400
Polaris district	312	181,023	20,937	11,140	12,100
Qtz Hill/Vipond district	1,118	1,024,485	198,991	72,032	500
Rock Creek district	1	647	12,629	-----	-----
Sheridan district	32,515	185,044	151,661	1,445,503	294,452
Tidal Wave district	33,368	143,037	150,109	2,801,820	21,873

The districts listed in table 1.4 yielded a total value of approximately $39,590,000 at the time that they were in production (Loen and Pearson 1989); much of this was from BNF-administered land or patented claims surrounded by BNF-administered land. Loen and Pearson (1989) estimated that an additional $8 million in value was taken from the Calvert district, mostly in tungsten. Lost Creek district produced $400,000 - again in tungsten.

Placers in the vicinity of the BNF were found in the Sheridan district (Bivens Creek), Argenta district (French Gulch), and west of Wisdom (Pioneer and Nugget creeks). Many of the other placers in this area of southwest Montana are located on Bureau of Land Management administered land downstream from lode mines on BNF-administered land. Other placer production from BNF-administered land itself has been in small isolated deposits many of which skirt the Tobacco Root Mountains.

Placers reached their maximum production before 1872, when the richest ones began to play out; production was primarily by “hydraulicking” and sluicing. 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 the 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. During World War II, government price supports and essential industry rulings brought many small to medium copper, lead, and zinc properties into production. Following the war, the increased supply and labor costs coupled with the withdrawal of price supports prematurely closed most of these properties. The Korean conflict brought some of them back on line as once again the government influenced the economics of mining. Additional properties were brought on line as the Defense Logistics Agency went through a period of creating stockpiles of critical strategic minerals.

1.5.1.1 Production

The total value of minerals produced from all mines within the Beaverhead National Forest boundaries was probably about $50 million, almost entirely from lode mines (Loen and Pearson 1989). The estimated values reflect the prices of commodities at the time of production, not current prices.

1.5.1.2 Milling

An understanding of the history of milling developments is essential for interpreting mill sites, understanding tailings characteristics, and determining the potential for the presence of hazardous substances. Mills, usually adjacent to the mines, produced two materials: 1) a product which was either the commodity itself or a concentrate which was shipped offsite 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 sites off USFS administered 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 ground and mixed with reagents 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 BEAVERHEAD NATIONAL FOREST INVESTIGATION

A total of 387 sites were identified on or near the Beaverhead National Forest (BNF) by using the U.S. Bureau of Mines MILS database as a basic reference and other sources of information including Pardee and Schrader (1933), Elliot *et al.* (1992), McClernan (1982), and Winters *et al.* (1994). Table 1.5 summarizes the process by which the final results were achieved in the Beaverhead National Forest inventory. These numbers are accurate to the extent that the database is updated and will change reflecting current progress in database entry.

Table 1.5 Summary of Beaverhead National Forest investigation.

Total number of abandoned/inactive mines sites that were:

PART A - Field Form	
Located in the general area from MILS or other sources	387
PART B - Field Form (Screening Criteria)	
Screened out by BNF minerals administrator or by description in literature	96
Unable to locate	38
Visited by MBMG geologist	253
Screened out by geologist	200
Visited by hydrogeologist	53
Screened out by hydrogeologist	7
PART C - Field Form	
Sampled (Water and/or Soil)	46

Discussions of the 46 sites that were sampled are included in this report. All 387 sites inventoried as possibly affecting BNF-administered land are listed in appendix II.

1.7 MINING DISTRICTS AND DRAINAGE BASINS

The mines in the Beaverhead National Forest are located within more than 11 mining districts. The boundaries of these districts are subject to interpretation and change, and often the same district is known by several names. Because of the ill-defined nature of the districts, the MBMG and USFS chose to inventory the mines according to drainage basin. This is a convenient way to separate the National Forest into manageable areas for discussion of both geology and hydrogeology; and perhaps more importantly, it is an aid to the assessment of cumulative environmental impacts on a drainage.

The drainages discussed in the following report include the Beaverhead-Red Rock, the Big Hole, and the Jefferson-Madison-Ruby. The Jefferson, Madison, and Ruby drainages are combined because all sites investigated for environmental problems in these drainages are located in the Tobacco Root Mountains.

2.0 BEAVERHEAD-RED ROCK RIVER DRAINAGE

For the purpose of this investigation, the Beaverhead River and Red Rock River drainages have been combined and will be referred to as the Beaverhead-Red Rock River drainage. This drainage is in the south-central portion of the Beaverhead National Forest and covers an area of approximately 3,620 mi². The drainage is bounded on the northeast by the Gravelly, Snowcrest and Ruby ranges, on the south and west by the Centennial Range and Beaverhead Mountains, on the northwest by the Pioneer Mountains.

The headwaters of the Red Rock River are several miles southeast of the Red Rock Lakes, on the Continental Divide between Montana and Idaho. Flowing west from the Red Rock Lakes, the river passes through the Lima Reservoir. It then turns northwestward and eventually empties into the Clark Canyon Reservoir. The water that spills from the Clark Canyon Reservoir becomes the Beaverhead River, which flows past Dillon and joins the Big Hole and Ruby Rivers near Twin Bridges to form the Jefferson River. Important tributaries to the Red Rock and Beaverhead Rivers include Odell Creek, Little Sheep Creek, Big Sheep Creek, Junction Creek, Medicine Lodge Creek, Horse Prairie Creek, Grasshopper Creek, Rattlesnake Creek, and Blacktail Deer Creek.

Most of the basin's residents derive their livelihoods from cattle, recreation, or forest industries. The BNF-administered land in the upland portions of the basin is managed to accommodate multiple uses, including cattle grazing, recreational activities, and timber harvesting. Private lands in the valley bottom are used primarily for grazing livestock and raising alfalfa and grain. About 135,000 acres of land in the basin are irrigated (Shields 1996). The largest city in the basin is Dillon, with a population of 4,000. Other population centers include Argenta, Lakeview, Monida, Lima, and Dell.

2.1 GEOLOGY

The Beaverhead River drains an area of Beaverhead-Deerlodge National Forest administered land which includes the Argenta/Ermont (and French Creek), Badger Pass, Baldy Mountain, Monument, Lemhi Pass and Polaris metal-producing districts, and additionally nebulous areas such as the Blacktail Mountains area, the Big Hole Divide area and the west flank of the Ruby Mountains area (Loen and Pearson 1989). Although some of the sites found on the Dillon and Dubois 1° x 2° sheets drain into the Red Rock drainage they are included here because of their geographic proximity to the area. The Beaverhead drainage is a minor player in the overall picture of abandoned mines associated with BNF-administered land in southwest Montana. Much of the mining in the area drained by the Beaverhead River occurred on Bureau of Land Management land.

The regional geology was mapped by Ruppel (1993) and ranges from Precambrian Missoula Group sediments near the Big Hole Pass area to the west, to a complexly folded and faulted area near the Baldy Mountain area, to Tertiary Bozeman Group sediments and volcanic rocks in the Beaverhead River valley. A northeast-trending range front fault is the western edge of the Ruby Range on the east side of the Beaverhead Valley. The west side of the Ruby Mountains is characterized by northwest-trending faults cutting Archean quartzo-feldspathic gneisses, schists, marbles, and Middle Proterozoic diabases. The Ruby Mountains and the Blacktail Range are host to metamorphic-type deposits including talc, graphite, sillimanite, corundum, iron, manganese, and pegmatites (Geach 1972). The main metal-producing districts (Baldy Mountain, etc.) lie in an area that has been overthrust and has high-angle normal faults (Lowell 1965).

There are numerous references for the Beaverhead River drainage. Winchell (1914) gave brief descriptions of the mining districts of the Dillon quadrangle. P.J.Shenon (1927) described specifically the Argenta and Bannack districts. Oren Sassman (1941) wrote a historical perspective of the metal mining in Beaverhead County. Lyden (1948) included this area in his report on placer mining. Geach (1972) described many of the mines and mineral prospects of Beaverhead County. Loen and Pearson (1984) give concise mine summaries for the Dillon 1° x 2° quadrangle. There have been several theses and dissertations on the various mining districts including Schutz (1986) who wrote a comprehensive study of the mineralization of the Baldy Mountain district. The geology of the Dillon 1° x 2° sheet has recently been mapped by Ruppel *et al.* (1993) at a scale of 1:250,000. Most recently, Winters *et al.* (1994) of the U.S. Bureau of Mines conducted an appraisal of mineral resources for the Beaverhead National Forest.

2.2 ECONOMIC GEOLOGY

Ore deposits in the metal-producing districts are generally hosted in Paleozoic and lower Mesozoic rocks which have been intruded by small granodiorite to monzogranite stocks. Most are replacements and veins in carbonate rocks (Loen and Pearson 1989). In the Bald Mountain district, the mineralization is hosted by Paleozoic limestones which was intruded by the Mount Torrey (Pioneer) batholith. In all these districts, gold and silver were the principal commodities, with lesser amounts of lead, copper, and zinc. The Argenta district was primarily mined for lead and silver, with lesser amounts of gold, copper, and zinc.

Phosphate and other industrial minerals occur locally throughout the area. The Permian Phosphoria Formation hosts phosphatic shale which was explored in the late 50's and 60's by the U.S. Bureau of Mines, among others. Tungsten is found in skarns in the Baldy Mountain district (most notably at the Little Hawk mine).

The Ruby Mountains host numerous talc occurrences in Archean gneiss and marble. There are magnetite occurrences in the banded iron formations (Loen and Pearson 1989), also. The Blacktail Mountains area has very minor amounts of mineralization - primarily industrial minerals and an isolated copper occurrence.

Placers occur in most of the secondary drainages to the Beaverhead River associated with mining districts. Gold was discovered first in Grasshopper Creek at Bannack in 1862 (Sahinen

1935) before the other major placer deposits of Montana. Dyer Creek, Cold Spring Creek (an extremely small deposit), Jeff Davis Gulch, and Rattlesnake Creek and its tributaries French and Watson creeks, and Frying Pan basin all contained placers.

2.3 HYDROLOGY AND HYDROGEOLOGY

In the Beaverhead-Red Rock River drainage, average annual precipitation ranges from 10 inches in the valleys to 50 inches in the mountain areas (SCS 1977). Dillon, which is 5,100 ft above sea level, receives an average of 10 inches of precipitation annually (NOAA 1991). May and June are typically the wettest months.

An average monthly flow hydrograph for Odell Creek, at the upper end of the basin (figure 2.1) shows that spring runoff usually begins in May and peaks during June. A hydrograph from the Beaverhead River near Twin Bridges shows a much different picture (figure 2.2). Because surface-water flow down the basin is partly regulated by the Lima and Clark Canyon reservoirs and there is extensive irrigation, flows actually decline in the spring and summer and rise in the fall and winter. The basin's mean discharge, as measured at the gaging station near Twin Bridges, is 408 cfs, equivalent to about 295,000 acre-ft per year (Shields *et al.* 1996).

Tertiary and Quaternary alluvial and glacial deposits are the most important hydrogeologic units in the basin and provide the most reliable supply of ground water. The Tertiary materials are exposed mostly along the flanks of the mountains and consist primarily of sandstone and sandy siltstone. Quaternary deposits include glacial tills, glacial outwash, alluvial fans,and alluvium that occur mainly in the mountains valleys and in the central Beaverhead valley. Paleozoic sedimentary rocks, Tertiary and Cretaceous igneous and metamorphic rocks, and Proterozoic and Archean metamorphic rocks that are exposed in the mountains also yield ground water, especially where they have been extensively fractured or faulted. Groundwater is used extensively for irrigation and for rural and municipal water-supply. The city of Dillon uses ground water as its sole source of water.

2.4 SUMMARY OF THE BEAVERHEAD-RED ROCK RIVER DRAINAGE

Within the Beaverhead-Red Rock River drainage, 96 mine and mill sites are on or near the Beaverhead National Forest (see figure 2.3 and table 2.1). Of these sites, seven were found to have potentially adverse effects on soil or water quality on BNF-administered land. These sites are listed in **bold** in table 2.1 and are discussed in alphabetical order in the following sections. Six of the seven sites have one or more discharges from workings or waste material and three of the sites have potential erosion problems.

If mine openings or other dangerous features (unstable structures, highwalls, steep waste-rock dumps) were observed, the site has a bold-type **Y** under the hazard heading in table 2.1. In general, only those sites at which samples were collected were evaluated in detail. Of the 94 sites inventoried in the Beaverhead-Red Rock drainage, 25 were identified that have safety problems.

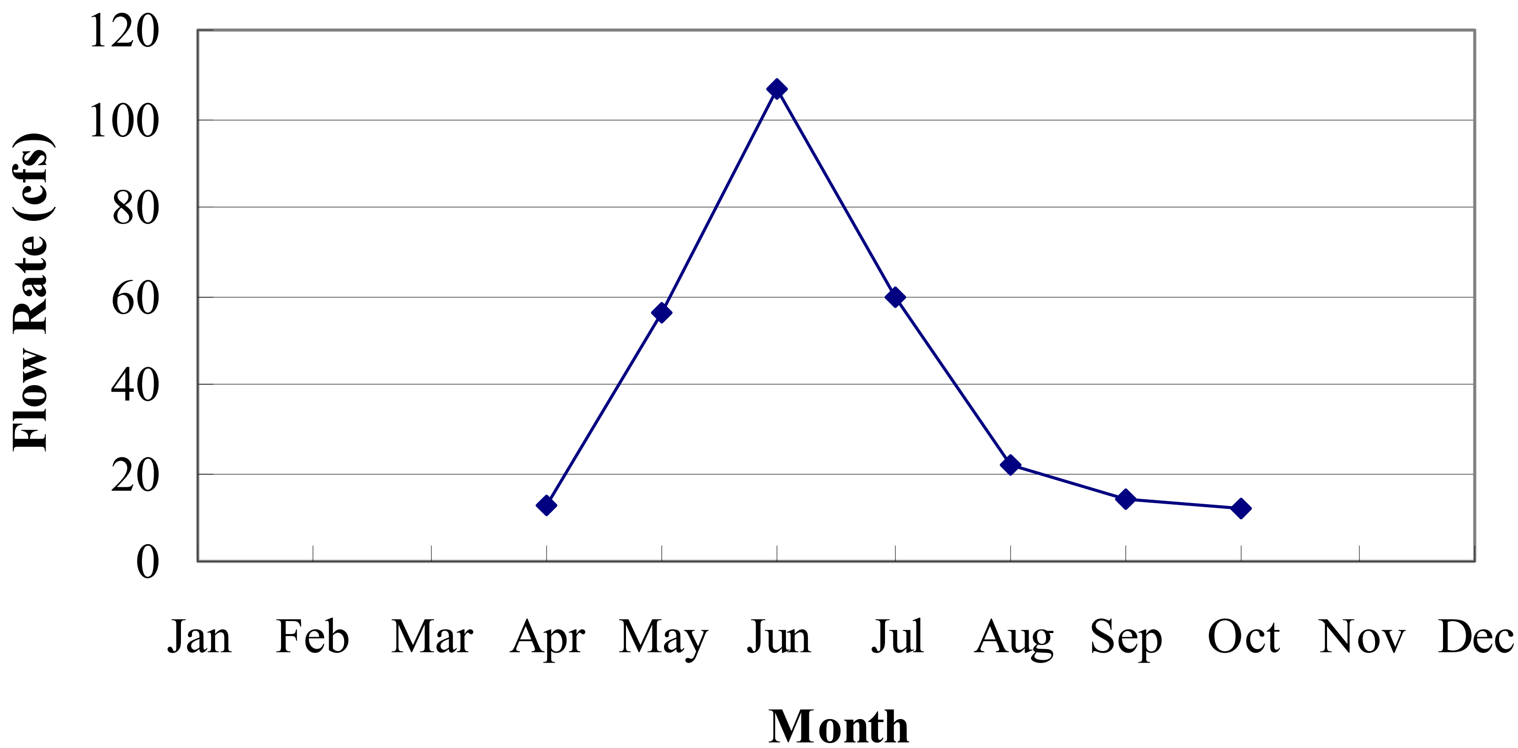

Figure 2.1 Average monthly flow, Odell Creek above Taft Ranch, near Lakeview, Montana (U.S. Geological Survey Station No. 06008000). Period of record: 1993 to 1995. Data source: Shields *et al.* (1996).

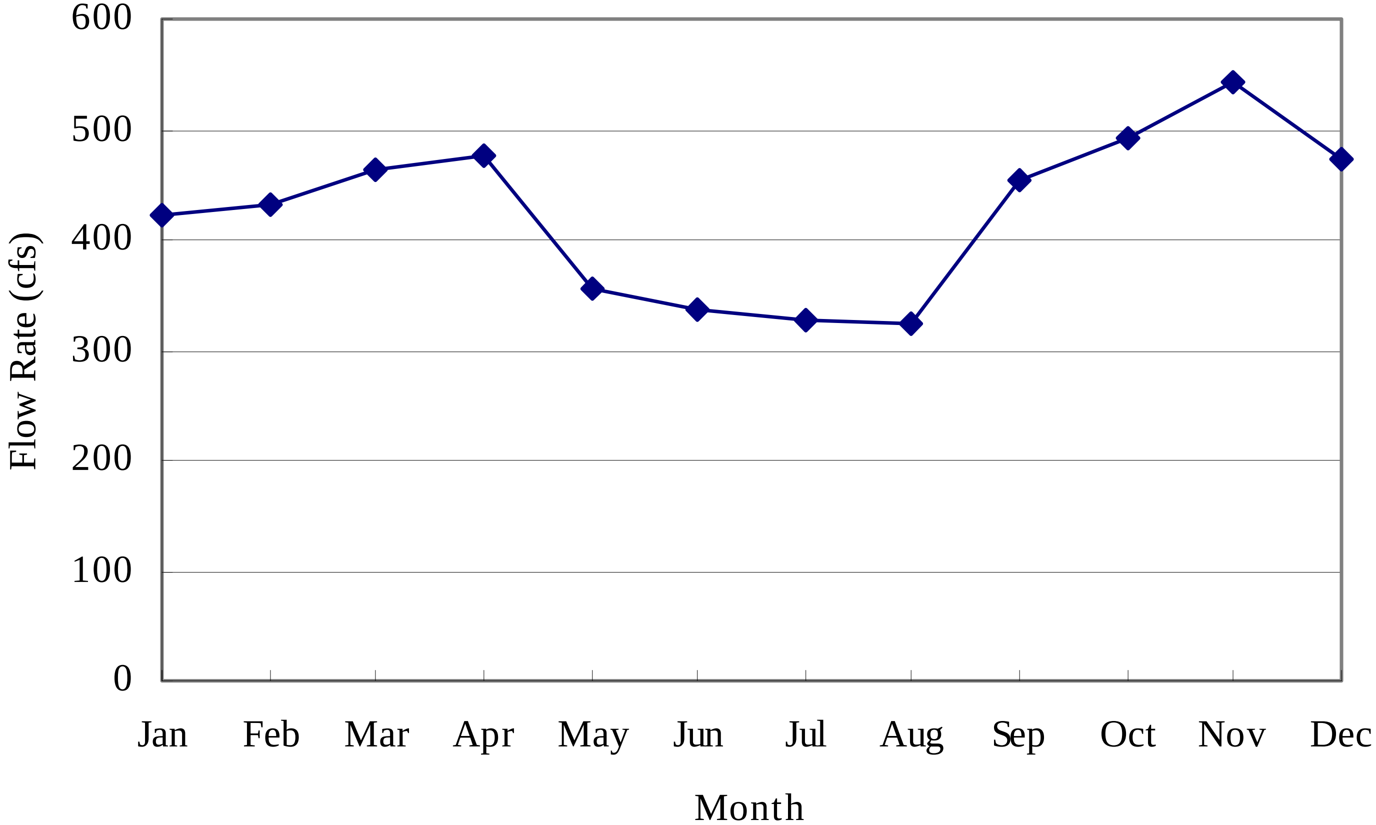

Figure 2.2 Average monthly flow, Beaverhead River near Twin Bridges, Montana (U. S. Geological Survey Station No. 06018500). Period of record: 1965 to 1995. Data source: Shields et al. (1996).

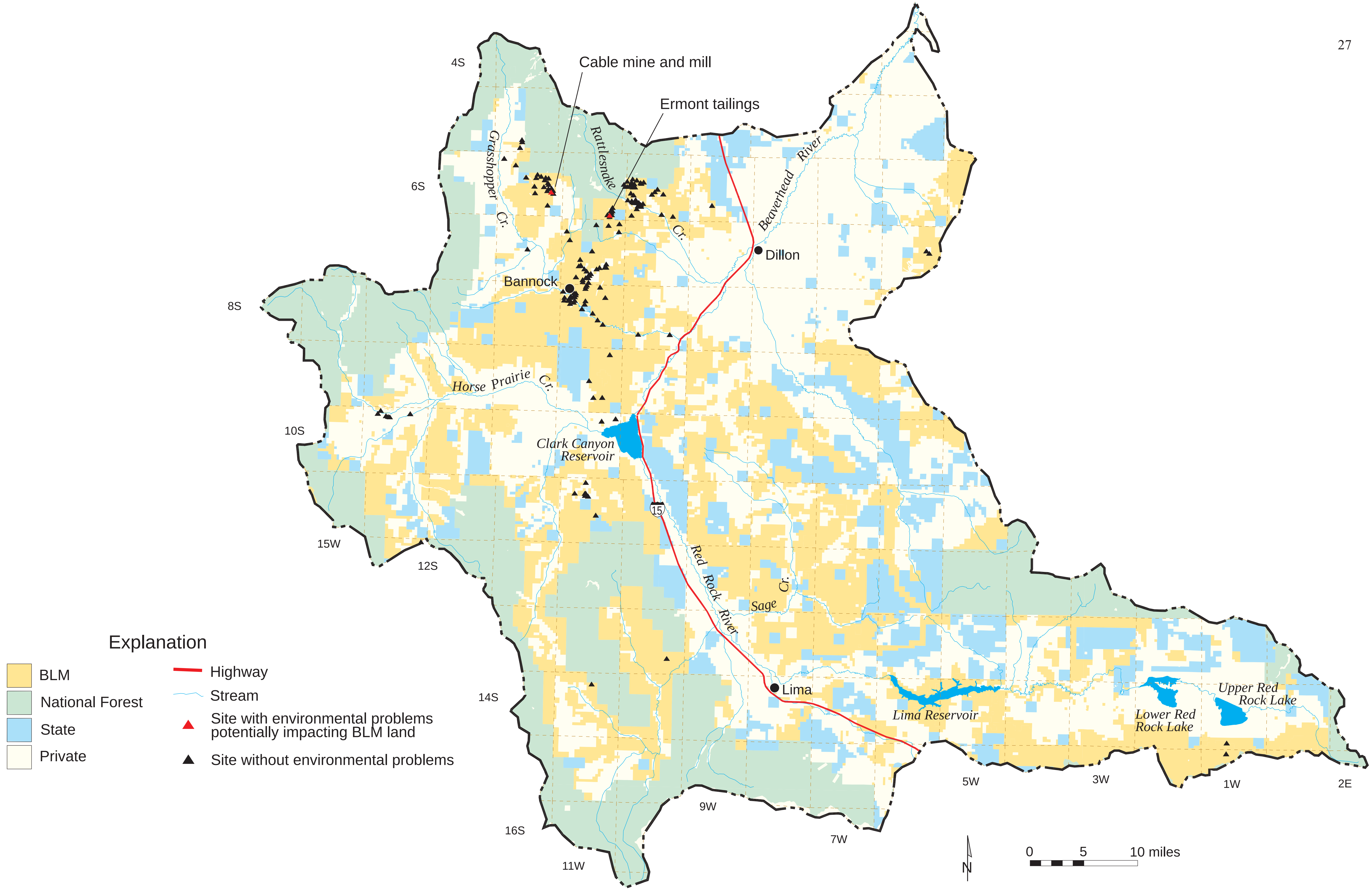

Figure 2.3. Abandoned/inactive mines inventoried in the Beaverhead and Red Rock River drainages.

Table 2.1 Summary of sites inventoried in the Beaverhead-Red Rock River drainage. Site name in **bold type** indicates potential environmental problems. Bold type **Y** in hazard column indicates a safety concern was noted at the site.

Name / ID[1]	**Owner[2]**	**Visit**	**Sample[3]**	**Hazard[4]**	**Remarks**
Anderson Deposit - Asbestos BE004320	MIX	N	N	NE	Screened out. May be same as Bestos & Vidah Claims. Scattered prospect pits and trenches only.
Argenta (Gladstone) BE000282	PRV	N	N	**Y**	Viewed from a distance. Dry with no visible impact. Hazardous mine opening(s).
Beaverhead (Lucky Strike) BE000035	NF	Y	N	NE	No impact.
Bestos & Vidah Claims BE000528	NF	N	N	NE	Screened out. Scattered prospect pits and trenches.
Birch Creek - Cave Gulch Area BE000604	NF	N	N	NE	Unable to locate. May be a phosphate claim.
Blue Eyed Annie BE004275	PRV	Y	N	N	Dry. No visible impact.
Buffalo Group BE003910	MIX	N	N	NE	Screened out. Probably a graphite occurrence. May be patented claims.
Cabin Creek Area BE000652	NF	N	N	NE	Screened out. Graphite occurrence. May be open shafts in area (Bump 1998).
Capitol BE000486	NF	Y	Y	N	Seep at toe of waste-rock dump.
Cave Creek BE004525	NF	N	N	NE	Unable to locate. May be a phosphate claim.
Cave Nitrate BE000816	MIX	N	N	NE	Screened out. Nitrate deposit.
Comet, Comet Group BE000660	MIX	Y	N	**Y**	Small intermittent discharge from an adit. Several partially open adits.
Copper Queen BE008335	MIX	Y	Y	N	Adit discharge (spring?) flows adjacent to a small waste-rock dump.
Crooked Run Creek BE000526	MIX	N	N	NE	Screened out.
Cross BE000827	NF	Y	N	**Y**	Some barrels are stored in lower adit (gated). Active claim (Bump 1998).
Discovery BE004530	NF	Y	N	**Y**	Hazardous mine opening(s). Active claim (Bump 1998).
Doodle Bug BE004435	MIX	N	N	NE	Unable to locate using information from MILS.
Dutchman Mining Co. BE004580	NF	Y	N	**Y**	Open shaft with locked gate.
East End of Lima District BE000898	MIX	N	N	NE	Screened out general area, but specific mines were investigated.

Table 2.1 Summary of sites inventoried in the Beaverhead-Red Rock River drainage (continued).

Name / ID[1]	Owner[2]	Visit	Sample[3]	Hazard[4]	Remarks
Echo Lode BE000606	MIX	Y	N	**Y**	Partially open adit and shaft.
Elkhorn Hot Springs BE000564	NF	Y	N	N	Commercial operation leased from Forest Service. Geothermal springs.
Fluorite No.1 BE000270	UNK	N	N	NE	Unable to locate. Location: 500 m precision in MILS. Part of Ermont Group.
French & Watson Gulches Placer BE000197	MIX	N	N	NE	Screened out, but visited general area.
Gallagher Gulch Prospects BE008041	NF	N	N	NE	Prospects only. Screened out.
Gladstone BE004250	PRV	N	N	**Y**	Viewed from a distance. Hazardous mine opening(s).
Golden Dawn BE000760	NF	Y	N	N	No impact.
Golden Era BE000288	MIX	Y	N	N	No impact.
Goldfinch BE000294	NF	Y	N	**Y**	Open shaft with locked grate. No visible impact.
Guy BE000593	PRV	Y	N	N	Patented claim. Three caved shafts. Sulfides on dump.
Harkness BE000826	NF	N	N	NE	Screened out.
Harkness North BE000754	NF	N	N	NE	Screened out. Trenches only (Lambeth and Mayerle 1983).
Hazel Prospect BE000252	NF	Y	N	N	No impact. See North Hazel Prospects also.
Henry BE004440	UNK	N	N	NE	Unable to locate using lat-long from MILS.
Jack Knight Prospect BE004050	UNK	N	N	NE	Unable to locate using lat-long from MILS.
Jack BE004460	NF	Y	N	**Y**	One open shaft that is about 20 ft deep but fenced. No environmental impact.
Kate Creek Graphite Deposits BE000755	MIX	N	N	NE	Screened out. Described as graphite occurrence with pits and caved adits (Perry 1948).
Kelley Gulch BE000730	NF	Y	N	N	No impact.
Last Chance BE000820	MIX	N	N	NE	Screened out. Uranium occurrence. Gated adit.

Table 2.1 Summary of sites inventoried in the Beaverhead-Red Rock River drainage (continued).

Name / ID[1]	**Owner[2]**	**Visit**	**Sample[3]**	**Hazard[4]**	**Remarks**
Last Chance Group, Shady Tree BE000762	NF	Y	N	N	No visible impact.
Last Chance No. 3 BE000540	UNK	N	N	NE	Unable to locate using lat-long from MILS.
Legal Tender BE000258	PRV	Y	N	**Y**	Hazardous caved shaft.
Lima Gypsum BE000510	MIX	N	N	NE	Screened out. Gypsum occurrence.
Little Sheep Creek BE003835	MIX	N	N	NE	Screened out. Phospate occurrence (Popoff and Service 1965; Swanson 1970).
Little Water Canyon BE000514	MIX	N	N	NE	Screened out. Phosphate occurrence. Adits closed by NFS in 1997 (Bump 1998).
Lucky Strike BE000066	NF	Y	N	NE	Screened out. Same as Beaverhead mine.
Lucky Strike BE004005	UNK	N	N	NE	Unable to locate using lat-long from MILS.
Magnet - Magna BE004185	MIX	Y	N	N	No impact.
Maiden Creek Copper BE000012	NF	N	N	NE	Screened out based on information from Geach (1972).
May Day/Mayday & Payday BE003920	NF	Y	N	N	Active mine.
McBride Creek BE000646	MIX	N	N	NE	Screened out. 11 patented claims in general area.
McCarthy Deposit (Gypsum) BE000090	MIX	N	N	**Y**	Screened out. Gypsum occurrence. One open adit according to Winters *et al.* (1994).
McConnell (Wellman) Group BE000599	MIX	Y	N	N	Visited general area. See entry for Wellman mine.
McDonald BE000330	NF	Y	N	**Y**	Partially caved adit.
North Hazel Prospects BE008021	NF	Y	N	N	One open but culverted adit. Other workings are caved.
Oro Grande & Eclipse BE000605	PRV	N	N	NE	Viewed from road. No impact to BNF-administered land.
Paradise Claim BE008043	NF	Y	Y	**Y**	Streamside waste-rock dump. Adit is intact but access restricted by wooden door. Active claim.

Table 2.1 Summary of sites inventoried in the Beaverhead-Red Rock River drainage (continued).

Name / ID[1]	**Owner[2]**	**Visit**	**Sample[3]**	**Hazard[4]**	**Remarks**
Park BE003975	NF	Y	N	**Y**	Hazardous opening(s).
Pay Day BE008042	NF	Y	Y	N	Adit discharge on active claim.
Pine Tree BE003990	NF	Y	N	**Y**	Open adit(s).
Prospects - T14S, R11W, SEC 02 BE008353	NF	N	N	NE	Screened out. Prospects on dry ridge.
Red Rock Basin BE000712	MIX	N	N	NE	Screened out. Barite occurrence in Tertiary sediment (Winters *et al.* 1994).
Roadside Adits, SEC. 15 BE008338	NF	Y	N	N	Collapsed adits.
Rosemont BE000342	NF	Y	N	**Y**	Two open shafts and an open adit.
Sheep Creek BE000508	MIX	N	N	NE	Screened out. Barite occurrence (Winters *et al.* 1994).
Silver Rule BE000348	PRV	Y	N	N	No impact.
Sourdough Cave BE008350	NF	N	N	NE	Screened out. Adit symbol on map, but it is a heritage site with pictographs in a natural cave (Bump 1998).
Spanish BE000354	PRV	Y	N	**Y**	Open adit and caved shaft.
S.S.&R. BE000155	MIX	Y	N	**Y**	Two caved shafts and two open cuts. Minor hazards.
Starlight BE000360	NF	Y	N	N	No impact.
Stinson BE003895	NF	Y	N	N	Intact adits with locked gates. No impact. Active claim (Bump 1998).
Storm and Simpson Mines BE000839	PRV	Y	N	**Y**	Open adit. Part of Thunderbird Group.
Storm King BE000366	NF	Y	N	**Y**	Fenced open shaft and a caved adit.
Sweeney; Bonanza II BE000821	NF	Y	N	**Y**	Three open adits.
Sweeney Gulch Prospects BE008353	NF	N	N	NE	Screened out. Prospects on dry ridge.
Sylvia BE000497	NF	Y	N	**Y**	At least 8 open shafts. Most are fenced. Active claim (Bump 1998).

Table 2.1 Summary of sites inventoried in the Beaverhead-Red Rock River drainage (continued).

Name / ID[1]	**Owner**[2]	**Visit**	**Sample**[3]	**Hazard**[4]	**Remarks**
Telstar Group BE000048	MIX	N	N	NE	No impact. Adjacent to the San Francisco patented claim along with the Dox and Comet Groups.
Tender Group BE000054	NF	Y	N	**Y**	Hazardous caved shaft.
Tiger Group BE004540	MIX	N	N	NE	Screened out because name describes a general location.
Trapper No. 1 BE000414	NF	N	N	NE	Screened out based on information from Geach (1972).
Unknown Stone BE008349	NF	N	N	NE	Screened out Prospects only.
Unnamed - T4S, R12W,SEC 15, DAAC BE008339	NF	Y	N	N	No impact.
Unnamed Copper Molybdenum BE004405	NF	N	N	NE	Screened out. No references and no record of production.
Unnamed Graphite BE000269	MIX	N	N	NE	Unable to locate using information from MILS.
Unnamed Graphite BE004390	MIX	N	N	NE	Screened out. Graphite deposit. Probably same as McBride Creek occurrence.
Unnamed Gypsum BE000449	MIX	N	N	NE	Screened out. Gypsum occurrence.
Unnamed Gypsum BE004335	MIX	N	N	NE	Screened out. Gypsum occurrence.
Unnamed Tungsten BE000071	NF	N	N	NE	Unable to locate using lat-long from MILS.
Unnamed Uranium Occurrence BE003805	NF	N	N	NE	Screened out.
Upper Trail Hollow Prospects BE008392	MIX	Y	N	N	Prospects only. No hazards or environmental problems.
Virginia Claim BE000870	NF	Y	N	N	No impact.
Virginia Gulch BE000060	NF	Y	N	N	No impact.
Wapita BE004565	NF	Y	N	**Y**	Open shaft. Active claim (Bump 1998).
Watson Gulch BE004620	NF	Y	Y	N	Streamside waste-rock dump and adit discharge. Active claim.

Table 2.1 Summary of sites inventoried in the Beaverhead-Red Rock River drainage (continued).

Name / ID[1]	Owner[2]	Visit	Sample[3]	Hazard[4]	Remarks
Wellman (New York Claim) BE008344	MIX	Y	Y	N	Discharge on patented land and seep from toe of waste-rock dump on BNF-administered land.
Yellow Band Group BE000396	NF	Y	N	**Y**	Hazardous mine opening(s). Site includes Yellow Band, Discovery, Cross, Park, Pine Tree, and Stinson claims. Active claims (Bump 1998).
Yellowstone Lode (Cabin) BE008044	NF	Y	N	NE	No impact.

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 visited).
2) Administration/Ownership Designation
NF: BNF-administered land
PRV: Private
MIX: Mixed (BNF-administered land and private)
UNK: Owner unknown
3) Solid and/or water samples (including leach samples)
4) Y: Physical and/or chemical safety hazards exist at the site.
NE: Physical and chemical safety hazards were not evaluated.
5) Mill site present

2.5 CAPITOL MINE

2.5.1 Site Location and Access

The Capitol mine (T6S R10W Sec. 5 ABAB) is located about five miles north of Argenta. It is on an east-facing mountainside at the head of Cave Gulch. Cave Gulch has an ephemeral stream that drains toward the Beaverhead River. The site is on BNF-administered land and is accessible by following a secondary dirt road that turns west off the Long John Road.

2.5.2 Site History - Geologic Features

Workings at the Capitol mine consist of a large open cut, three adits, and two shafts (Geach 1972). The total surface disturbance is approximately three acres. All of the underground workings are now caved. The workings explored a network of north-south trending, closely-spaced, mineralized fractures which cut Precambrian quartzite. The mineralized fracture filling includes quartz, galena, and cerrusite (Geach 1972). A selected grab sample assayed 5.40 percent lead, 0.8 percent zinc, 0.70 percent copper, 3.20 ounces silver, and 0.14 ounces of gold. The mine was in operation during the years 1940-1941, 1948-1949, and 1952-1953 (Geach 1972). Cumulative production for these periods was 36 tons of ore yielding 7,986 pounds lead, 634 pounds zinc, 311 pounds copper, 267 ounces silver, and 1 ounce gold (Geach 1972). Judging from the condition of the site today, the mine probably has operated for brief periods since 1953. Figure 2.4 is a plan map covering the lower portions of the site.

2.5.3 Environmental Condition

A small, clear seep emerges near the base of the lowermost waste-rock dump (figure 2.5). The water from the seep flows across the access road and into a boggy area adjacent to the Cave Gulch stream.

2.5.3.1 Site Features - Sample Locations

Water-quality samples were collected at the site on September 25, 1996. Sample BCAS10L was collected from the seep at the base of the dump. The flow rate of the seep was 0.5 gpm. Sample BCAS20L was collected from Cave Gulch Spring, upstream of the site (figure 2.6). The flow rate of the spring was 2.2 gpm. A third sample, BCAS30L, was collected from the Cave Gulch stream downstream of the site. The flow rate at this location was 12 gpm.

2.5.3.2 Soil

No erosion or leaching problems were noted at the site; therefore, no soil samples were collected.

2.5.3.3 Water

No MCLs or aquatic life criteria were exceeded in the waste-rock seep sample (table 2.2). The secondary MCL for aluminum was exceeded in the samples collected from Cave Gulch Spring and the Cave Gulch stream, downstream of the site.

2.5.3.4 Vegetation

Vegetation on the waste-rock dumps is moderate to sparse. Near the waste-rock seep, the vegetation appears healthy.

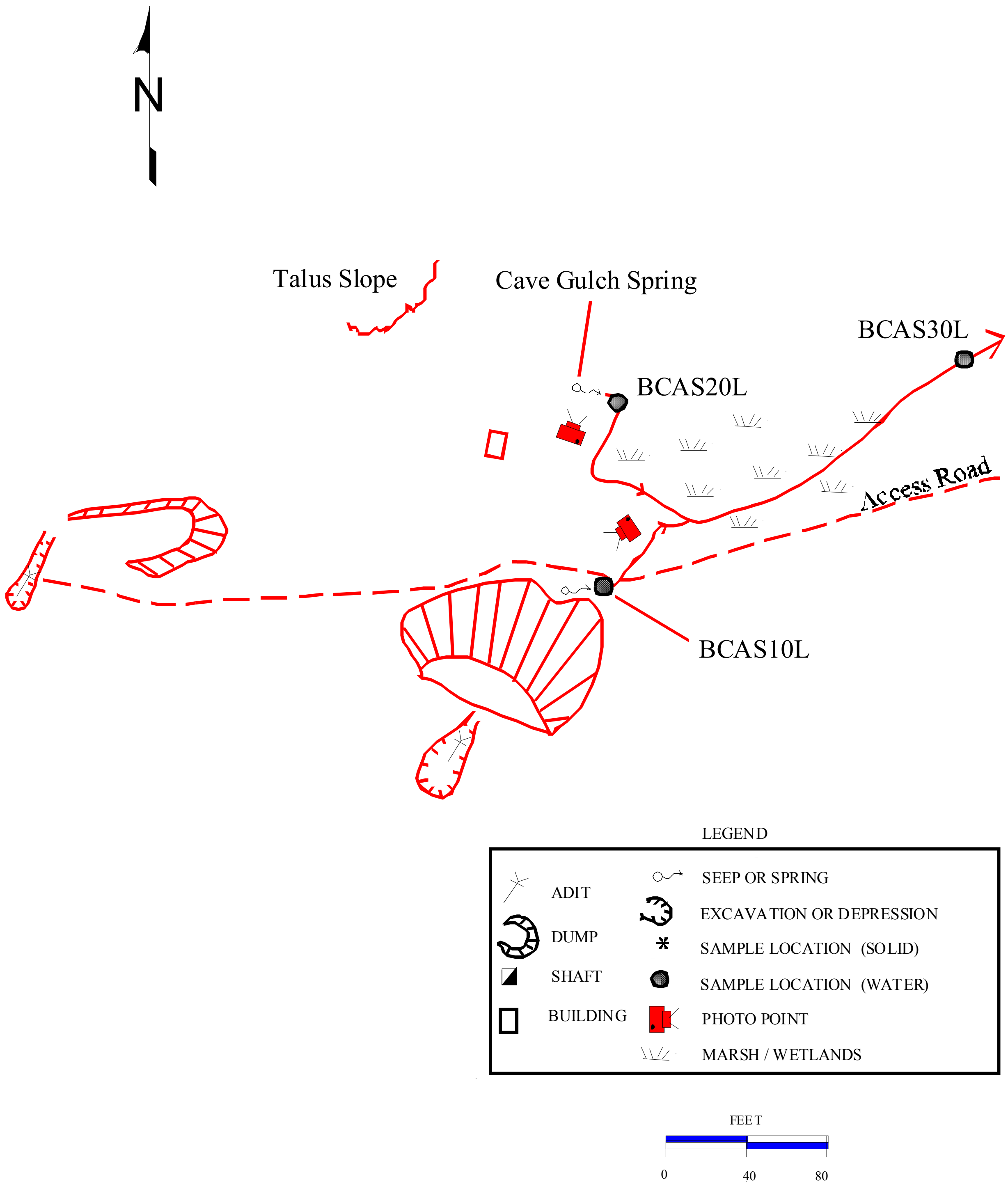

Figure 2.4 At the Capitol mine, a clear seep flows from the base of a waste-rock dump, September 1996.

Figure 2.5 A seep emerges at the base of the Capitol mine's lowermost dump. Sample BCAS10L was collected here.

Figure 2.6 Sample BCAS20L was collected from Cave Gulch Spring to provide an indication of background water quality.

Table 2.2 Water-quality exceedences at the Capitol mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Cave Gulch Spring - upstream of seep (BCAS20L)	S																		
Seep at base of waste-rock dump (BCAS10L)																			
Cave Gulch - downstream of site (BCAS30L)	S																		

Exceedence codes:

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

Note: The analytical results are listed in Appendix V

2.5.3.5 Summary of Environmental Conditions

No serious environmental problems were identified at the site. The high concentration of aluminum in the sample collected downstream of the mine is not attributable to the waste-rock dump seep. Instead, the Cave Gulch stream appears to have naturally high aluminum concentrations.

2.5.4 Structures

A cabin in fair condition is present near Cave Gulch Spring.

2.5.5 Safety

Other than the cabin, which might be unstable, no safety hazards were noted at the site.

2.6 COPPER QUEEN MINE

2.6.1 Site Location and Access

The Copper Queen mine is located along Forest Road 2406, which turns east off the Pioneer Mountains Scenic By-Way (Forest Road 484). The site is reached by driving approximately one mile to the small adit on the east side of the road and the waste dump on the west side of the road. The road is passable by two-wheel drive vehicle in good weather. The site is located in T4S R12W Sec. 22 ABBD on the Elkhorn Hot Springs 7.5-min. quadrangle.

2.6.2 Site History - Geologic Features

The Copper Queen is a patented claim and is one of the 68 Boston and Montana group claims (Geach 1972). It is associated with the Lynx and Broadway patented claims. The ore body was hosted by an intrusive—a hornblende-biotite granodiorite of the Pioneer batholith (Loen and Pearson 1989). The claim is west of the Comet Mountain fault that runs north-south through the area. The area downhill from the mine has intrusive boulders and quartz breccia. Uphill from the mine, there is a small (<1 ton) "ore" dump with sulfides (mostly pyrite), iron oxides, and quartz.

Workings at the site consist of one, possibly two, adits; the upper one is completely caved with some timbers still showing. The lower adit may be a continuation of the upper one but is breached about 50 feet back from the portal. There is one small shaft (collapsed) or a prospect to the west of the adit. The disturbed area covers 1-2 acres.

2.6.3 Environmental Condition

An intermittent drainage flows down from a clearcut uphill from the mine site and across the dumps where it emerges from the collapsed adit. It then flows on the lower side of the waste dump, through a culvert under the road, and down through a wetlands toward St. Louis Gulch. Flow from the area is estimated to be 2 gpm. There were several springs in or around the mine site. In fact, the "discharge" from the adit may actually be a pre-existing spring that just happens to emerge from where the mine encountered it.

2.6.3.1 Site Features - Sample Locations

The site was sampled on September 11, 1996. Sample SCQS10M was collected downstream of the adit, waste dump, and small wetlands area. This location was one of the only places that there was enough water in the channel to sample. The drainage flows intermittently, and it is unknown if it reaches St. Louis Gulch, about 0.3 miles from the mine. Site features and sample locations are shown on figure 2.7; figures 2.8 and 2.9 are photographs of the site.

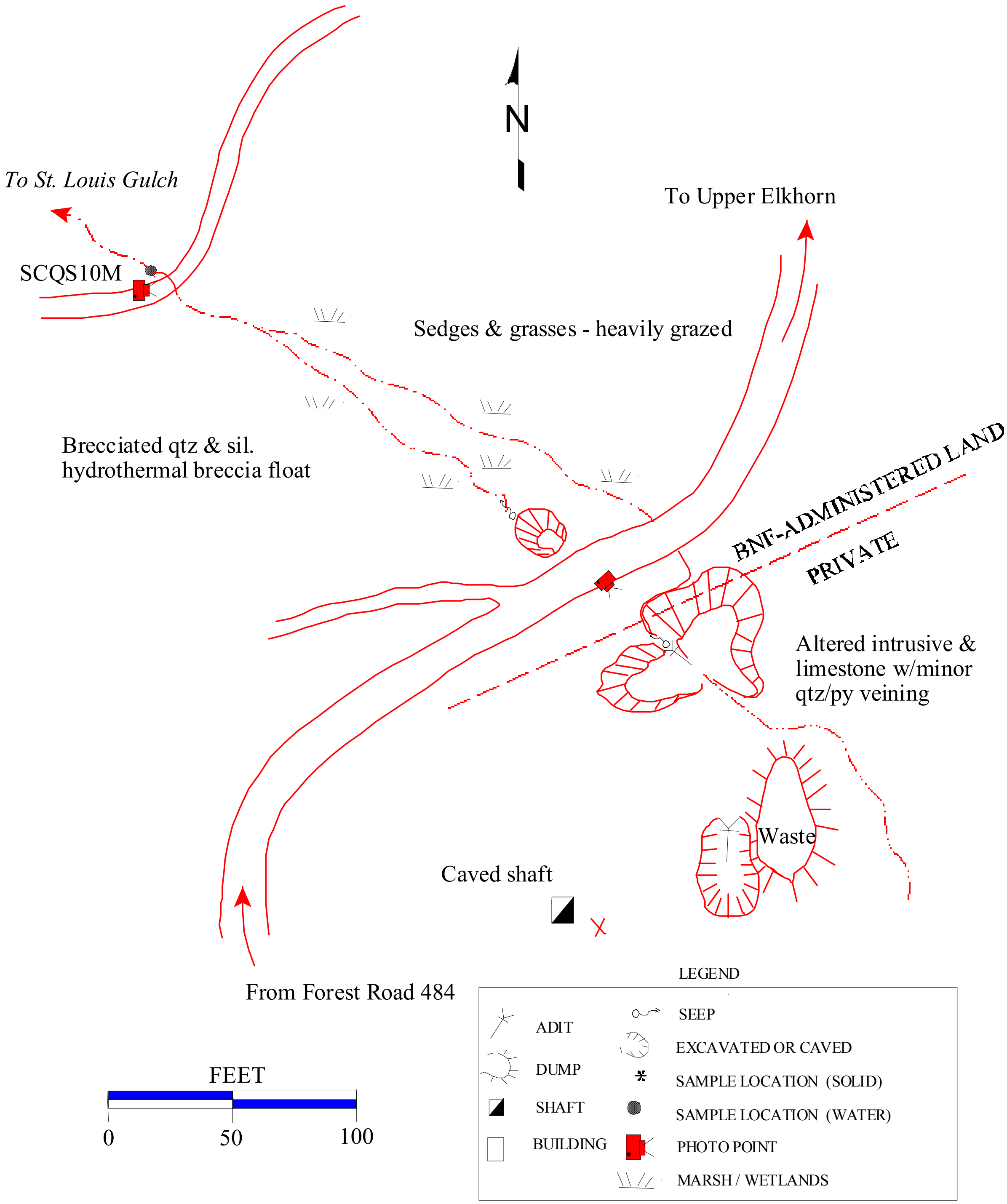

Figure 2.7 The Copper Queen patented claim had a small discharge that flowed through a culvert and down toward St. Louis Gulch, as mapped September 11, 1996.

Figure 2.8 The collapsed adit with a discharge at the Copper Queen mine was sampled downstream.

Figure 2.9 The adit discharge combined with a seep from the dump and spring area to form a small iron-stained flow near a logging road.

2.6.3.2 Soil

No soil samples were collected. The soil in the area downhill from the waste did not appear to be adversely impacted by runoff or sedimentation.

2.6.3.3 Water

The 2-gpm discharge may actually be a natural spring that happens to occur near the portal of the mine. Small springs also were found downhill from the mine. The only place where there was enough water to sample was approximately 500 feet downhill from the adit. The water here had an oily sheen and was iron stained; the concentration of iron exceeded the secondary MCL and acute aquatic life standards (table 2.3). The field pH was 9.06 (but the laboratory pH was 6.5), and the field SC was 107 µmhos/cm.

Table 2.3 Water-quality exceedences at the Copper Queen mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Discharge below site (SCQS10M)							S,A		S										

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

Note: The analytical results are listed in appendix V.

2.6.3.4 Vegetation

Mining in the area has had little impact on vegetation The spruce/fir forest is revegetating, and the grasses and sedges in the open areas appear healthy. The vegetation next to the creek also is healthy. The waste dump surrounding the adit is sparsely vegetated, probably due to the lack of soil. Impacts from a recent clear cut and from cattle grazing are much more pronounced.

2.6.3.5 Summary of Environmental Condition

This site easily could be overlooked. The adit did not stand out, and the small waste dump on the west side of the road blends into the scenery. Although the site has a small

discharge with high concentrations of iron and manganese, the discharge probably does not reach St. Louis Gulch. Overall, the environmental impact of the site is minimal.

2.6.4 Structures

No structures were observed at the Copper Queen, and no remains of any structures could be discerned.

2.6.5 Safety

No safety concerns were noted here, primarily due to the small size of the workings and the collapsed nature of the adit.

2.7 LUCKY STRIKE MINE

2.7.1 Site Location and Access

The Lucky Strike mine (T11S R13W Sec 14 BAC) is located about 10 miles southwest of Grant, Montana, along Jeff Davis Creek, southwest of Jeff Davis Peak. The site is on BNF-administered land, accessible by a dirt road through private and BLM-administered land from State Highway 324 at the Donovan Ranch.

2.7.2 Site History - Geologic Features

Lucky Strike mine is in the Colorado Mining District, above "Chinatown" on Jeff Davis Creek. Jeff Davis Creek was extensively placered in the 1880's, and more recent dredge piles are evident on private land below the National Forest. The most recent major placer operation (Searle Brothers) worked in the main drainage below the National Forest in the late 1980's. Small placer operations continue at several points along lower Jeff Davis Creek. Underground mining took place on the BLM-administered lands below the National Forest, but very limited underground operations are evident on the National Forest.

Twelve Lucky Strike claims were located in 1958 by G.T. Adams and Owen A. Adams. The mining operation was on Lucky Strike #1 and #2. Forest Service records indicate a cabin on the Lucky Strike #2, and an adit at the point of discovery 4.5 feet wide by 5 feet in height, and 10 feet deep in 1964.

In 1975, Owen N. Adams and G.T. Adams wrote to the Forest Service about their intention to operate, noting they had filed on the water of Jeff Davis Creek for mining purposes. The Notice of Intention to Operate proposed opening up an old tunnel and some placer mining, "but not to be extensive as to the Placer Mining. As the best ore is located in the tunnel." No trenching or drill sites, or timber-cutting, except for mine timbers, was planned.

In 1975, David Wilstead and Richard Fox filed a Notice of Intention to operate, to retimber existing adits, including the two sites on Lucky Strike 1 and 2 on the south side of Jeff

Davis Creek, and another about 1/4-mile north, on the ridge north of Jeff Davis Creek. In 1979, Forester Max Norris visited the site, where a sign on the outhouse proclaimed G.T. Adams, Ned O. Adams, and Randy Strupp owners of Lucky Strike 1-12.

The cabin was gone from the site sometime after 1986, and before 1994. BLM Mining Claim Records indicate the last assessment year was 1992. The claimants in the last year were Owen N. Adams Estate (Box A, Teasdale, UT 84773) and Rudoph S. Pace (Box 278, Torrey, UT 84775).

The site continues to be used as a hunting camp. The outhouse is still present, along with a small storage building, and assorted debris.

The USGS topographic map shows two prospects in this area, which are accessed by several hundred feet of road on the south side of Jeff Davis Creek, upstream from the former cabin site. The first prospect is evident today as a cut, possibly a caved adit. Several yards upstream from this prospect is the open adit with a small discharge. There is evidence of historic mining at the site in the form of a stone arrastre next to the stream immediately below the first prospect. There is a road above the prospects on the slope, presumably constructed for drilling access, but there is no evidence of drilling activity along the road.

M'Gonigle and Hait's geologic map of the Jeff Davis Peak quadrangle (1997) described the geology of the prospect area as a breccia zone in Archean granite gneiss, and an area of contact between gneiss and older latite porphyry.

2.7.3 Environmental Condition

A small, clear seep emerges from the adit portal. The rocks in the vicinity of the prospects are a tawny brown color. Rock samples collected at the Lucky Strike by Hammarstrom and VanGosen (USGS) in 1997 confirm the presence of sulfide minerals. In the two samples, copper values were 126 and 11 ppm, lead values were 17 and 44 ppm, and zinc values were 21 and 107 ppm. Gold values for the two samples were 0.035 ppm and <0.005 ppm. These data will be included with other information for the Chinatown area in a USGS open-file report.

2.7.3.1 Site Features - Sample Locations

Water-quality samples were collected June 11, 1998. The water flowing from the adit was collected in a small depression immediately above the road. This water came from under a bank of ice and snow which extended several feet inside the adit, so values are likely to be diluted. Jeff Davis Creek water was sampled at a point about 25 yards upstream from the adit, and at a point just below the dump of the lower prospect.

Sediment was collected from the Jeff Davis stream channel, just below the mine area, below remnants of a small sluice.

2.7.3.2 Soil

Metal concentrations in the stream sediment were low; none of the concentrations exceeded phytotoxic levels (table 2.4).

Table 2.4 Soil sampling results (mg/kg) for the Lucky Strike mine.

Sample Location	As	Cd	Cu	Pb	Zn
Sediment along Jeff Davis Cr - downstream of site (BLSD10L)	3.09	0.528[1]	10.1	14.4[1]	22.1

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3)
(2) Exceeds phytotoxic levels (table 1.3)

2.7.3.3 Water

The water quality of the adit discharge and Jeff Davis Creek were good; no standards were exceeded.

2.7.3.4 Vegetation

The waste-rock dumps and mine road are sparsely vegetated. The site is at the foot of a steep,north-facing slope forested with lodgepole pine and Douglas-fir, with Engelmann spruce in the canyon-bottom riparian zone.

2.7.3.5 Summary of Environmental Condition

The adit discharge and streamside waste-rock dump at the Lucky Strike mine have a very minor to negligible impact on water and sediment quality in Jeff Davis Creek.

2.7.4 Structures

An outhouse and a small storage shed in poor condition are present in the former cabin site, where the road crosses Jeff Davis Creek to access the mine.

2.7.5 Safety

The open adit represents a potential safety hazard.

2.8 PARADISE CLAIM

2.8.1 Site Location and Access

The Paradise Claim (T6S R10W Sec. 1 ADAA) is located several miles northwest of Argenta. The mine is on the west bank of Trout Creek, approximately 0.8 miles upstream of the confluence with French Creek. The site is on BNF-administered land and is easily accessible by road.

2.8.2 Site History - Geologic Features

The Paradise Claim on Trout Creek, a tributary of French Creek, consists of two trenches, an adit, and a small dump area. The adit explored a dike or sill intruded into Cambrian or Precambrian quartzite. The igneous rock is altered syenite(?); mineralogy includes scattered orthoclase phenocrysts, minor disseminated pyrite, minor calcite (in veins), and trace graphite(?). There is a trace of limonite staining on the dump rock. A dump sample assayed 38 ppm lead, 28 ppm zinc, 10 ppm copper, 1.2 ppm silver, trace gold, and 88 ppm arsenic. The site is an active claim (Bump 1998).

2.8.3 Environmental Condition

The site has a streamside waste-rock dump that is in contact with Trout Creek over a 130-foot distance.

2.8.3.1 Site Features - Sample Locations

The site was sampled on October 8, 1996. Soil sample BTRD10M was collected from the streamside waste to determine if the dump is a possible source of heavy metal contamination. Water-quality samples were collected upstream (BTRS20M) and downstream (BTRS10M) of the site to determine if Trout Creek is impacted by the waste. Site features and sampling locations are shown on figure 2.10; figures 2.11 and 2.12 are photographs of the site.

2.8.3.2 Soil

The concentrations of several metals in the streamside dump are above Clark Fork Superfund background levels (table 2.5). Arsenic is the only contaminant that comes close to exceeding phytotoxic levels.

Table 2.5 Soil sampling results (mg/kg) for the Paradise Claim.

Sample Location	**As**	**Cd**	**Cu**	**Pb**	**Zn**
Streamside waste-rock dump (BTRD10M)	95[1]	0.69[1]	10	46.0[1]	57[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3)
(2) Exceeds phytotoxic levels (table 1.3)

2.8.3.3 Water

The chronic aquatic life criteria for silver was exceeded upstream of the site (table 2.6); however, downstream of the site, there were no exceedences.

Table 2.6 Water-quality exceedences at the Paradise Claim.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Trout Creek - upstream of mine (BTRS20M)												C							
Trout Creek - downstream of mine (BTRS10M)																			

Exceedence codes: P - Primary MCL, S - Secondary MCL, A - Aquatic Life Acute, C - Aquatic Life Chronic
Note: The analytical results are listed in appendix V.

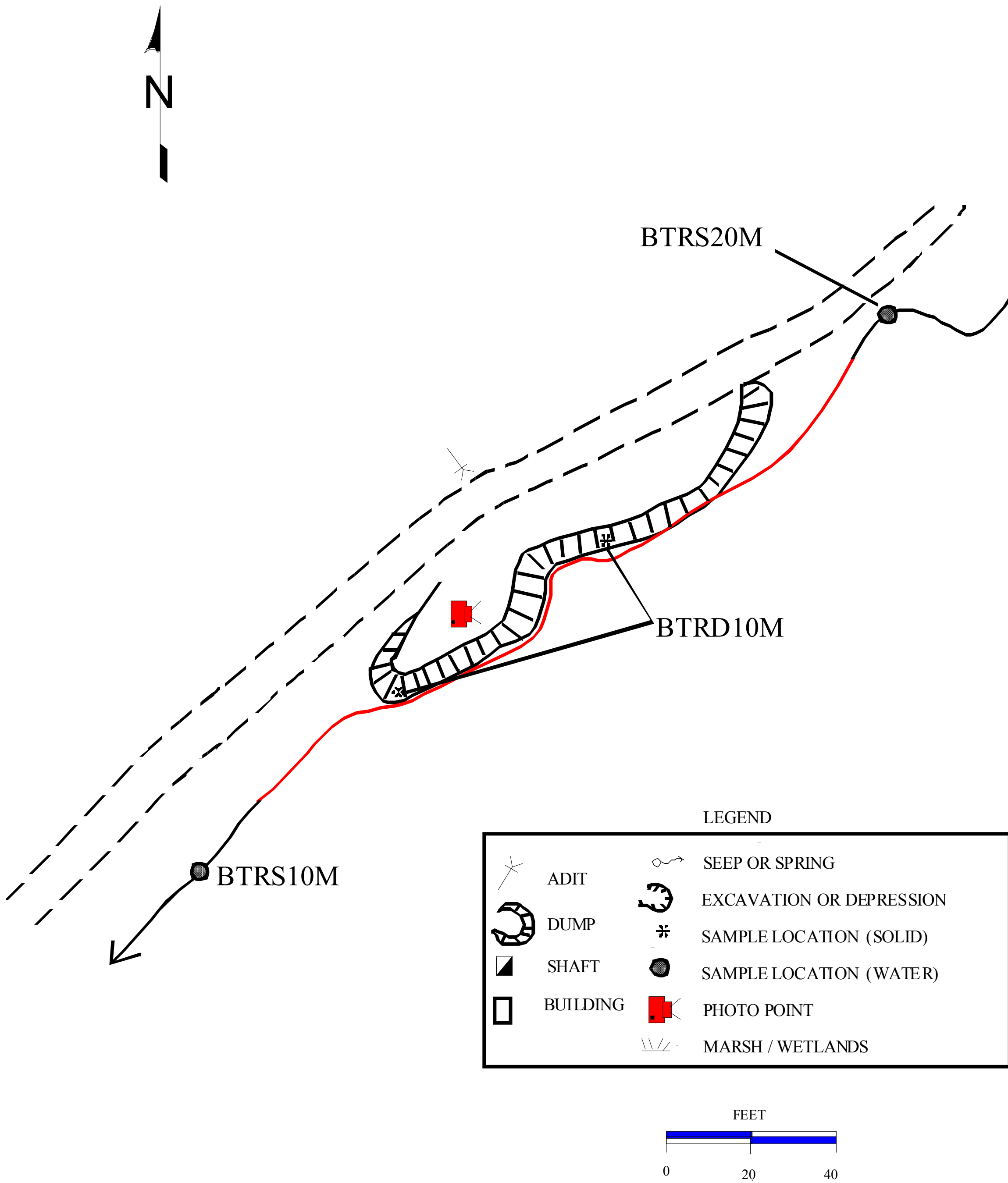

Figure 2.10 Trout Creek flows past a streamside waste-rock dump at the Paradise claim (10/8/96).

Figure 2.11 A small waste-rock dump is located on the bank of Trout Creek.

Figure 2.12 The condition of the Paradise Claim's adit is unknown because the portal is closed with a wood door that can not be opened.

2.8.3.4 Vegetation

The streamside dump is naturally revegetating with grasses and brush.

2.8.3.5 Summary of Environmental Conditions

The streamside dump at the Paradise Claim is being actively eroded by Trout Creek. The dump contains arsenic at concentrations close to phytotoxic levels; therefore, sediment eroded from the dump could pose an environmental problem. Removal of the dump from the flood plain probably would be advisable.

2.8.4 Structures

No structures were observed at the site.

2.8.5 Safety

A wooden door placed across the adit portal is now impossible to open without excavating several feet of talus. The condition of the adit beyond the door unknown.

2.9 PAY DAY MINE

2.9.1 Site Location and Access

The Pay Day mine (T6S R10W Sec. 7 ACBD) is located about three miles north of Argenta. It is on a southeast-facing mountainside at the head of the Dexter Gulch drainage. Dexter Gulch is an ephemeral stream that flows into Frying Pan Gulch. The site is on BNF-administered land and is accessible by following a secondary dirt road that turns north off the Long John Road.

2.9.2 Site History - Geologic Features

Two surface trenches, a caved adit(?), and two dumps are found approximately one mile north of the May Day Mine. This site probably explored the same shear zone as that worked on the May Day claim. Host rock is reddish-brown to brown Precambrian Belt shale. There is scant evidence of mineralization on dump and wall rocks; iron oxide staining and sparse quartz is present. A dump sample assayed 22 ppm lead, 92 ppm zinc, 36 ppm copper, trace silver, trace gold, and 70 ppm arsenic. It is an active claim (Bump 1998).

2.9.3 Environmental Condition

A small iron-oxyhydroxide stained discharge flows from the collapsed adit portal. The discharge infiltrates the ground when it reaches the small waste-rock dump. In the trenches below the adit, there is an ephemeral spring. Another spring located a short distance below the mine has been developed for livestock.

2.9.3.1 Site Features - Sample Locations

Water-quality samples were collected at the site on September 25, 1996. Sample BUBS10M was collected from the adit discharge, which had a flow rate of 0.1 gpm. A second sample (BUBS30M) was collected from the developed spring. The flow rate of the spring was 0.6 gpm. Site features and sample locations are shown in figure 2.13; figures 2.14 and 2.15 are photographs of the site.

2.9.3.2 Soil

No mine waste erosion or leaching problems were noted at the site; therefore no soil samples were collected

2.9.3.3 Water

The adit discharge had concentrations of aluminum, iron, and manganese that exceed secondary MCLs (table 2.7). Aluminum also exceeded acute and chronic aquatic life criteria. The spring downgradient of the mine had no water-quality problems.

Table 2.7 Water-quality exceedences at the Pay Day 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 discharge (BUBS10M)	S,A C						S		S										
Livestock spring - downgradient of site (BUBS30M)																			

Exceedence codes: P - Primary MCL, S - Secondary MCL, A - Aquatic Life Acute, C - Aquatic Life Chronic
Note: The analytical results are listed in appendix V.

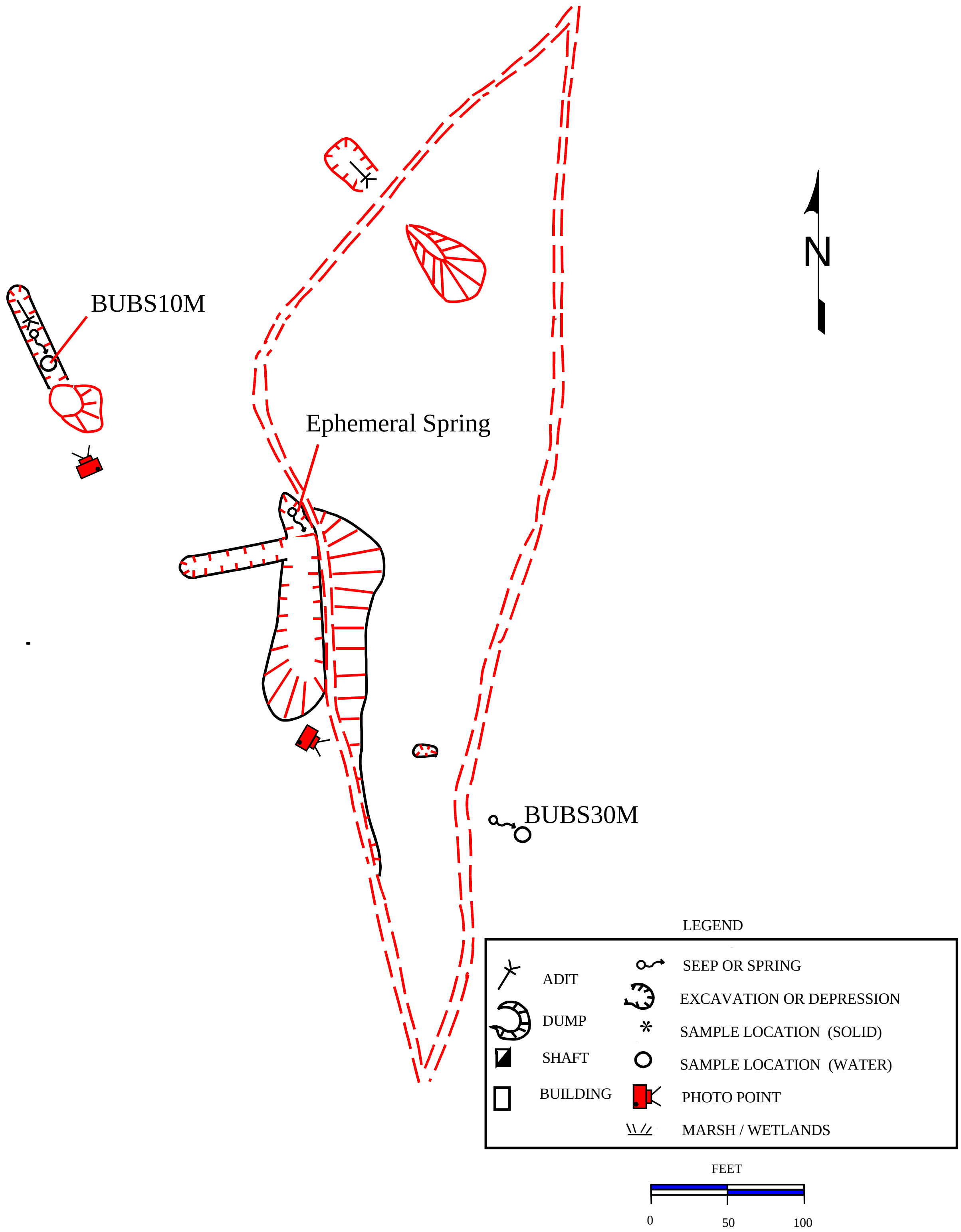

Figure 2.13 A small iron-oxyhydroxide stained spring flows from the upper adit at the Pay Day group, as mapped in September 1996.

Figure 2.14 The adit discharge at the Pay Day mine contains high concentrations of aluminum, iron, and manganese.

Figure 2.15 A spring several hundred feet downhill from the mine is used for watering livestock. The water quality here is good.

2.9.3.4 Vegetation

The waste-rock dumps and other disturbed areas are naturally revegetating.

2.9.3.5 Summary of Environmental Conditions

The site's adit discharge contains elevated concentrations of aluminum, iron, and manganese. The discharge may impact ground-water quality near the site, but the spring below the mine appears to be unaffected.

2.9.4 Structures

No structures were observed at the site.

2.9.5 Safety

No safety hazards were noted at the site.

2.10 WATSON GULCH MINE

2.10.1 Site Location and Access

The Watson Gulch mine (T5S R11W Sec. 36 BBDB) is located northwest of Argenta near the head of Watson Gulch. A small stream flows down Watson Gulch and is a tributary to French Creek. The site is on BNF-administered land and is accessed by hiking approximately one mile up the Watson Gulch drainage from the French Creek–Thief Creek Road.

2.10.2 Site History - Geologic Features

The Watson Gulch manganese oxide mine consists of several prospect pits, a caved adit, and two moderate-sized dumps. Total surface disturbance is less than one acre. The mine apparently explored manganese enrichment in a light-gray to light-purple dolomite (Pennsylvanian Amsden Formation?). Dump rock exhibits sparse limonite and manganese staining. Two assay samples collected at the site contained 1,495 and 700 ppm manganese; low lead and arsenic concentrations were reported for these samples. The mine was active in 1956 and 1957 (MBMG files). The Forest Service lists the site as an active claim (Bump 1998).

2.10.3 Environmental Condition

A small, clear discharge surfaces near the portal of the collapsed adit and pools inside an old mine building. A small trickle exits the building and quickly sinks into the ground. The site also has a streamside waste-rock dump on the west bank of the stream flowing down Watson Gulch. The dump is generally composed of coarse, unmineralized material.

2.10.3.1 Site Features - Sample Locations

The site was sampled on October 8, 1996. Water-quality sample BFCS20M was collected from the adit discharge which had a flow rate was 0.5 gpm. Samples were collected from the Watson Gulch stream above (BFCS10L) and below (BFCS30L) the site. The flow rate at the upstream location was 135 gpm; at the downstream location, the rate was 90 gpm. One soil sample (BFCD10L) was collected along the edge of the streamside waste-rock dump to determine if dump material is a potential source of leachable metals. Site features and sample locations are shown on figure 2.16; figures 2.17 and 2.18 are photographs of the site.

2.10.3.2 Soil

The soil between the waste-rock dump and the Watson Gulch stream contained copper at a concentration above the phytotoxic level (table 2.8).

Table 2.8 Soil sampling results (mg/kg) for the Watson Gulch mine.

Sample Location	As	Cd	Cu	Pb	Zn
Streamside waste-rock dump (BFCD10L)	14.0[1]	0.71[1]	143[1,2]	21.0[1]	243[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3)
(2) Exceeds phytotoxic levels (table 1.3)

2.10.3.3 Water

Water quality at the site appears good. No MCLs or aquatic life criteria were exceeded.

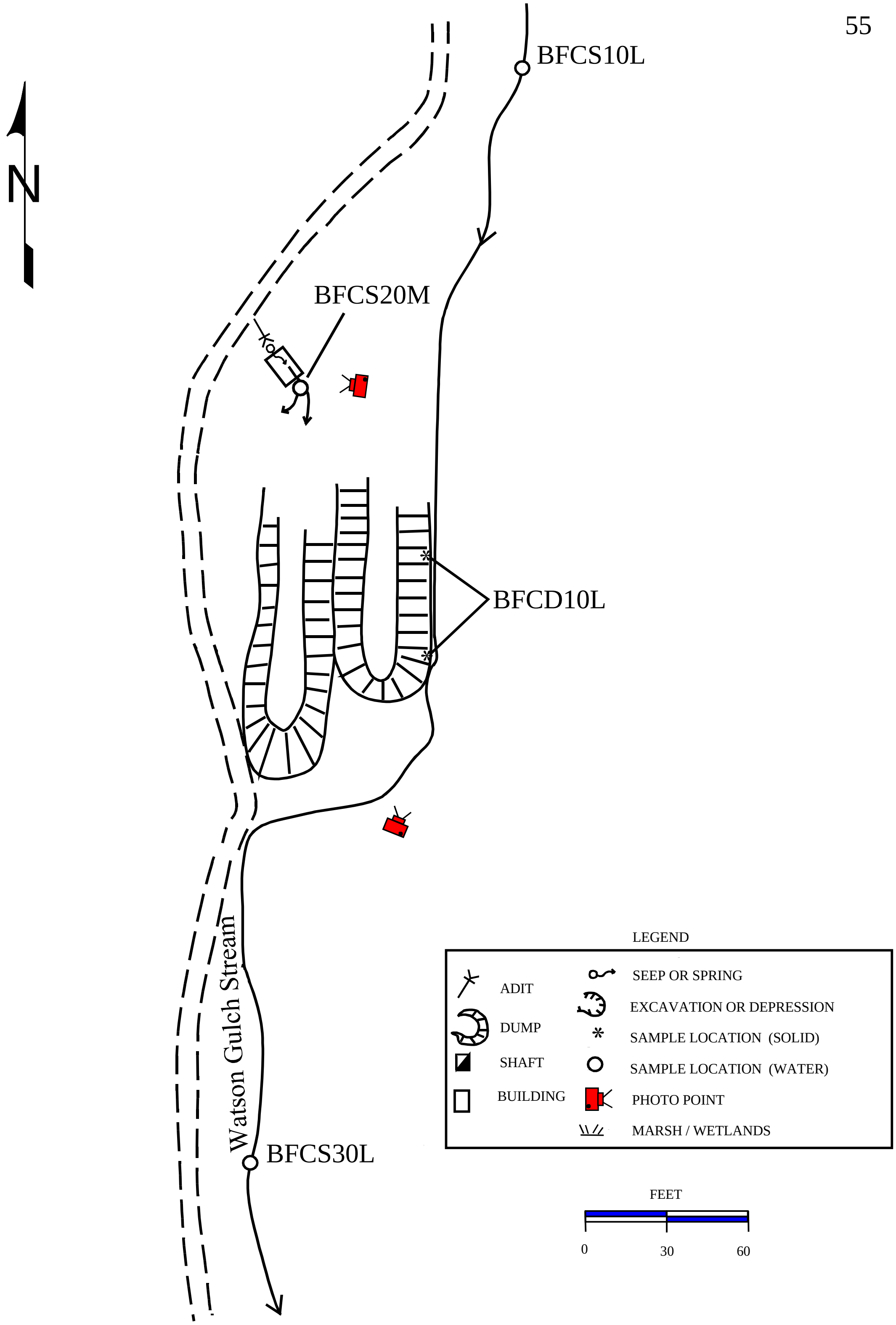

Figure 2.16 At the Watson Gulch mine, there is a small adit discharge and a streamside waste-rock dump (10/8/96).

Figure 2.17 A large waste-rock dump is located on the bank of the Watson Gulch stream.

Figure 2.18 Sample BFCS30L was collected from the Watson Gulch stream below the mine.

2.10.3.4 Vegetation

The waste-rock dumps are largely composed of gravel to cobble-sized material; as a result, vegetation is sparse. Elsewhere around the site, vegetation appears healthy.

2.10.3.5 Summary of Environmental Conditions

The waste-rock dump adjacent to the stream is the only potential environmental problem identified at the Watson Gulch mine. Soil around the dump was found to contain a high concentration of copper. Under low flow conditions, such as those when the site was sampled, the likelihood of contaminated soil eroding into the stream is minimal. Under high flow conditions, there may be some impact, but it is still probably minor.

2.10.4 Structures

A mine building is located close to the collapsed adit portal. The building is in poor condition. Two cabins located in the woods southwest of the adit are in good condition. At least one of the cabins appears to have been inhabited recently. All of these structures are on BNF-administered land.

2.10.5 Safety

The mine building next to the adit could be unstable and therefore is identified as a hazard.

2.11 WELLMAN GROUP/NEW YORK CLAIM

2.11.1 Site Location and Access

The Wellman Group consists of 11 claims on Wellman Creek. The claims are accessed via Forest Road 7442 after turning east off of Forest Route 73 on Grasshopper Creek. The New York claim is part of the group and is located in T4S R12W Sec 33 ABDB. Most of the workings are behind a locked gate.

2.11.2 Site History - Geologic Features

This site is alternately known as the McConnell group/the Wellman group/the New York claim, and the Wellman mine. Loen and Pearson (1989) stated that the mine is in Cretaceous granodiorite of the Pioneer batholith. They showed it as having recorded production and as being a vein or replacement deposit of base- or precious-metals. Geach (1972) listed the ore minerals as pyrite with minor galena, sphalerite, and chalcopyrite in a gangue of white quartz. Winchell (1914) stated that the mineralization was carried in quartz/pyrite veins with ore minerals including chalcopyrite, galena, sphalerite, and chalcocite with secondary minerals including malachite, azurite, and native copper.

Geach (1972) reported that the New York claim's adit was approximately 800 feet long. His assays showed select ore that contained 1.05% Cu, 5.30% Pb, 2.70 % Zn, 5.0 opt Ag, and 0.020 opt Au. A second adit at the W.M.C. claim (figure 2.19) had approximately 4,800 feet of workings.

2.11.3 Environmental Condition

High sulfide waste from the New York claim had a barren area below it with seeps emerging adjacent to the creek. The seeps were merely boggy areas, and there was not enough water to sample. The adit, which is on private land, had a small discharge of less than one gpm.

2.11.3.1 Site Features - Sample Locations

Two samples were collected from Wellman Creek on November 1, 1996: one upstream (WWMS20M) and one downstream (WWMS20M) of the New York claim (figure 2.19). The upstream sample was taken approximately 350 feet above the mine. The downstream sample was taken approximately 250 feet down from the mine and 500 feet up from the culvert on the main access road. Because only a small amount of water was flowing from the seep/bog at the toe of the dump, the seep was not sampled. The adit discharge is on private land, so it was not sampled. Figures 2.20 and 2.21 are photographs of the site.

2.11.3.2 Soil

No soil samples were collected. Soil on BNF-administered land did not appear to be affected by runoff or sedimentation from the disturbed area.

2.11.3.3 Water

The upstream water sample (WWMS20M) had a field pH of 8.2 and an SC of 183 µmhos/cm. The water at this location was clear and cold; the flow rate was estimated to be 15 gpm. The downstream sample (WWMS10M) had a pH of 7.6 and an SC of 184 µmhos/cm; the creek's flow rate (33 gpm) was approximately twice that observed at the upstream sample site.

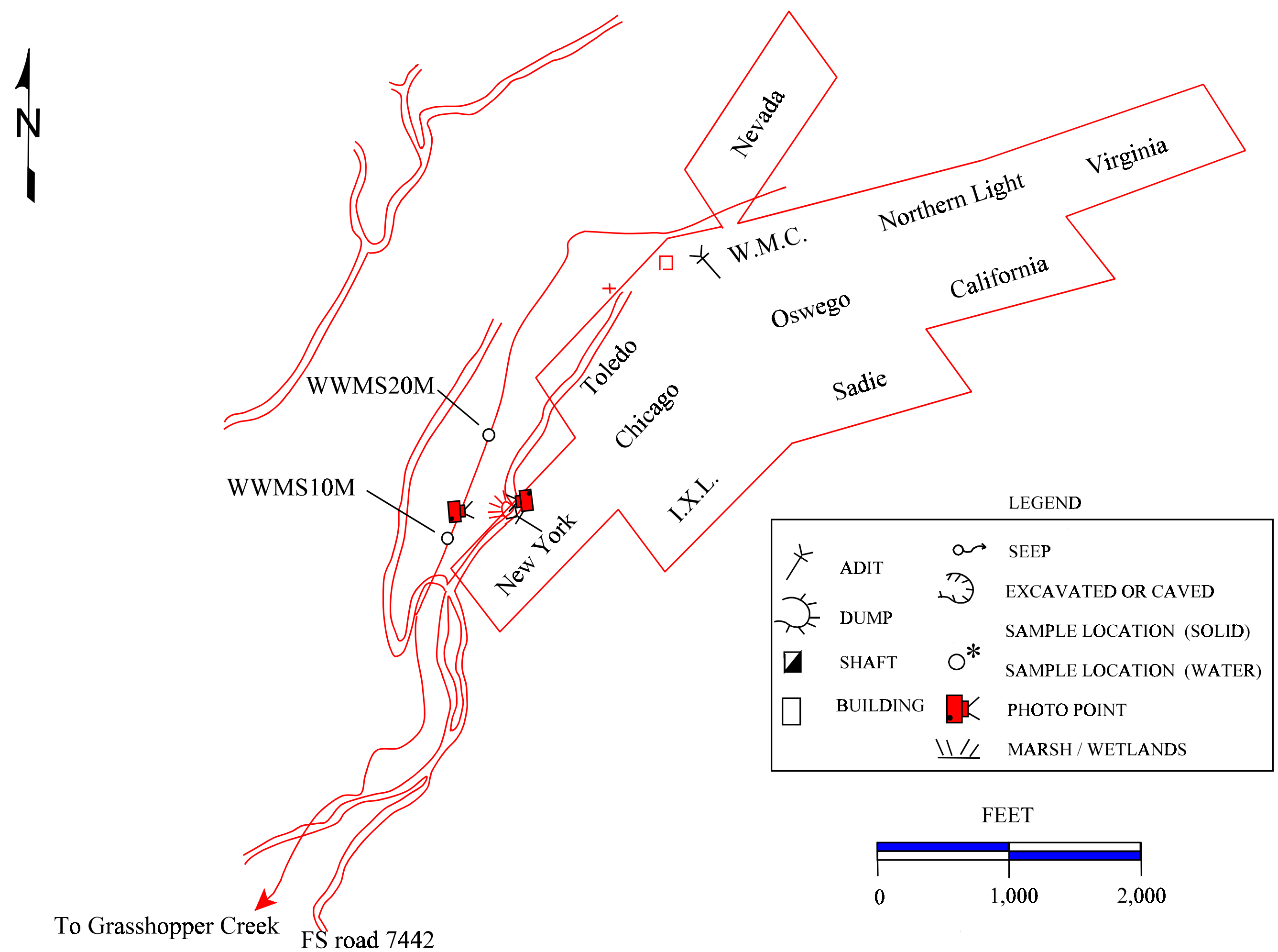

Figure 2.19 Schematic of the Wellman group taken from the Elkhorn Hot Springs 7.5-min. USFS ownership map (11/1/96).

Figure 2.20 A survey marker shows the private/BNF-administered land boundary. The high sulfide waste dump is primarily on patented land.

Figure 2.21 Downhill from the waste dump, the vegetation has died.

There were many springs contributing to the flow in the area between the two sites. Concentrations of aluminum, copper, manganese, and zinc exceeded water-quality standards downstream of the site (table 2.9). No standards were exceeded upstream of the site.

Table 2.9 Water-quality exceedences at the Wellman Group/New York Claim.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Wellman Creek - upstream of site (WWMS20M)																			
Wellman Creek - downstream of site (WWMS10M)	S,C					A,C			S				A,C						

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

Note: The analytical results are listed in appendix V.

2.11.3.4 Vegetation

The area directly downhill from the waste dump is barren of vegetation, and stumps remain where the timber has been cut. It is unknown if the trees were dead before they were cut.

2.11.3.5 Summary of Environmental Condition

This site is fairly small (<5 acres), with visible impacts to the vegetation below the waste dump. The seeps down from the dump are relatively small and do not contribute greatly to the flow in the stream. However, the concentrations of several metals rise significantly as the creek passes the site.

2.11.4 Structures

No buildings were located at the New York claim at the time of the study. However, work was being done on a cabin at the W.M.C. or Toledo claim (on private land).

2.11.5 Safety

The face of the New York claim’s dump is steep and poses a trip and fall hazard. The potential hazards on private land were not evaluated.

3.0 BIG HOLE RIVER DRAINAGE

The Big Hole River drainage is in the western portion of the Beaverhead National Forest and covers an area of approximately 2,790 mi^2. The basin can be divided into three distinct sections: 1) the upper basin, in the vicinity of the towns of Wisdom and Jackson, 2) the canyon, between the State Highway 43 bridge near Squaw Creek and Maiden Rock, and 3) the lower basin, in the vicinity of Melrose, Glen, and Twin Bridges. The basin received its name from early trappers who referred to valleys as “holes”. Because the upper basin is a particularly broad valley, it earned the name “Big Hole”.

The headwaters of the Big Hole River are in the Beaverhead Mountains, several miles south of Jackson, Montana. From there, it traces a broad “S” curve as it winds its way around the north end of the Pioneer Mountains and then the southern tip of the Highland Mountains. Near Twin Bridges, it joins the Beaverhead and Ruby Rivers to form the Jefferson River. The overall length of the river is about 130 miles. Major tributaries to the Big Hole include Warm Springs Creek, Miner Creek, Swamp Creek, Steel Creek, Trail Creek, Pintler Creek, Wise River, Canyon Creek, and Birch Creek.

Most residents within this sparsely populated basin derive their livelihoods from ranching, recreation, or forestry. The BNF in the upland portions of the basin is managed to accommodate multiple uses, including livestock grazing, recreational activities, and timber harvest. Private lands in the valley bottom are used primarily from livestock grazing, with about 134,000 acres of land devoted to irrigated hay and pasture for winter feeding of livestock (DNRC 1981).

Population centers in the basin include (from upstream to downstream) Jackson, Wisdom, Wise River, Divide, Melrose, and Glen. The total population in the basin is about 900 people.

3.1 GEOLOGY

BNF-administered lands in the Big Hole drainage are located in the Anaconda Range, the Beaverhead, and Pioneer Mountains. Geology of the entire drainage is shown on the map of the Dillon 1:250,000 quadrangle by Ruppel *et al.* (1993). The area is part of the western Montana thrust belt, where rocks were folded and thrust by Cretaceous compression, and subsequently cut by Tertiary high-angle faults. The Beaverhead range contains complexly deformed Belt Supergroup sedimentary rocks intruded by thin mafic dikes and sills. The Anaconda (Pintler) and Pioneer ranges consist of folded and faulted Paleozoic and Proterozoic sedimentary rocks intruded by Tertiary and Cretaceous granitic stocks and batholiths.

3.2 ECONOMIC GEOLOGY

The Beaverhead and Pioneer ranges host the only significant mining activity on BNF-administered lands in the drainage. Most mines are clustered about the margins of the Cretaceous to Eocene granitic intrusions. Mines of the Beaverhead Mountains are associated with complex fault zones and thin mafic Proterozoic(?) dikes and sills. Geach (1972), Loen and Pearson (1989), and Winters *et al.* (1994) summarize the geology of all mining districts and individual properties. All or parts of the Birch Creek, Lost Creek, Rock Creek, Hecla, Elkhorn, Quartz Hill-Vipond, Calvert Hill, French Gulch, and Wisdom districts as defined by Loen and Pearson (1989) are located in the Big Hole drainage.

3.3 HYDROLOGY AND HYDROGEOLOGY

The climate of the Big Hole basin is characterized by long, cold winters, mild summers, and low annual rainfall. Wisdom, which is 6,060 ft above sea level, receives an average of 11 inches of precipitation annually (NOAA 1991). Glen, which is 4,995 ft above sea level, receives an annual average of less than 9 inches. The average annual precipitation in the alpine areas ranges from 30 to 50 inches (SCS 1977). May and June are typically the wettest months.

An average monthly flow hydrograph for the Big Hole River near Melrose (figure 3.1) shows that spring runoff in the basin usually begins in April and peaks during May and June. Discharge rapidly declines in July when precipitation is considerably less and most of the seasonal snow pack has melted. Between August and March, the major component of streamflow is derived from ground water. The mean discharge at the Melrose gaging station is 1,120 cfs, or 810,000 acre-ft per year (Shields *et al.* 1996).

As noted previously, the Big Hole and its tributaries are the primary sources of irrigation water in the basin. Flows for fisheries and recreation are other sources of water demand. A third, relatively small demand is for municipal use. The City of Butte, located in the Upper Clark Fork River drainage, has a water right for 21.26 cfs (DNRC 1995); however, on the average, Butte only diverts about 14.5 cfs (Miller 1996).

Tertiary and Quaternary alluvial and glacial deposits are the most important hydrogeologic units in the basin and provide the most reliable supplies of ground water. The Tertiary materials are exposed mostly along the flanks of the mountains and primarily consist of sandstone and sandy siltstone. Quaternary deposits include glacial tills, glacial outwash, and alluvium that occur mainly in the mountains valleys and in the central Big Hole valley. The Paleozoic sedimentary rocks, Tertiary and Cretaceous igneous and metamorphic rocks, and Proterzoic metamorphic rocks that are exposed in the mountains also yield ground water, especially where they have been extensively fractured or faulted. Ground-water use in the basin is primarily for domestic and livestock purposes.

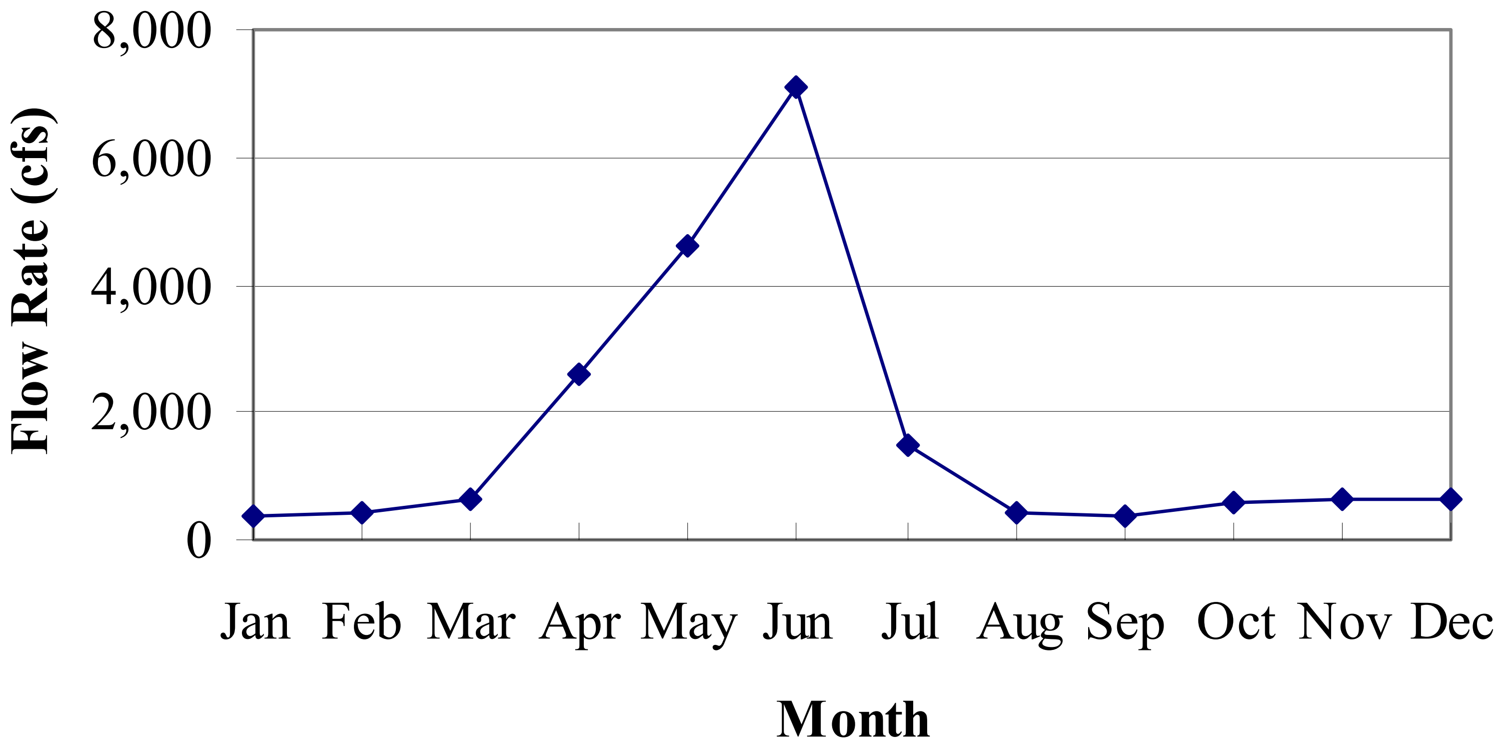

Figure 3.1 Average monthly flow, Big Hole River near Melrose, Montana (U.S. Geological Survey Station No. 06025500). Period of record: 1924 to 1995. Data source: Shields *et al.* (1996).

3.4 SUMMARY OF THE BIG HOLE RIVER DRAINAGE

Within the Big Hole River drainage, 173 mine and mill sites are on or near the Beaverhead National Forest (see figure 3.2 and table 3.1). Of these sites, 20 were found to have potentially adverse effects on soil or water quality on BNF-administered land. These sites are listed in **bold** in table 3.1 and are discussed in alphabetical order in the following sections. Ten of the twenty sites have one or more discharges from workings or waste material, and twelve have potential problems.

If mine openings or other dangerous features (unstable structures, highwalls, steep waste-rock dumps) were observed, the site has a bold-type **Y** under the hazard heading in table 3.1. In general, only those sites at which samples were collected were evaluated in detail. Of the 173 sites inventoried in the Big Hole drainage, 64 were identified that have safety problems.

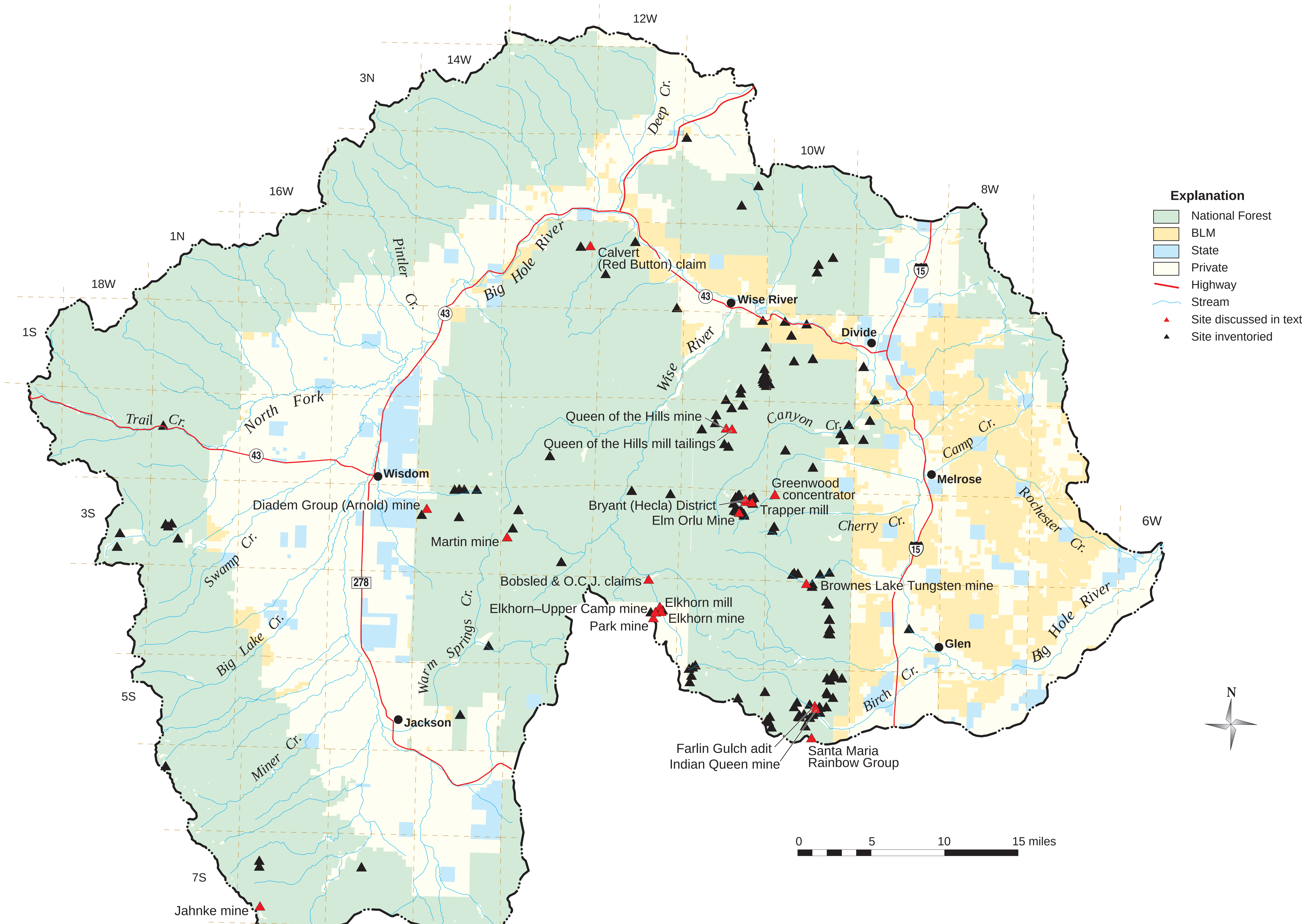

Figure 3.2. Abandoned / inactive mines inventoried in the Big Hole River drainage.

Table 3.1 Summary of sites inventoried in the Big Hole River drainage. Site name in **bold type** indicates potential environmental problems. Bold type **Y** in hazard column indicates a safety concern was noted at the site.

Name / ID[1]	**Owner**[2]	**Visit**	**Sample**[3]	**Hazard**[4]	**Remarks**
Adams Peak Claims BE000852	NF	Y	N	N	Visited general area. Unable to identify which trenches are these claims.
Ajax BE000156	PRV	Y	N	**Y**	Open adit. Site being considered for reclamation.
Amadon Group/Amadem/Amaden BE000594	NF	N	N	NE	Screened out. Possible Mg, Cu, Mo occurrence.
Armor Creek Prospect/Odell Claims BE000808	NF	N	N	NE	No impact.
Aurora BE000947	PRV	Y	N	N	Associated with East Aurora mine.
Barbour (Barber?) Gulch Adits BE008345	NF	Y	N	**Y**	Open adit.
Big Four BE004215	PRV	Y	N	N	Viewed from road. Lots of junk but no open adits observed.
Birch Creek Iron BE000624	PRV	Y	N	N	Same as Jumbo Group.
Birch Creek Limestone BE000664	NF	Y	N	**Y**	Highwalls present. Also, one open but grated, 6 ft wide, 20 ft deep well.
Birch Creek Placer BE008319	MIX	Y	N	N	Visited general area. Placer.
Black Bear BE000796	NF	Y	N	**Y**	Open adit on slope. Possibly two additional caved adits.
Blackmore/Pear Lake BE000846	NF	N	N	NE	Screened out. Prospect only according to Pattee (1960).
Blue Bell/Blue Belt BE008306	NF	Y	N	N	No visible impact.
Bobsled & OCJ Claims BE000581	PRV	Y	Y	N	Streamside waste-rock dump.
Bonanza BE008307	PRV	Y	N	NE	No visible impact.
Bonapart Prospect BE004295	PRV	Y	N	**Y**	Walked general area. May have open adits.
Boston and Montana Company BE000766	MIX	Y	N	N	No impact.
Bozeadar Property BE004010	NF	N	N	NE	Screened out. Described as two pits in Winters *et al.* (1994).

Table 3.1 Summary of sites inventoried in the Big Hole River drainage (continued).

Name / ID[1]	Owner[2]	Visit	Sample[3]	Hazard[4]	Remarks
Brownes Lake Tungsten (Ivanhoe) BE000642	MIX	Y	Y	**Y**	Unstable highwall. Streamside waste.
Brownes Lake-Lost Creek Area BE000592	MIX	N	N	NE	Visited general area. No impact.
Bryant Mining District (Hecla) BE000906	MIX	Y	Y	**Y**	General mining district. Hazardous mine opening(s). Sampled Trapper Creek below mines (see section 3.23 - Trapper mine and mill).
Burggieros A/ G-W BE000162	PRV	Y	N	NE	No visible impact.
Buster Claims BE008203	NF	Y	N	**Y**	Unpatented claims with open adits.
Buster BE000168	PRV	Y	N	**Y**	One 10 ft open inclined shaft and one culverted adit.
Calvert (Red Button Claim) BE000636	NF	Y	Y	**Y**	Adit discharge, flooded pit and seeps along toe of waste-rock dump, and streamside waste.
Cannivan Gulch BE000072	NF	Y	N	N	Drill pads and prospects only. No impact.
Carney BE008346	NF	Y	Y	N	Streamside waste.
Cattle Gulch Syncline BE000550	MIX	N	N	NE	Screened out. Phosphate occurrence.
Churchill BE000989	PRV	N	N	NE	Screened out.
Clara (Monty Clinton) BE000965	NF	Y	Y	**Y**	Adit discharge and hazardous collapsed shaft. Site being considered for reclamation.
Cleopatra BE004545	PRV	N	N	NE	Visited general area. No impacts observed.
Cleve-Avon Group BE000180	PRV	Y	N	**Y**	Two open adits. Site includes the Upper and Lower Cleve and Avon mines.
Couer D'Alene BE000790	UNK	N	N	NE	Unable to locate using lat-long from MILS.
Coolidge Town Site BE004550	NF	Y	N	N	Town site only. See Old Elkhorn mine or Coolidge mine in Argenta district.
Copper Contact Claim BE000864	PRV	Y	N	N	Prospect on east side of Indian Queen workings.
Copper Queen BE000600	UNK	N	N	NE	Unable to located using lat-long from MILS.
Daisy Vein BE004195	PRV	Y	N	N	No impact.

Table 3.1 Summary of sites inventoried in the Big Hole River drainage (continued).

Name / ID[1]	**Owner**[2]	**Visit**	**Sample**[3]	**Hazard**[4]	**Remarks**
Dark Horse/Darkhorse BE004575	PRV	Y	N	**Y**	Hazardous mine opening(s).
Dewey BE000682	UNK	N	N	NE	Unable to locate using lat-long from MILS.
Diadem Group (Arnold) BE000120	NF	Y	Y	**Y**	Adit discharge and two hazardous openings.
Dry Hollow Gulch Prospect BE000694	MIX	N	N	NE	Screened out. Phosphate prospect.
East Aurora BE000875	PRV	Y	N	N	No impact. Same site as Aurora mine.
Elkhorn Mill[5] **BE008333**	MIX	Y	Y	**Y**	Eroding tailings. Mill building is a hazardous structure but privately owned.
Elkhorn/Old Elkhorn BE000582	NF	Y	Y	**Y**	Adit discharge and seeps. Mine waste in flood plain. See section 3.11.
Elkhorn-Upper Camp BE008334	NF	Y	Y	N	Small discharge from collapsed adit.
Elm Orlu BE000611	MIX	Y	Y	**Y**	Streamside waste-rock dump. Hazardous mine opening(s).
Fairview BE004465	NF	N	N	NE	Unable to locate using lat-long from MILS.
Farlin Gulch Adit BE008322	NF	Y	Y	**Y**	Small streamside waste-rock dump. Steep sided prospect pit or shaft.
Fitzwater Claims BE000670	NF	Y	N	N	Visited general area. Limestone occurrence.
Fleecer Mountain Area SB006364	MIX	Y	N	N	Screened out.
Florence and Lilly BE008321	NF	Y	N	**Y**	Highwalls. May be same as Sata Maira (Santa Maria).
Fluorescent and Star Claims BE003880	NF	Y	N	**Y**	At least one partially open adit and some highwalls on dozer trenches.
Fool Hen Prospect/Foolhen BE000822	NF	N	N	NE	Screened out. Trench only.
Forest Queen BE004610	PRV	N	N	NE	Screened out. All private but visited general area.
Fraction BE004615	MIX	Y	N	**Y**	Flooded shaft but no discharge to creek. Ownership uncertain.
Franklin BE000186	PRV	Y	N	**Y**	Observed open inclined adit from public road.
Franklin No. 1 BE000784	UNK	N	N	NE	Unable to locate using lat-long from MILS.
French Creek Placer DL004924	S	N	N	NE	Screened out. Placer inside Mt. Haggin Wildlife Game Management area.

Table 3.1 Summary of sites inventoried in the Big Hole River drainage (continued).

Name / ID[1]	**Owner**[2]	**Visit**	**Sample**[3]	**Hazard**[4]	**Remarks**
Garnet Adit BE008331	NF	Y	N	**Y**	Open adit and several trenches.
Glow Worm Prospect; Greenhorn Claim BE000768	NF	Y	N	**Y**	Open adits and shafts.
Gob BE000149	UNK	N	N	NE	Unable to locate using lat-long from MILS.
Gold Coin BE000887	NF	N	N	NE	Screened out. Ridgetop location.
Gold Nugget BE000150	NF	Y	N	**Y**	Open adit and seasonal residence.
Granite BE008320	PRV	Y	N	N	Dump in bottom of drainage but no water. East of Indian Queen site.
Granite and Tiger Mines BE004035	NF	Y	N	**Y**	Visited site but uncertain of the name.
Gray Jockey/Grey Jockey[5] BE000893	PRV	Y	N	**Y**	Dry tailings.
Great Western BE000899	PRV	Y	N	NE	No impact.
Greenstone BE000546	PRV	Y	N	**Y**	Many open workings but all shafts are fenced with barbed wire and all adits are cable gated.
Greenwood Concentrator[5] **BE008327**	MIX	Y	Y	N	Streamside tailings.
Haggerty Property/Kopper Koin BE000144	NF	Y	N	**Y**	Open adit and open shafts fenced with barbed wire.
Harrison/Dora BE004020	PRV	N	N	NE	Screened out.
Hecla BE004025	PRV	N	N	NE	Screened out. All private.
Ibex/Bear Paw **BE004410**	NF	Y	Y	N	Small adit discharge.
Indian Girl BE000802	NF	N	N	NE	Screened out. Prospect pit only according to Winters et al. (1994).
Indian Queen[5] **BE000828**	MIX	Y	Y	**Y**	Smelter site but apparently no mill. Streamside slag.
International Prospect BE000774	NF	N	N	NE	Screened out. Tungsten/molybdenum occurrence.
Jahnke/Straight Tip Group **BE000504**	PRV	Y	Y	**Y**	Partially open adit with discharge.
Joe Maurice BE000935	NF	N	N	NE	Screened out. Geach (1972) says all workings are collapsed.

Table 3.1 Summary of sites inventoried in the Big Hole River drainage (continued).

Name / ID[1]	Owner[2]	Visit	Sample[3]	Hazard[4]	Remarks
Jumbo Group (Burch, U.S. Treasurer) BE000834	PRV	Y	N	N	No impact.
Jumper No. 1 BE000468	NF	Y	N	**Y**	Hazardous highwalls.
Keokuk/Keokirk BE004205	PRV	Y	N	**Y**	Open shafts.
Keystone BE000911	NF	N	N	NE	Visited general area but unable to located.
Knoby BE004200	PRV	Y	N	N	Small prospect only. No impact.
La Marche Creek BE000910	PRV	N	N	NE	Screened out. Phosphate occurrence and private.
Last Chance BE000772	NF	Y	N	**Y**	Hazardous mine opening(s).
Len Claims BE004085	NF	N	N	NE	No impact.
Lentung (Prospect) Deposit BE000052	NF	Y	N	N	No impact. Exploration drill roads and holes only.
Lime Kiln Gulch Quarry BE004495	PRV	N	N	NE	Screened out. Limestone quarry.
Limestone Occurrence BE000089	PRV	N	N	NE	Screened out. Limestone occurrence.
Lion Mountain Group BE004370	PRV	Y	N	N	15 patented claims. Visited general area.
Lion Mountain Tunnel BE008328	PRV	Y	N	**Y**	Ice and runoff from upslope contribute water to tunnel. Water does not reach Spring Creek.
Little Moose Horn BE000058	MIX	Y	N	NE	No impact.
LM Claims BE008204	NF	Y	N	N	No impact. Unpatented claims. Exporation only.
Log Cabin Lode BE000917	NF	Y	N	**Y**	Open adit. Waste rock in ephemeral drainage. Environmental impact to BNF-administered land is minimal.
Lone Pine (Quartz Hill) BE000923	PRV	Y	N	**Y**	Hazardous mine opening(s).
Lost Creek-”B” Adit BE000498	NF	Y	N	**Y**	Highwalls around pits. Adit is caved.
Lost Creek - “H” Adit BE008340	NF	Y	N	**Y**	Locks broken off gate to adit. Open cut above adit.
Lost Creek-Willow Creek Syncline BE000598	MIX	N	N	NE	Screened out. Phosphate occurrence.

Table 3.1 Summary of sites inventoried in the Big Hole River drainage (continued).

Name / ID[1]	**Owner**[2]	**Visit**	**Sample**[3]	**Hazard**[4]	**Remarks**
Lower Cleve Tunnel BE004420	PRV	Y	N	**Y**	Observed open adit from road. Gate is present but easily by-passed by crawling.
Lucky Jim Beam Group BE000084	NF	N	N	NE	Barite claim. Screened out.
Luke Si Quarry BE000714	NF	N	N	NE	Screened out in office. Silica quarry.
Mammoth Adit BE003915	NF	N	N	NE	Unable to locate. DeBoer (1991) shows it as caved.
Martin BE000971	NF	Y	Y	**Y**	Adit discharges and streamside waste. Unstable structures and hazardous subsidence around collapsed shaft.
Maynard BE000977	NF	Y	N	N	No impact.
Minnie Gaffney BE003940	PRV	Y	N	N	No impact. Visited general area. Patented claim.
Molytung Claims BE008205	NF	Y	N	N	Visited general area. Exploration only on unpatented claims.
Monaghan Prospect BE000515	NF	N	N	NE	Screened out.
Montana Lode BE000894	NF	Y	N	N	Short trench.
Monte Cristo BE000929	NF	Y	N	**Y**	No environmental impact, but several hazardous pits present.
Moosehorn/Moose Horn BE000888	PRV	Y	N	**Y**	Open shaft and highwall. Site being considered for reclamation.
Mt. Fleecer-Jerry Creek\Star Group SB006416	Mix	N	N	NE	Screened out. Name refers to a general area.
Mt. Tory/Mount Torrey BE000966	NF	N	N	NE	Screened out. Name may refer to a general area.
New Ariadne BE000378	PRV	N	N	NE	Visited general area. No obvious runoff or discharge from hill.
New Atlantis/New Atlantus BE003905	PRV	N	N	NE	Visited general area. No discharges from hill.
North Star Property/South Star BE000815	PRV	N	N	NE	Patented claims. No impact.
Old Atlantis/Old Atlantus BE003960	PRV	N	N	NE	Visited general area. No discharges from hill.
Oro Fino BE003965	PRV	N	N	NE	Unable to locate using information from MILS.
Park BE000587	NF	Y	Y	**Y**	Open shafts and small discharge.

Table 3.1 Summary of sites inventoried in the Big Hole River drainage (continued).

Name / ID[1]	Owner[2]	Visit	Sample[3]	Hazard[4]	Remarks
Patsy Ann SB006572	NF	N	N	**Y**	Two caved adits (Winters *et al.* 1994). Forest Service has identified HMOs at site.
Pete Ampo BE003985	MIX	N	N	NE	Unable to locate using information from MILS.
Pettingill/Pettingale BE000881	UNK	N	N	NE	Unable to locate using information from MILS.
Phyllis Claim BE000750	NF	Y	N	**Y**	Open adit. Visited general area and walked property boundary with U.S. Treasurer and Jumbo Group.
Pioneer BE000474	NF	Y	N	N	No visible impact.
Pioneer or Nugget Creek/Arcadia BE008273	PRV	N	N	NE	Active site in 1993.
Prospects East of Brownes Lake BE008332	NF	Y	N	N	Two groups of prospects on roads from Brownes Lake Tungsten site.
Prospects West of Keokuk Mine BE008329	NF	Y	N	**Y**	Adit, inclined shaft and several prospects.
Quartz Hill Mill[5] BE008314	PRV	Y	N	**Y**	Dry mill site. Highwalls associated with old mill foundation.
Quartz Hill Syncline BE000544	MIX	N	N	NE	Screened out. Phosphate occurrence.
Queen of the Hills BE000924	NF	Y	Y	**Y**	Partially open adit with discharge.
Queen of the Hills Tailings[5] BE008318	NF	Y	Y	N	Streamside tailings.
Queen Property BE004070	MIX	N	N	NE	Visited general area. May be same as Indian Queen.
Rocky Heep (Prospect) BE000858	UNK	N	N	NE	Unable to locate using information from MILS.
Saginaw BE000570	PRV	Y	N	**Y**	Hazardous mine opening(s) or highwall.
Santa Maria Rainbow Group BE000036	NF	Y	Y	**Y**	An intermittent seep and two waste-rock dumps near but not in stream. Three partially caved adits.
Sappington Creek Shaft BE008330	NF	Y	N	**Y**	Open shaft.
Sec 27 Unnamed BE008300	NF	Y	N	N	Placer. Active in 1993.

Table 3.1 Summary of sites inventoried in the Big Hole River drainage (continued).

Name / ID[1]	Owner[2]	Visit	Sample[3]	Hazard[4]	Remarks
Section 14 Mines BE008342	NF	Y	N	**Y**	Open adits and shaft.
Sheep Creek/Humbolt Mountain BE008069	NF	Y	N	**Y**	Open inclined shaft.
Sheep Mountain Prospects BE000941	NF	Y	N	NE	No impact.
Sheep Mountain Tungsten Prospect BE000798	UNK	N	N	NE	Unable to locate using lat-long from MILS.
Shelley BE000778	NF	Y	N	N	Prospect only.
Silver King BE003825	PRV	N	N	N	Screened out. See report by Pioneer Technical Services (1995).
South Fork Parker Creek SB008272	NF	Y	N	**Y**	Boarded up adit. No discharge.
South Greenstone Gulch BE000718	NF	Y	N	N	Two exploration trenches in general area. Phosphate occurrence.
Stanfield Tungsten Prospect BE000810	NF	Y	N	**Y**	15 ft highwalls around pit.
Star & Star Extension/Moonlight BE000767	NF	Y	N	**Y**	Partially open adits.
Sugarloaf Mountain Adit BE008341	NF	Y	N	N	Collapsed adit and prospects. No impact.
The Faithful/Old Faithful BE000918	PRV	Y	N	N	No impact.
Titanus BE000953	MIX	Y	N	**Y**	Hazardous mine opening, highwall, and/or structure.
Trail Creek Placers BE004130	UNK	N	N	NE	Screened out. Placer.
Trapper Creek Syncline BE000502	NF	N	N	NE	Screened out. Phosphate occurrence.
Trapper Mill Site[5] BE008325	MIX	Y	Y	**Y**	Series of settling ponds rimmed by tailings. Hazardous mill structure.
Trapper BE000617	MIX	Y	N	**Y**	Open vertical and inclined shafts on private land.
True Blue[5] BE008326	PRV	Y	N	NE	Mill site. Building torn down in 1996.
True Fissure BE004140	PRV	N	N	NE	Visited general area. No drainage from hill.
Trusty Lake Syncline BE000556	NF	N	N	NE	Screened out. Phosphate occurrence.

Table 3.1 Summary of sites inventoried in the Big Hole River drainage (continued).

Name / ID[1]	Owner[2]	Visit	Sample[3]	Hazard[4]	Remarks
Tuxedo BE000959	PRV	Y	N	**Y**	Hazardous mine opening(s).
Twin Fir BE008308	PRV	Y	N	N	No visible impact.
Unknown - Pine Dale SB008347	NF	Y	N	**Y**	Open vertical and inclined shafts. Dry.
Unnamed Gold BE008301	UNK	N	N	NE	Unable to locate using information from MILS.
Unnamed Molybdenum, Tungsten, Garnet BE000101	NF	Y	N	NE	Visited general area. Several prospects in this vicinity.
Unnamed Tungsten BE000053	NF	N	N	NE	Unable to locate using information from MILS.
Unnamed Tungsten, Moly, Garnet BE000005	NF	N	N	NE	Unable to locate using information from MILS.
Unnamed Tungsten, Molybdenum, Garnet BE000077	UNK	N	N	NE	Screened out.
Unnamed Tungsten, Molybdenum, Garnet BE000377	MIX	N	N	NE	Screened out.
Upper Canyon Creek BE000700	NF	N	N	NE	Screened out. Phosphate occurrence.
Upper Cleve BE004145	PRV	Y	N	**Y**	See report by Pioneer Technical Services (1995).
Upper French Creek BE000724	NF	Y	N	N	Trench and prospects only. Phosphate occurrence.
West Limb BE000706	NF	Y	N	**Y**	Two partially open adits. Lower adit is caved.
West Lone Pine BE008315	PRV	Y	N	N	No visible impact.
White Cap Claim BE000773	NF	Y	N	N	Several pits, two with natural seeps.
White Elephant BE008207	NF	Y	N	N	No impact. Two-lobe collapsed adit.
Wise River Placer BE000786	MIX	N	N	NE	Screened out. Placer and location uncertain.

1) Mines in **bold** may pose environmental problems and are discussed in the text.
2) Administration/Ownership Designation
NF: BNF-administered land, PRV: Private, MIX: Mixed (BNF-administered land and private), S: State, UNK: Unknown
3) Solid and/or water samples (including leach samples)
4) Y: Physical and/or chemical safety hazards exist at the site.
NE: Physical and chemical safety hazards were not evaluated.
5) Mill site present

3.5 BOBSLED AND OCJ CLAIMS

3.5.1 Site Location and Access

The Bobsled and OCJ claims are located along Forest Road 2465, past the Mono Creek Campground after turning off the Pioneer Mountains Scenic By-way (Forest Road 484). The site is accessed by turning off Road 2465 where it crosses Elkhorn Creek in section 2 and walking north to the mines. These nine patented claims are on the Maurice Mountain 7.5-min. quadrangle in T4S R12W Sec. 2 BBBA, and T3S R12W Sec. 35 C and D. All of the workings are on private land.

3.5.2 Site History - Geologic Features

The Bobsled and OCJ claims are mentioned by the USBM (Winters *et al.* 1994) as having two caved adits trending S72°W, with massive quartz/molybdenite pods in veins at least 1-foot thick in a coarse-grained intrusive. A sample by the USBM assayed 0.45% molybdenum. Large blocks of quartz/molybdenum veins remain on the waste dumps.

Ruppel *et al.* (1993) mapped this area as a part of a large Late Cretaceous granodiorite intrusive (Pioneer batholith). Geach (1972) more specifically stated that the country rock is alaskite. He included only the two middle adits in his descriptions; there are at least two other adits along Elkhorn Creek.

3.5.3 Environmental Condition

The dumps at the site are small and very low in sulfides; they are not deeply eroded. Two of the dumps are in the flood plain of Elkhorn Creek. The site's four adits are completely collapsed and do not discharge water. The host rock is an intrusive with quartz and molybdenum mineralization.

3.5.3.1 Site Features - Sample Locations

The site was visited and sampled on October 2, 1996. Because the streamside waste is on patented land, Elkhorn Creek was sampled on BNF-administered land upstream and downstream of the dumps. The upstream and downstream samples were designated EOCS20L and EOCS10L, respectively. The flow rate of the creek at the time of sampling was estimated to be approximately 2 to 3 cfs. Site features and sample locations are shown on figure 3.3; photographs of the site are shown in figures 3.4 and 3.5.

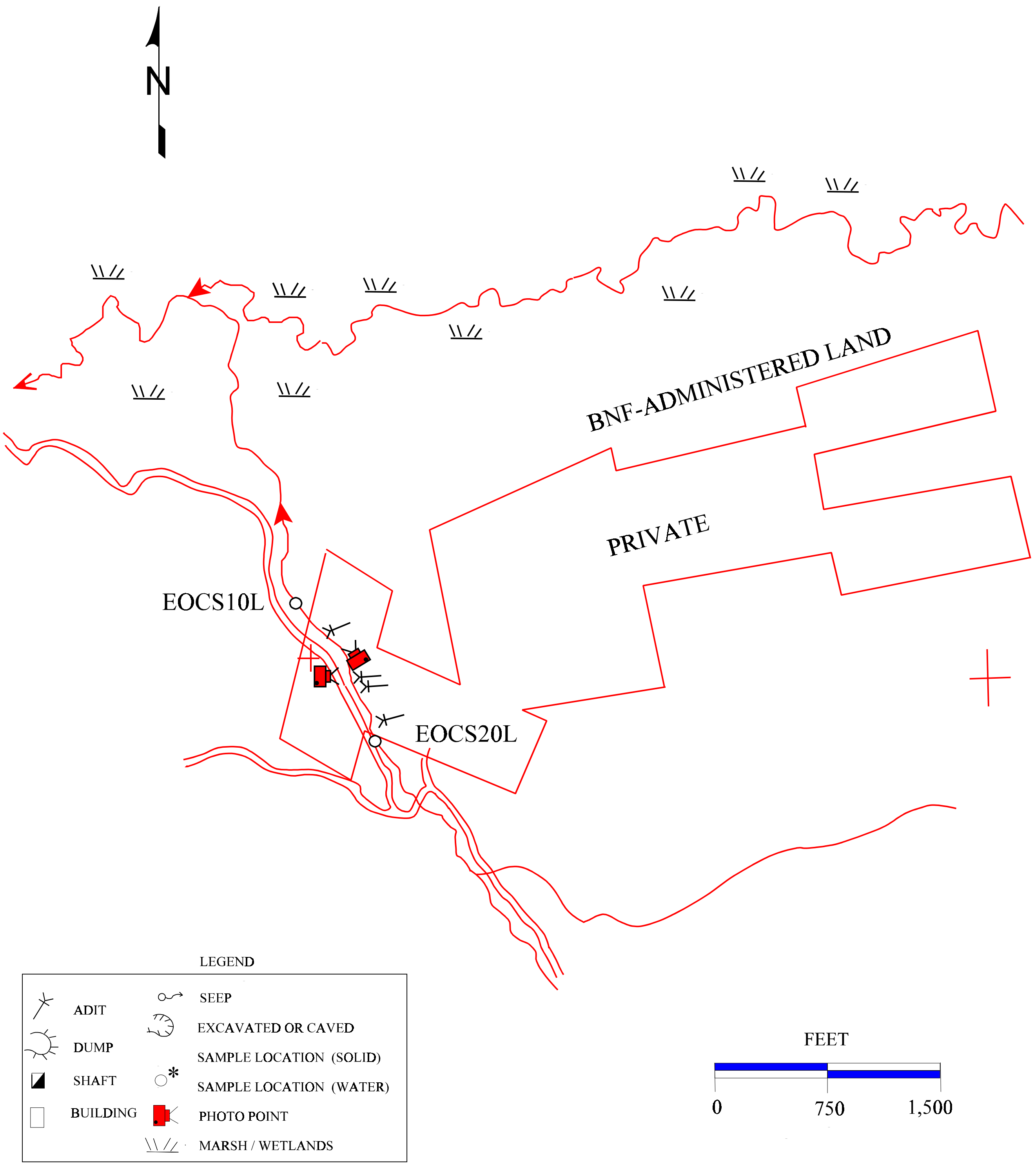

Figure 3.3 Schematic map of the Bobsled and OCJ claims as taken from the Maurice Meadows 7.5 min USFS ownership map (10/96).

Figure 3.4 A small waste-rock dump at the Bobsled and OCJ claims (light streak to the left of the dark backpack) was in contact with Elkhorn Creek.

Figure 3.5 The toe of the larger waste-rock dump is in contact with Elkhorn Creek.

3.5.3.2 Soil

No soil samples were collected at the Bobsled and OCJ claims because the waste dumps are on private land.

3.5.3.3 Water

The results of the water-quality analyses showed no exceedences related to the streamside waste. Also, no water-quality problems from the Elkhorn mine and mill were evident (see section 3.11).

3.5.3.4 Vegetation

No stressed or dying vegetation was evident at the site. The waste-rock dumps are barren to sparsely vegetated with grasses. The undisturbed area around the site is primarily vegetated with lodgepole pine; open areas are covered by grasses.

3.5.3.5 Summary of Environmental Condition

The small mines in the area appeared to have a negligible impact on BNF-administered land. The primary mineralization was restricted to quartz/molybdenum veins.

3.5.4 Structures

No structures were associated with the Bobsled and OCJ claims. There may be structures located away from the creek, but they were not noted during the site visit.

3.5.5 Safety

No safety concerns were identified at the site. All adits appear completely caved, and the waste dumps, while steep, are small. The old workings are located on the opposite side of the creek from the road and so are not easily reached except by foot.

3.6 BROWNES LAKE TUNGSTEN (IVANHOE) MINE

3.6.1 Site Location and Access

The Brownes Lake Tungsten mine, also known as the Ivanhoe, is reached by following the Rock Creek drainage west after exiting Interstate 15 at Glen. The mine location is shown on the Storm Peak 7.5-min. quadrangle in T4S R10W Sec. 4 AADA.. The access road to the mine is gated just after it crosses Rock Creek in section 4; therefore, the last half mile to the site must be hiked. Part of the open pit and waste-rock dump are on BNF-administered land.

3.6.2 Site History - Geologic Features

DeBoer (1991) wrote a detailed thesis on the Lentung deposit, on which the Brownes Lake mine is located. Walker (1963) and Geach (1972) include the area in their descriptions of the mines. DeBoer (1991) stated that the Brownes Lake area was initially prospected as a copper property in 1902 (Ivanhoe claims) and was mined in 1928 and 1929. The area was explored for tungsten as a strategic mineral from 1942 to 1951. The Brownes Lake mine produced 625,107 tons of 0.35% WO_3 from 1953 to 1957. The mine was shut down in 1957 when the government ceased its stockpile program (DeBoer 1991). From the 1970s to present, General Electric, Union Carbide and US Borax have subsequently explored for tungsten in the general area .

DeBoer (1991) mapped the area at a scale of 1"=200' showing the mine located in Mississippian Amsden Formation skarn at the contact with the Cretaceous Brownes Lake granite. The skarn is confined to the lower half of the middle Amsden; it is stratabound (DeBoer 1991). Ore metals at Brownes Lake include W and Mo, with Cu, Pb, Zn, Ag and Bi present as well. Scheelite was the primary ore mineral in the deposit; it was associated with andraditic garnet.

3.6.3 Environmental Condition

The open pit disturbance at the Brownes Lake mine is on private and BNF-administered land. Waste on the steep slopes above Rock Creek are on BNF-administered land. The waste is locally in contact with the stream, and DeBoer (1991) had waste rock mapped along the stream side. An overflow channel from Lake Agnes cascades along the edge of the open pit and is in contact with a small amount of mine waste. It is rapidly eroding the hillside above the mine and flows partly outside its banks in a poorly developed channel near the bottom of the slope.

3.6.3.1 Site Features - Sample Locations

Water-quality samples were collected at the site on August 29, 1996. The flow from Lake Agnes was sampled above (ABLS10L) and below (ABLS20L) the mine. A third sample

(RBLS10L) was collected from Rock Creek upstream from the access road and the streamside waste. A fourth sample (RBLS20L) was taken from Rock Creek downstream of the confluence with the Lake Agnes stream and the waste. Site features and sample locations are shown on figure 3.6; photographs of the site are shown in figures 3.7 and 3.8.

3.6.3.2 Soil

No soil samples were taken except for a leach sample of the waste rock at the base of the steep slope. Waste rock extends to the edge of the creek.

3.6.3.3 Water

The water quality in Rock Creek and the outflow from Lake Agnes appeared to be unaffected by the mining activity (table 3.2). The water from Rock Creek upstream of the mine had a field-pH of 8.1 and an SC of 41 µmhos/cm. Downstream of the mine, the field pH measured 7.8, and the SC was 45 µmhos/cm. The outflow from Lake Agnes had a field pH of 8.2 and an SC of 78 µmhos/cm; the downstream sample had a field pH of 8.3 and an SC of 89 µmhos/cm. The chronic aquatic life standard for mercury was exceeded on Rock Creek both upstream and downstream of the mine. Because the concentration was only 0.1 µg/l, which is the laboratory detection limit, additional sampling is advisable in order to evaluate whether or not a water-quality problem truly exists. The silver concentration upstream of the site (1.9 µg/l) also exceeded chronic aquatic life standards, but downstream the concentration was below the laboratory detection limit.

3.6.3.4 Vegetation

Disturbance to vegetation was related to the physical deposition of the waste over the side of the hill below the mine. Willows grew along the banks of the creek and the forest was composed of healthy looking Douglas fir and lodgepole pine trees.

3.6.3.5 Summary of Environmental Condition

The streams around the Brownes Lake mine had no water-quality exceedences that could be attributed to mining activity. Because the mine exploited a tungsten occurrence and is hosted in carbonate rock, environmental problems appear to be negligible. The waste dumped over the hill looks aesthetically unappealing but is probably chemically innocuous.

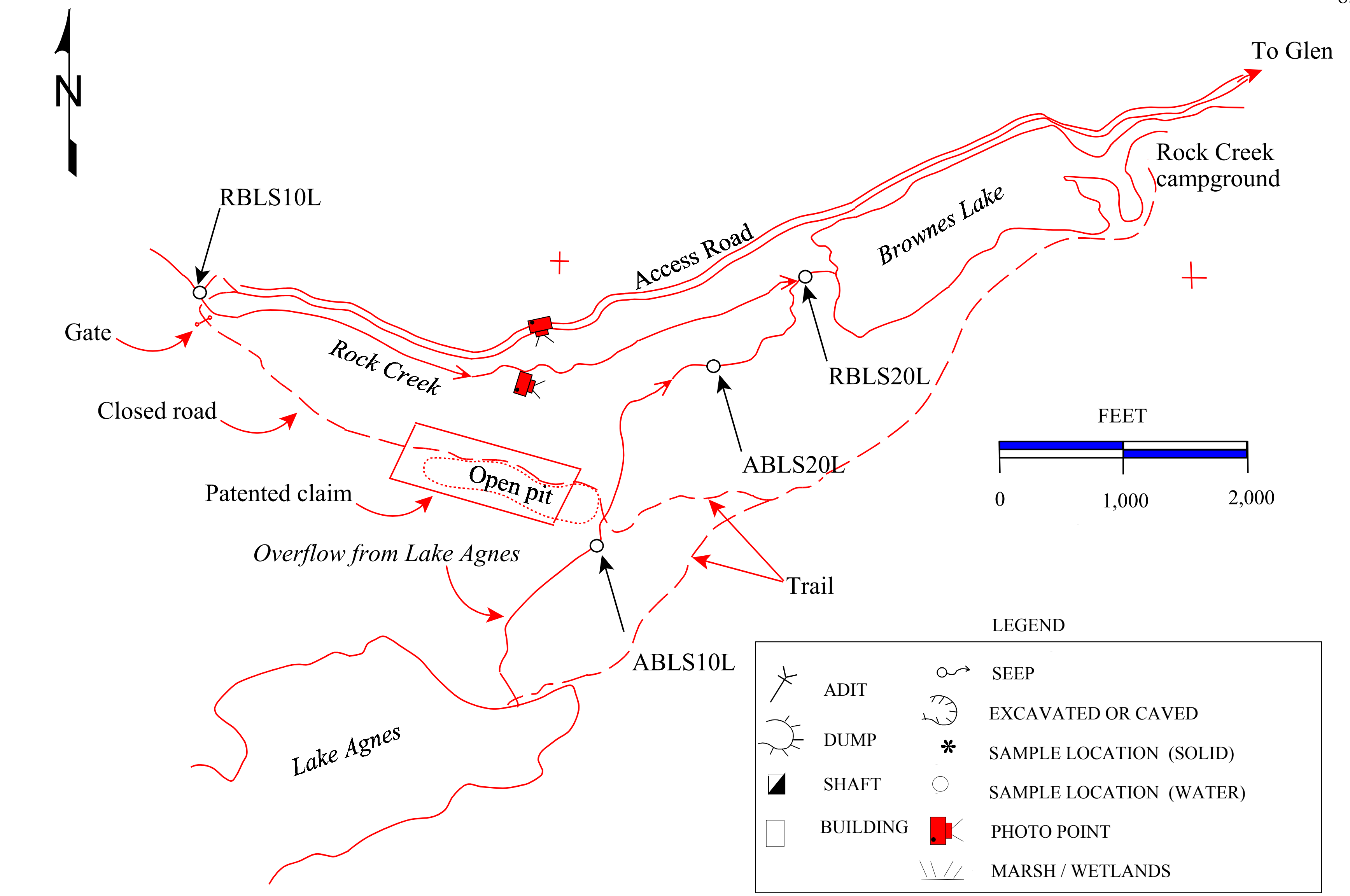

Figure 3.6 The Brownes Lake (Ivanhoe) tungsten deposit has dangerous highwalls and streamside waste, as shown in this August 29, 1996 schematic taken from the Storm Peak 7.5-min USFS ownership map.

Figure 3.7 The Brownes Lake tungsten deposit is perched on the mountainside above Rock Creek.

Figure 3.8 Gravel to boulder-sized waste rock is deposited along the bank of Rock Creek.

Table 3.2 Water-quality exceedences at the Brownes Lake (Ivanhoe) tungsten mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Rock Creek - upstream of site (RBLS10L)																			
Rock Creek - downstream of site (RBLS20L)																			
Lake Agnes outflow - upstream of site (ABLS10L)										C		C							
Lake Agnes outflow - downstream of site (ABLS20L)										C									

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

Note: The analytical results are listed in appendix V.

3.6.4 Structures

No structures remain at the mine. Some buildings were located at the bottom of the hill by Rock Creek, but they have been demolished; only scattered remnants and a concrete slab remain. Some rusting metal junk is located near the bottom of the hill.

3.6.5 Safety

The near-vertical highwalls and the boulders that occasionally dislodge from unconsolidated material at the tops of the highwalls are safety concerns, especially because the area is used extensively by hikers and four-wheelers going to Lake Agnes and Rainbow Lake.

3.7 CALVERT (RED BUTTON) MINE

3.7.1 Site Location and Access

The location of the Calvert (Red Button) mine is shown on the Foolhen Mountain 7.5-min. quadrangle in T1N R13W Sec.12 DADC. The site is on BNF-administered land and is reached by turning west off Highway 43 at the Dickie bridge, following a Forest Service road up

Bryant Creek, and turning right at a sign for the Calvert Loop. The road to a lower adit turns off approximately 0.3 miles before reaching the main open pit workings. The site is accessible by 2-wheel drive in the summer and fall months.

3.7.2 Site History - Geologic Features

Truckle (1988) places the Calvert mine in 55°SW-dipping Mississippian strata associated with a southwest-dipping reverse fault. The limestone at the mine has been intruded by the Foolhen Mountain tonalite, a part of the Pioneer batholith. Walker (1963) summarized work at the Calvert mine, although he hypothesized the limestone involved was the Cambrian Meagher Formation, probably as a roof pendant in an outlier of the Boulder batholith.

The heyday of the mine was from 1956 to 1957 when the U.S. government tungsten purchasing program was in place. It also was operated from 1959 to 1969. It was in 1967 that the lower adit was begun, but it was abandoned because of poor rock quality (Geach 1972). The adit was driven to attempt block caving beneath the pit. Minerals Engineering Company of Grand Junction, CO was the main operator until 1972 when it was sold to General Electric. In 1974, GE did some diamond drilling, and in 1983, the mine was listed as abandoned. When operating, the ore was shipped to Glen, MT where it was processed at the 250 ton-per-day mill there. The mill was dismantled and sold in 1975 after being used one year.

The primary ore mineral extracted at the site was scheelite, with gangue minerals including garnet, epidote, quartz, and chlorite (Walker 1963). The average grade, as estimated by Walker (1963), was slightly greater than 1.0% WO_3 which was fairly high for tungsten deposits in the area. Approximately 113,000 tons were mined. The ore body was estimated at 200 feet in diameter plunging 45° to the south (Walker 1963).

3.7.3 Environmental Condition

A large flooded pit and a smaller, slightly flooded pit to the west are the primary features of the site. The large flooded pit is filled with approximately 45 feet of water, but there is an obvious seasonal variation in the water level. The water appeared to support aquatic life (water striders and trout). The adit south of the pit has a small discharge, and there are seeps or springs emerging from the toe of the waste-rock dump. Large pieces of waste (mostly marble, intrusive, and minor skarn) are in contact with Calvert Creek. The waste dump from the adit is in contact with the creek; it is mostly unaltered intrusive.

3.7.3.1 Site Features - Sample Locations

Samples were collected at the site on August 9, 1996. One water sample (CCHS10M) was taken near the edge of the large pit. Another sample (CCHS20H) was taken from the adit discharge approximately eight feet from the portal. The straight-line distance from the adit to the creek is 130 feet; however, the discharge has been diverted and flows to the west along the road before intermittently flowing into the creek near a culvert.

Samples were collected from Calvert Creek upstream (CCHS40H) and downstream (CCHS30H) of the streamside waste dump and the confluence with the adit discharge. The upstream sample was taken approximately 50 feet west of the westernmost toe of the dump. The downstream sample was taken 265 feet below the site and 50 feet downstream of the disturbance of the waste dump area southwest of the site.

Site features and sample locations are shown on figure 3.9; figure 3.10 is a topographic map of the main pit that was compiled by Anaconda Company geologist in 1961. Photographs of the site are shown in figures 3.11 and 3.12.

3.7.3.2 Soil

No soil samples were taken. Waste is adjacent to the creek, but there appeared to be no adverse impacts on the surrounding area.

3.7.3.3 Water

The water in the flooded pit was clear and cold; it had a distinctive bluish-green tint, probably due to its clarity. The pH of the pit water when measured in the field was 10.2, but the pH measured in the laboratory was 7.7. The laboratory measurement is probably the more accurate one. The concentration of mercury in the water was 0.11 µg/l, just above the laboratory detection limit. This concentration exceeds the chronic aquatic life standard (table 3.3).

The adit discharge flowed at 2.5 gpm and was clear. No analyte concentrations exceeded standards. Calvert Creek also was found to have no water-quality problems.

3.7.3.4 Vegetation

The benches of the pit are sparsely vegetated with lodgepole pine. The highwalls would probably revegetate if it were not for sloughing rock. The area around the pit is revegetating with

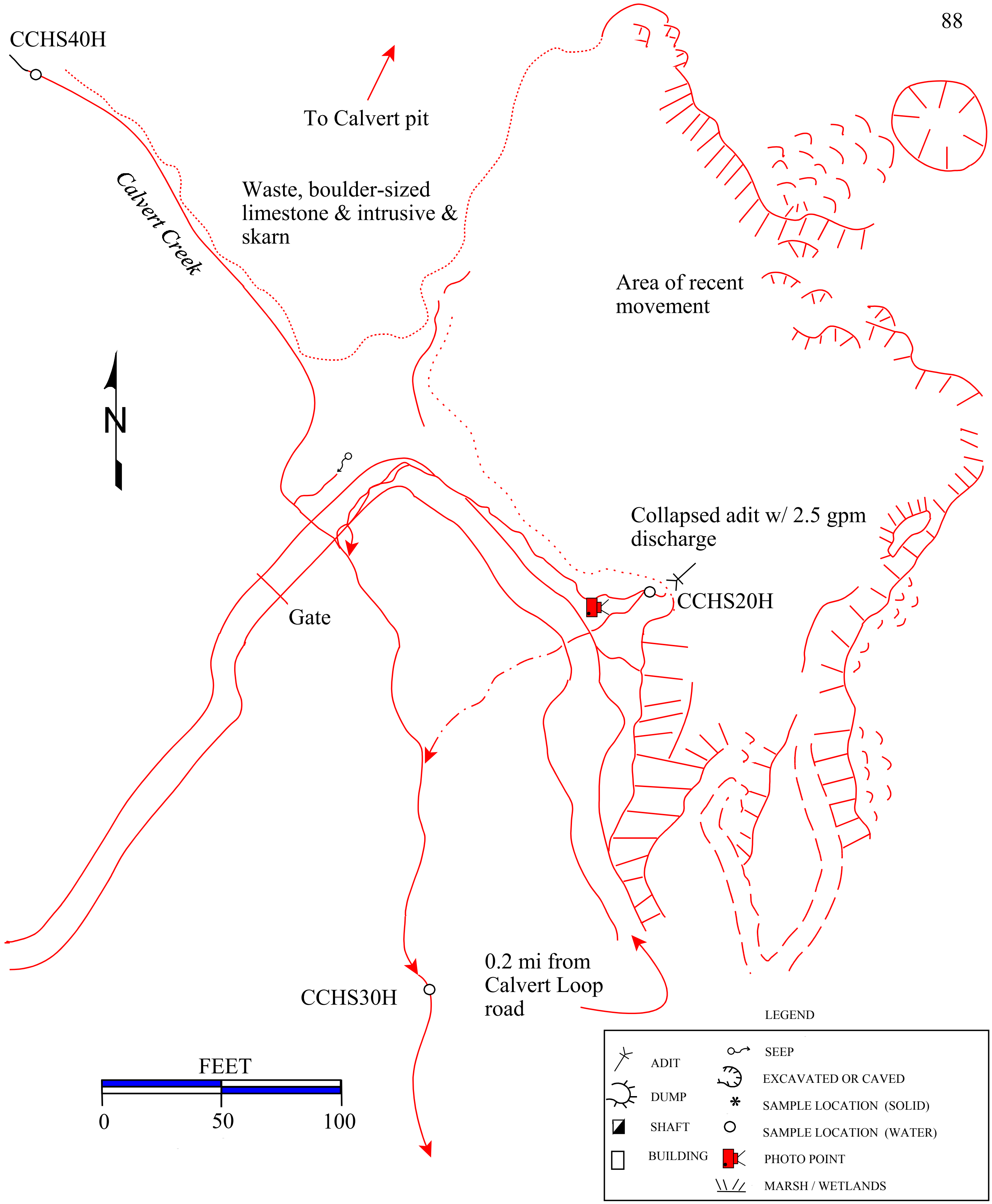

Figure 3.9 Site map of the Calvert mine area, August 1996. Slumping has occurred on the slope above the adit.

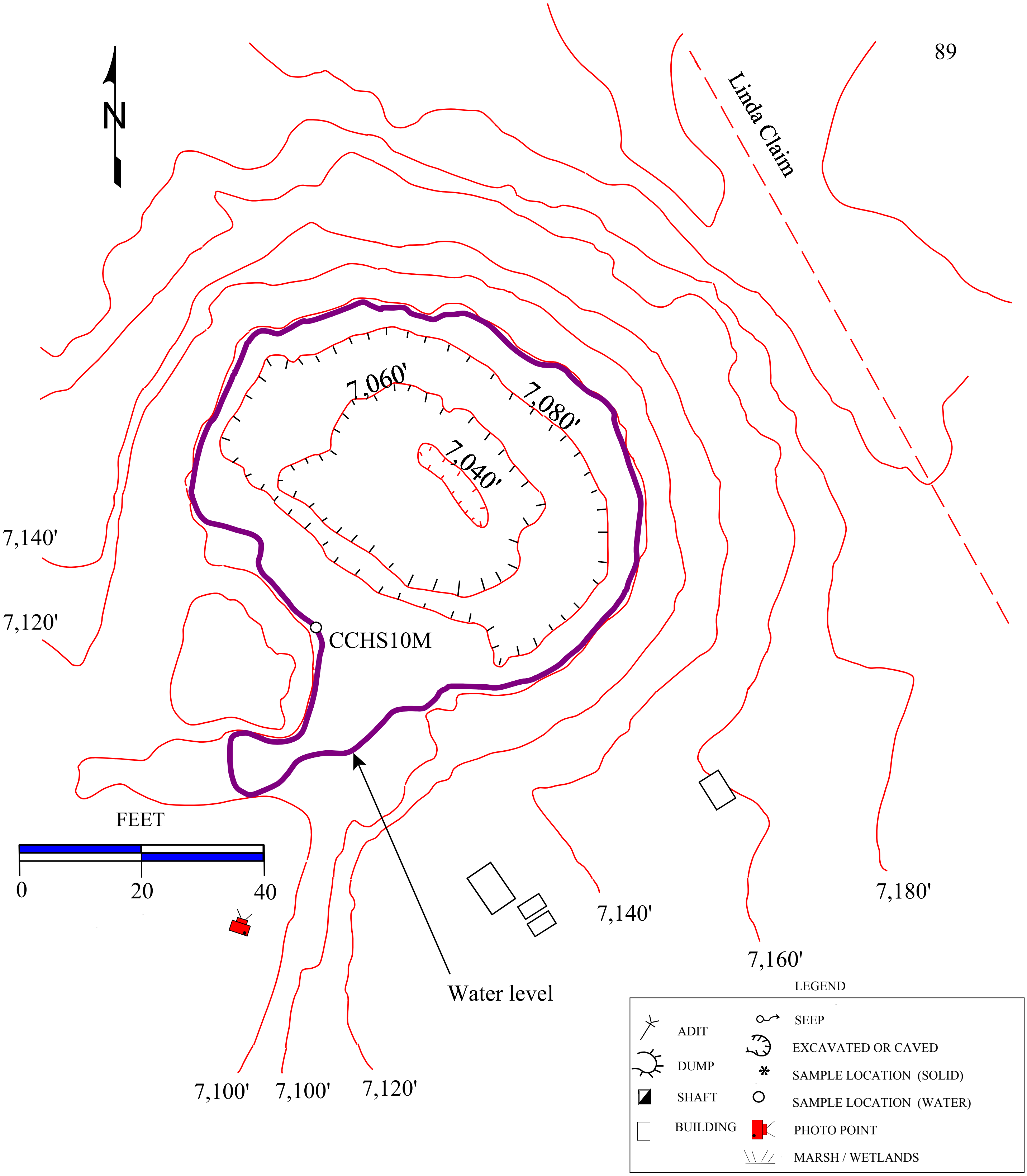

Figure 3.10 The Calvert pit showing water level as mapped October 31, 1961 by Anaconda Company geologists. Water sample location CCHS10M from the MBMG study is shown also.

Figure 3.11 The water in the flooded pit is approximately 45 ft deep; the dimensions of the pit are roughly 250 ft x 300 ft x 85 ft.

Figure 3.12 A slight mass movement of earth has occurred upslope from the collapsed adit south of the open pit.

Table 3.3 Water-quality exceedences at the Calvert mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Pit water (CCHS10M)										C									
Adit discharge (CCHS20H)																			
Calvert Creek - downstream of site (CCHS30H)																			
Calvert Creek - upstream of site (CCHS40H)																			

Exceedence codes:

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

Note: The analytical results are listed in appendix V.

lodgepole pine. Grasses and wildflowers are prevalent in the open areas. The lodgepole pine trees grow in a "dog hair" pattern above the collapsed adit and reflect the movement of the ground by their leaning stance; in some cases, they have toppled over.

3.7.3.5 Summary of Environmental Condition

Although the water in the main pit is a suspicious shade of blue-green, analytical results showed that mercury was the only metal exceeding standards. The streamside waste rock and the adit discharge that flows into Calvert Creek do not appear to adversely affect the water-quality of the creek. The slope above the adit is slumping and eroding. If it were to catastrophically fail and block the creek, the environmental impact would be great.

3.7.4 Structures

No intact structures remain at the site. There is a concrete pad remaining - possibly the site for the shop as shown on the 1961 map by Anaconda Company staff (figure 3.10). One log cabin in bad condition lies to the east of the site. The lower part of the site has a chute for disposing of waste from the adit. Plans by the Forest Service in 1997 called for removal of this structure and remedial work in the creek, restoring it to its original channel (Montana Standard 1997).

3.7.5 Safety

This area is a favorite of mineral collectors seeking garnet, epidote, and beryl crystals. It is also popular with hunters, dirt bikers, and other recreational-vehicle users. The high walls are steep and rubbly with deep water at their base. The benches have eroded into steep to vertical slopes and are very unstable. Swimmers and divers may be attracted to the blue water. The large waste dump appears stable but with individual rocks capable of sliding or toppling down the slope. The adit was open at least until 1988 (Truckle 1996).

The slumping area south of the road is of some concern if it were to catastrophically fail. Local areas show signs of movement with cracks in the earth and leaning trees. The gate closing off the road to the clearcut to the south of the adit could be moved up to the fork in the road 0.2 miles to the north thereby restricting motor vehicle access to the area in front of the adit. It is unknown (without further study) if a mass movement of earth would involve the main road above the adit.

3.8 CARNEY MINE

3.8.1 Site Location and Access

The Carney mine is accessed by a circuitous route through public lands by turning north off State Highway 278 onto Forest Road 928, turning west on Forest Road 220, and south on Forest Roads 2435, 71212, 71211, and 71210. The last two miles are considered accessible by four-wheel drive only. A more direct route would be across private land, but the landowners did not give permission to cross their land. The mine can be located on the Jackson Hill 7.5-min. quadrangle at T5S R14W Sec. 22 CAAD. It is entirely on BNF-administered land.

3.8.2 Site History - Geologic Features

Workings at the site consists of a main adit, a second smaller adit or prospect, two small prospects farther uphill, and one waste dump in contact with Woody Creek (figure 3.13). Only one previous study was found that references the Carney mine. The USBM (Winters *et al.* 1994) described the material on the dump as “extensively altered, moderately iron-stained silica-flooded rock”. The same study reported that a select sample of a stockpile assayed out with “no significant metals values”.

3.8.3 Environmental Condition

The site appears to have only a minor environmental impact. A waste dump is in the flood plain of Woody Creek and is in direct contact with the creek over a 25-foot reach. Very few sulfides were noted on the waste dump; primarily oxides and silicified material are present.

3.8.3.1 Site Features - Sample Locations

Upstream (WCAS10L) and downstream (WCAS20L) water-quality samples were taken on August 11, 1997. Also, a composite soil sample (WCAD10H) was taken at the base of the waste dump near its contact with the creek. Sample locations are shown in figure 3.13; photographs of the site are shown in figures 3.14 and 3.15.

3.8.3.2 Soil

The analysis of sample WCAD10H shows that the metal concentrations in the soil/waste rock adjacent to the creek are fairly low. None of the metal concentrations exceed phytotoxic limits (table 3.4).

Table 3.4 Soil sampling results (mg/kg) for the Carney mine.

Sample Location	As	Cd	Cu	Pb	Zn
Streamside waste-rock dump (WCAD10H)	27.7[1]	4.6[1]	99.8[1]	8.9[1]	59.0[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3)
(2) Exceeds phytotoxic levels (table 1.3)

3.8.3.3 Water

On the day the site was sampled, Woody Creek was flowing at approximately 300 gpm. The watercourse was not stained, and there was no evidence of any other effects from mining. Aluminum concentrations in the samples collected from Woody Creek exceeded water-quality standards, but the exceedences were not attributable to the site (table 3.5).

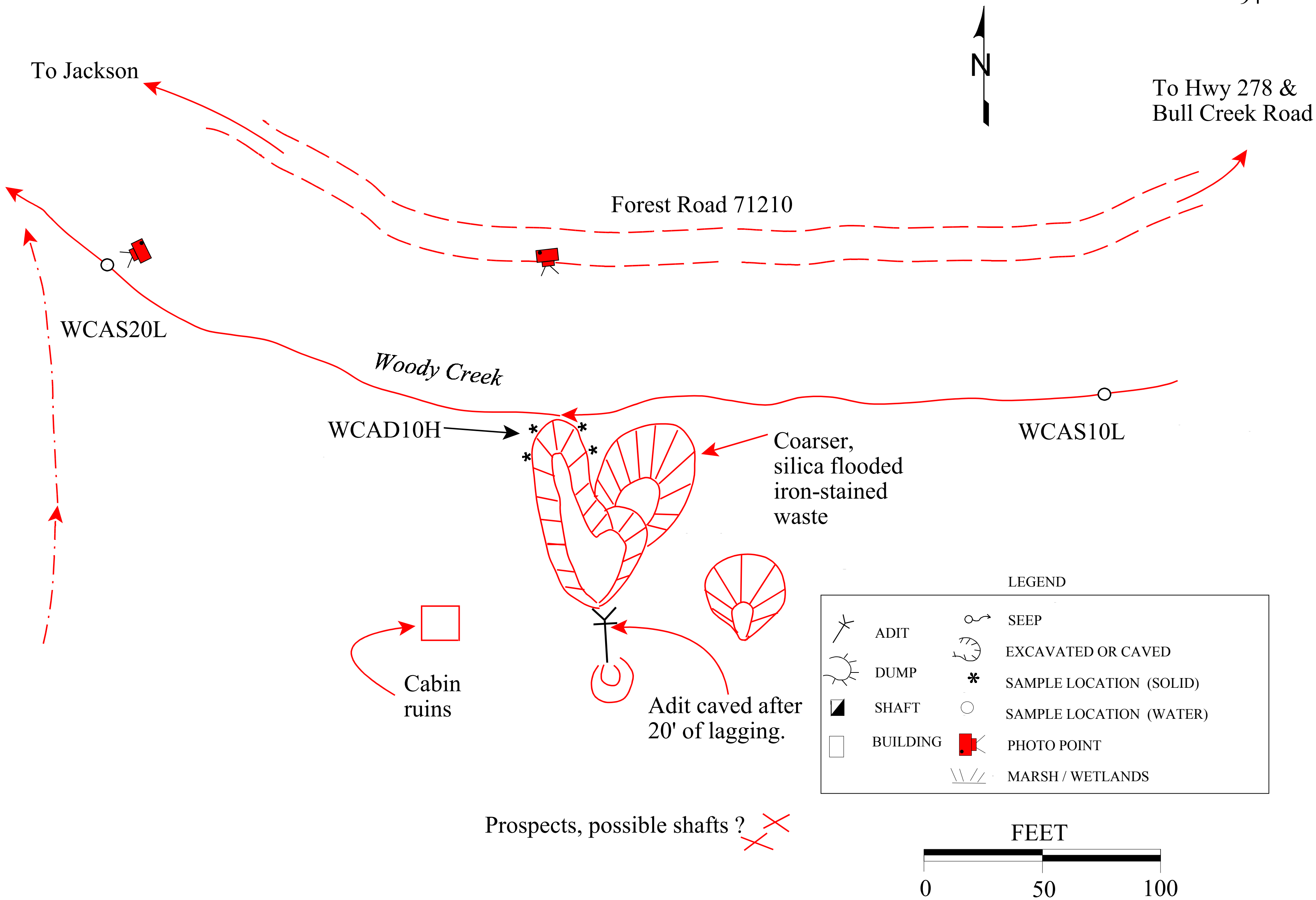

Figure 3.13 The small waste dump at the Carney mine contacted Woody Creek during times of high water but was not in contact on August 11, 1997.

Figure 3.14 Woody Creek flows through willows where the creek is in contact with the toe of the waste dump.

Figure 3.15 Lush vegetation and a small volume flow characterize Woody Creek downstream from the mine.

Table 3.5 Water-quality exceedences at the Carney mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Woody Creek - upstream of site (WCAS10L)	S,C																		
Woody Creek - downstream of site (WCAS20L)	S,C																		

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

Note: The analytical results are listed in appendix V.

3.8.3.4 Vegetation

Willows and tall grasses line the banks of Woody Creek. The small waste dump is not vegetated but did not appear to affect the surrounding environment. The site is located at the edge of a lodgepole pine/Douglas fir forest where it meets the open grassland of a small marshy meadow. Woody Creek flows through the site and creates a wetland where tall grasses grow.

3.8.3.5 Summary of Environmental Condition

The site is very small and has few sulfides on the waste dump. Woody Creek did not appear affected by the mine in any way.

3.8.4 Structures

The rotten logs are the only remnants of a cabin located west of the main adit. The cabin is not considered a hazard because none of the walls remained standing.

3.8.5 Safety

The main adit at the Carney is partially open (for approximately 20-feet where lagged) and could be considered a safety hazard. The area was not easily accessible but probably does have a few visitors.

3.9 CLARA MINE

3.9.1 Site Location and Access

The Clara mine (T3S R14W Sec. 18 BAAC) is reached by following the Steel Creek road from Wisdom to the Wilke Ranch. After asking permission at the ranch, drive 1½-miles over 2-track roads to the Dry Gulch drainage. Access is by driving through the gate and up Dry Gulch and then walking the last 200 to 300 feet because of downed trees. The site is on BNF-administered land.

3.9.2 Site History - Geologic Features

The ore-bearing zone at the Clara mine, also known as the Monty Clinton, was described by Geach (1972) as a "narrow fissure vein cutting quartz monzonite". The vein was described as a 1- to 1½-foot wide, west-dipping northeast-trending quartz-sulfide-oxide vein along which an adit was driven. Geach (1972) also reported that the only recorded production from 1902 to 1965 was in 1960 when four tons of ore were mined. According to Geach (1972), there were an adit and a shaft in close proximity. They are now caved. According to Forest Service records (Wisdom Ranger District files 1997), Dave Fisher was the most recent claimant of the site.

3.9.3 Environmental Condition

The Clara mine site appears to be fairly dry, with only a seasonal adit discharge. The headwater of Dry Gulch Creek, a spring that flowed less than five gpm when the site was sampled in August 1997, is a short distance upstream of the mine and is probably seasonal. Some rusting metal junk was observed at the site, and the mine building by the caved shaft contained some cans of unidentified substances.

3.9.3.1 Site Features - Sample Locations

A water-quality sample (SCLS10M) was taken from the small spring that emerges at the upper end of the site where it is captured for stock use. Another sample (SCLS30M) was taken downstream from the site; a third sample (SCLS20H) was taken from the adit discharge as it flowed from the collapsed adit. A soil sample (SCLD10H) was taken from the slope in front of the waste dump. Site features and sample locations are shown in figure 3.16; site photographs are shown in figures 3.17 and 3.18.

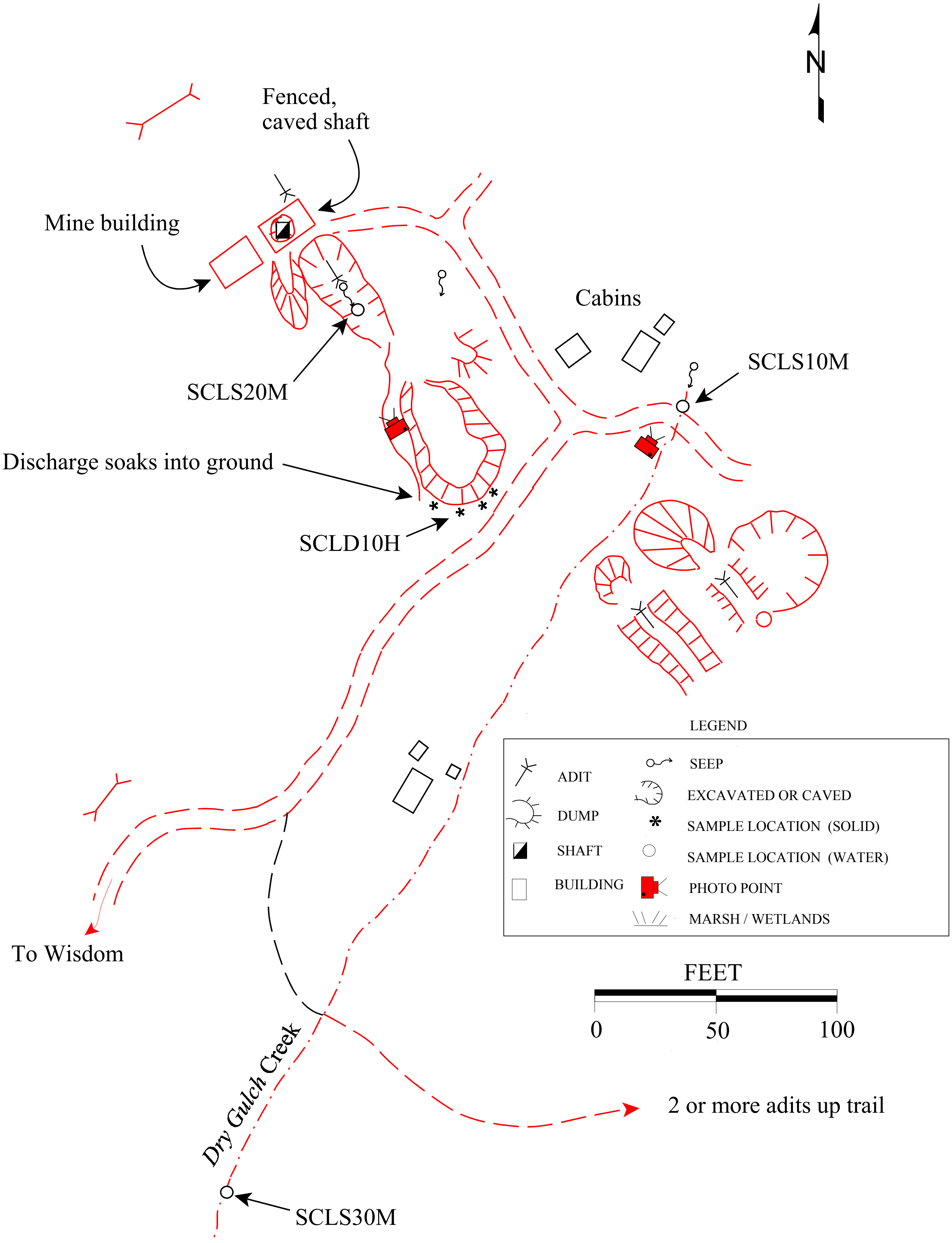

Figure 3.16 Seeps from the adit at the Clara and the surrounding hillside form Dry Gulch Creek, a small tributary to Steel Creek (August 1997).

Figure 3.17 Upstream from the Clara mine, a small spring marks the beginning of Dry Gulch Creek, a small tributary to Steel Creek.

Figure 3.18 The collapsed adit has a small, probably seasonal discharge, that flows across a flat area and soaks into the ground.

3.9.3.2 Soil

The composite soil sample showed that no phytotoxic limits are exceeded at the Clara (table 3.6). The soil did not appear affected by the waste on the dump.

Table 3.6 Soil sampling results (mg/kg) for the Clara mine.

Sample Location	**As**	**Cd**	**Cu**	**Pb**	**Zn**
Soil near toe of waste-rock dump (SCLD10H)	4.9[1]	5.1[1]	10.2[1]	10.6[1]	129[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3)
(2) Exceeds phytotoxic levels (table 1.3)

3.9.3.3 Water

The field pH of the adit discharge was 7.0, and the SC was 221 µmhos/cm; the spring upstream of the site had a field pH of 6.4 and an SC of 161 µmhos/cm; Dry Gulch downstream of the site had a pH of 7.6 and an SC of 196 µmhos/cm. The pH of the spring was below the lower limit of the secondary MCL range. Aluminum and iron levels exceeded water-quality standards in the spring and downstream samples (table 3.7); the upstream sample had the higher values in both cases. The concentration of manganese in the adit discharge exceeded the secondary MCL for drinking water. The flow rate at all three sample locations was estimated to be from 3 to 5 gpm at the time of the site visit.

Table 3.7 Water-quality exceedences at the Clara mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Spring upstream of site (SCLS10M)	S,C						S,A												S
Adit discharge (SCLS20H)									S										
Dry Gulch - downstream of site (SCLS30M)	S,C						S		S										

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

Note: The analytical results are listed in appendix V.

3.9.3.4 Vegetation

It was difficult to assess the impact of the mining on vegetation in the area because the site was so disturbed by cattle grazing. The mine did not appear to affect the vegetation to a great extent. The waste dump had large Douglas fir trees growing on it; the adit and dump were moderately well vegetated. The area was a mixture of aspen/Douglas fir to the east, and open, dry sage/grasslands to the west.

3.9.3.5 Summary of Environmental Condition

Pioneer Technical Services (1995) noted that Dry Gulch downstream of the Clara exceeded the acute aquatic life standard for iron and zinc and the chronic aquatic life criteria for copper and zinc. The MBMG samples showed iron and aluminum concentrations were high in Dry Gulch, but there were no exceedences for copper or zinc. The MBMG sample from the adit discharge had a high concentration of manganese. The data collected by Pioneer Technical Services (1995) and MBMG suggest water quality at the site is variable and that further characterization of the site is advisable.

3.9.4 Structures

The site has one log cabin in very good condition, one steel-shingled mine building, one log cabin with an outhouse in good condition farther down the drainage, and one cabin in bad condition. Several small outhouse-type buildings also are present.

3.9.5 Safety

The adits at the Clara are all collapsed except one which is partially open with a crawl space for a portal about 35 feet back from the original opening. The shaft to the north of the main adit was completely caved at the time of the site visit but could potentially open up at a later time.

3.10 DIADEM GROUP (ARNOLD) MINE

3.10.1 Site Location and Access

The Diadem Group (Arnold) mine (T3N R14W Sec. 7 DACB) is located on BNF-administered land east of the town of Wisdom. The site is within the Steel Creek drainage, a tributary to the Big Hole River. The site can be accessed on foot from adjoining National Forest lands. Vehicle access to the site is possible but requires obtaining private landowner permission.

3.10.2 Site History - Geologic Features

At the site, mineralization is associated with parallel veins hosted by a monzonite dike within foliated granite (Winters *et al.* 1994). Samples collected by the U.S. Bureau of Mines contained up to 2.96 ounces per ton gold, 16.2 ounces per ton silver, 0.54% copper, 0.82% zinc, and 0.15% molybdenum.

More than 700 feet of underground workings exist behind a caved shaft and a caved adit (Winters *et al.* 1994).

3.10.3 Environmental Condition

A small iron-stained discharge flows from a collapsed adit that is located several hundred feet from an ephemeral drainage. The discharge sinks into the ground less than a hundred feet from its origin.

3.10.3.1 Site Features - Sample Locations

A water-quality sample (BARS10M) was collected from the adit discharge on October 9, 1996. The flow rate of the discharge was 0.1 gpm. Site features and sample locations are shown on figure 3.19; figures 3.20 and 3.21 are photographs of the site.

3.10.3.2 Soil

Soils at the site did not appear to be impacted by metal contamination; therefore, no soil samples were collected.

3.10.3.3 Water

Iron and manganese concentrations in the adit discharge exceeded the secondary MCLs (table 3.8). As noted previously, the discharge infiltrates the ground before reaching any surface-water receptor; however, it may impact ground-water quality near the site.

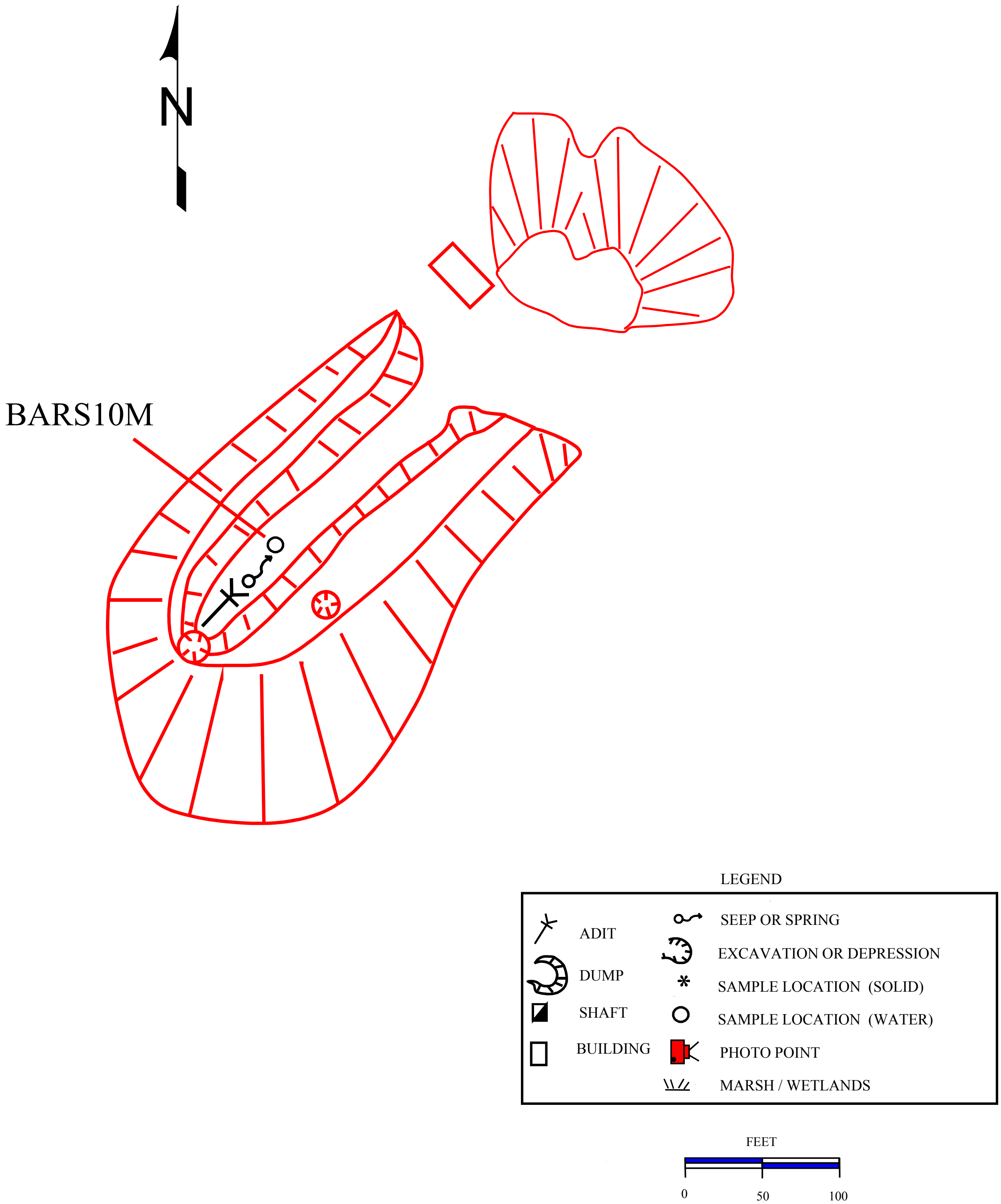

Figure 3.19 Site map of the Arnold (Diadem Group) mine, October 1996.

Figure 3.20 A small discharge flows from a collapsed adit at the Diadem Group (Arnold) mine.

Figure 3.21 An empty mine building is located near the adit.

Table 3.8 Water-quality exceedences at the Diadem Group (Arnold) 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 discharge (BARS10M)							S		S										

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

Note: The analytical results are listed in appendix V.

3.10.3.4 Vegetation

Along the path of the adit discharge, wetland grasses are abundant. The waste-rock dump is moderately vegetated with grasses and brush.

3.10.3.5 Summary of Environmental Conditions

The Diadem Group (Arnold) mine's small adit discharge contains concentrations of iron and manganese that exceed secondary drinking water MCLs. The discharge infiltrates the ground a short distance from the adit and therefore may affect nearby ground-water quality. Vegetation in contact with the adit discharge appears to be healthy. Although the discharge is unsightly, it probably does not pose a serious risk to human health or the environment.

3.10.4 Structures

A mine building in fair condition is located near the adit and waste-rock dump. Near the ephemeral drainage below the mine workings, there are remnants of a cabin.

3.10.5 Safety

Two hazardous openings were observed at the site. One opening is a hole associated with the collapse of the main adit. A second hole was found on a bench east of the adit. This opening must be associated with an unmarked working. The hole is small (3-foot diameter) but appears to be deep; it can be easily overlooked if care is not taken.

3.11 ELKHORN MINE AND MILL

3.11.1 Site Location and Access

National Forest Route 484 (Pioneer Mountains Scenic By-Way) leads to the Mono Creek campground turn-off from which Forest Road 2465 follows Elkhorn Creek. This road is the main access to the town of Coolidge, and the Elkhorn mine and mill. The road along Elkhorn Creek ends at a Forest Service campground where a walking path then leads a quarter mile to the town of Coolidge and across the creek to the Elkhorn mine and mill. The site is located on the Elkhorn Hot Springs 7.5-min. quadrangle in T4S R12W Sec. 14 AADD and Sec. 11 DDDB. The site is on BNF-administered and private land.

3.11.2 Site History - Geologic Features

Discovered in 1872, the Elkhorn mine eventually totaled 24,000 feet of workings on two levels. The entire group of claims produced 1,013 ounces of gold, 180,843 ounces of silver, 370,799 pounds of copper, 4,100 pounds of zinc, and 851,725 pounds of lead from nine vein systems. The two main veins are the Park and the Idanha which follow east-west mineralized faults (Winters *et al.* 1994). Reports stated that early in its development, 15 tons of high-grade ore yielded 500 to 800 opt silver and 15% copper from a 4-foot by 5-foot shaft that was 50-feet deep. The mine was idle from 1893 to 1906. The Boston-Montana Development Company and its successors organized in 1913-14 and were out of business by 1930. The company was reorganized in 1944 as the Boston Mines Company. When the Pettengil reservoir breached in 1927, the resulting flood wiped out part of the 38-mile long, narrow gauge railroad that serviced the mine. This calamity combined with falling silver prices led to the collapse of mining here. The railroad had cost $1,500,000 to build (completed in 1919), the mill had cost $900,000 (completed in 1921-22), and the power line had cost $150,000 (Sassman 1941). Flooded shafts and discharges are reported throughout the literature for the mine. Evans (1946) reported downpours of water in the stopes.

According to a Northern Testing Laboratory report (1982), the area was explored in the early 1970s by Boldex (Bethlehem Steel and General Electric Company) for tungsten. The site was last worked in the early 1980s by Timberline Minerals, Inc. (and/or Elkhorn Mining and Exploration of Corvallis) when they rehabilitated the portals and reopened 1,800 feet on the 1,000 foot level (The Wallace Miner 1981). In 1990, Puma, Inc. of Corvallis began salvaging the lumber from the mill building, but they did not finish the demolition.

Ore was hosted in a quartz monzonite or granite in northeast/southwest striking veins. Ruppel *et al.* (1993) describe the lithology here as a Late Cretaceous intrusive that is part of the Pioneer batholith. Veins include one set that strike N50°E and dip 65° to 80° SE; the other (minor) set strike approximately east-west and generally dip steeply to the north (Evans 1946). Geach (1972) estimated the veins in the area range from 5 to 50 feet wide but admitted that these estimates could not be confirmed because the workings were inaccessible at the time. Other reports state that the mineralization stretched 1,000 feet. Vein minerals include quartz, pyrite, tetrahedrite, galena, sphalerite, chalcopyrite, and molybdenite.

3.11.3 Environmental Condition

The mine has several obvious environmental problems. The main adit discharges about 150 gpm that precipitates orange-brown ferric oxyhydroxides along the discharge channel. Within a short distance, the discharge channel splits with half the flow running down the face of a waste dump and the other half running down the road bed. Below the dump, the flows join together again and run toward Elkhorn Creek. A past attempt at controlling the flow was made by constructing a small catch-basin, but at the time of the site visit, the discharge did not enter the basin; instead, it flowed directly into Elkhorn Creek. A second adit at the site has a small (2 gpm), clear discharge.

The waste dumps have seeps that emerge from their bases. Also, the dumps are scarred by rills and gullies that attest to continuing erosion problems.

Tailings from the mill are located in the natural channel of Elkhorn Creek. Approximately 95% of Elkhorn Creek is diverted around the tailings via an artificial channel upstream of the mill, but still a small volume of water flows through the waste. The tailings are largely devoid of vegetation and may be prone to wind as well as water erosion.

3.11.3.1 Site Features - Sample Locations

The volume of waste-rock material at the site was estimated at 126,000 tons by Northern Testing Laboratory (1982). Assays on the waste rock ran trace Au, 0.2 opt to trace Ag, 10 to 149 ppm Pb, 248 to 423 ppm Zn, 173 to 321 ppm Cu, and 2.0 to 3.0 percent Fe, with negligible Sb, Bi, and As. The mine waste was described as sandy gravel to silty sand that was at least 38.5 feet thick.

The volume of the tailings was estimated at 12,000 tons by Northern Testing Laboratory (1982). Assay samples collected by augering contained trace Au, 0.6 to 0.8 opt Ag, 450 to 1110 ppm Pb, 675 to 1250 ppm Zn, 67 to 655 ppm Cu, and negligible Sb and Bi, and 50 to 100 ppm As. The mill tailings were described as silty sand to clayey silt with thicknesses up to 25 feet (Northern Testing Laboratory 1982).

The MBMG collected four water samples in the area in September 1996. On Elkhorn Creek, sample ELES20L was taken upstream from all mining activity. Sample ELES10L was taken from an adit discharge at a collapsed adit southeast of the main workings. A sample from the main adit discharge (ELES30H) also was collected. Sample ELES40L was taken downstream from the mine and mill where Elkhorn Creek's original channel joins the channelized flow from a diversion ditch that carries flow around the site. Site features and sample locations are shown on figures 3.22 and 3.23; photographs of the site are shown in figures 3.24 and 3.25.

3.11.3.2 Soil

No soil samples were collected at the Elkhorn mine. Pioneer Technical Services (1995) and Northern Testing Laboratories (1982) characterized the waste and tailings at the site thoroughly.

3.11.3.3 Water

The water sample collected from the main adit's discharge (ELES30H) contained elevated concentrations aluminum, cadmium, copper, iron, lead, manganese, and zinc (table 3.9). In addition, the pH of the discharge (4.8) was outside the acceptable secondary MCL range of 6.5-8.5. The small discharge from the other adit had no water-quality problems. Elkhorn Creek below the site is obviously impacted by the discharges from the main adit and the tailings: copper and zinc concentrations were found to exceed aquatic life standards.

Table 3.9 Water-quality exceedences at the Elkhorn mine and mill.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Elkhorn Creek - upstream of site (ELES20L)																			
Adit A01 discharge (ELES10L)																			
Adit A02 discharge (ELES30H)	S,A C			P,A C		S,A C	S,A	P,C	S				A,C						S
Elkhorn Creek - downstream of site (ELES40L)						C							A,C						

Exceedence codes:

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

Note: The analytical results are listed in appendix V.

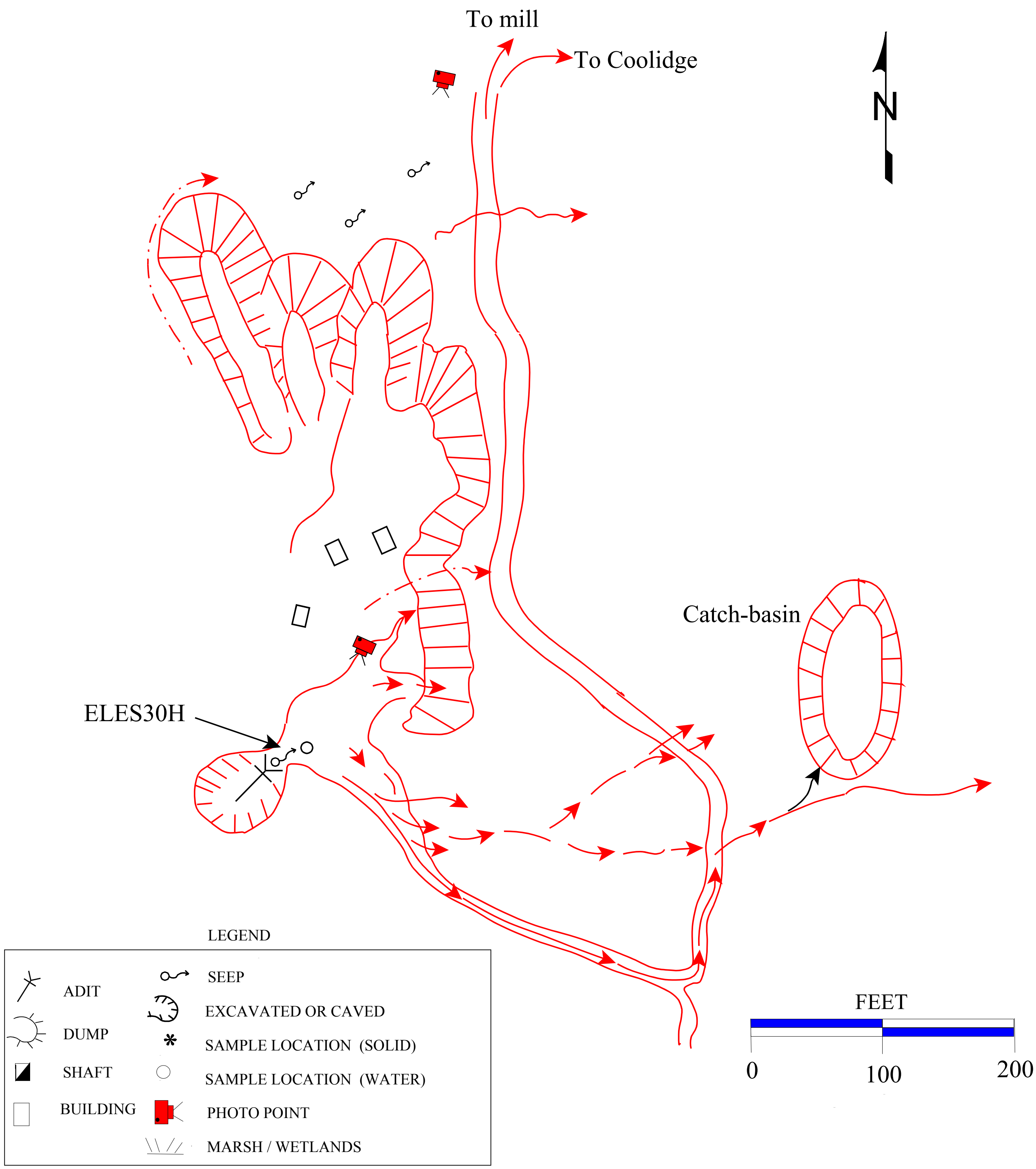

Figure 3.22 The Elkhorn mine discharges onto the waste dump and has seeps at the south end of the same dumps, as mapped September 10, 1996.

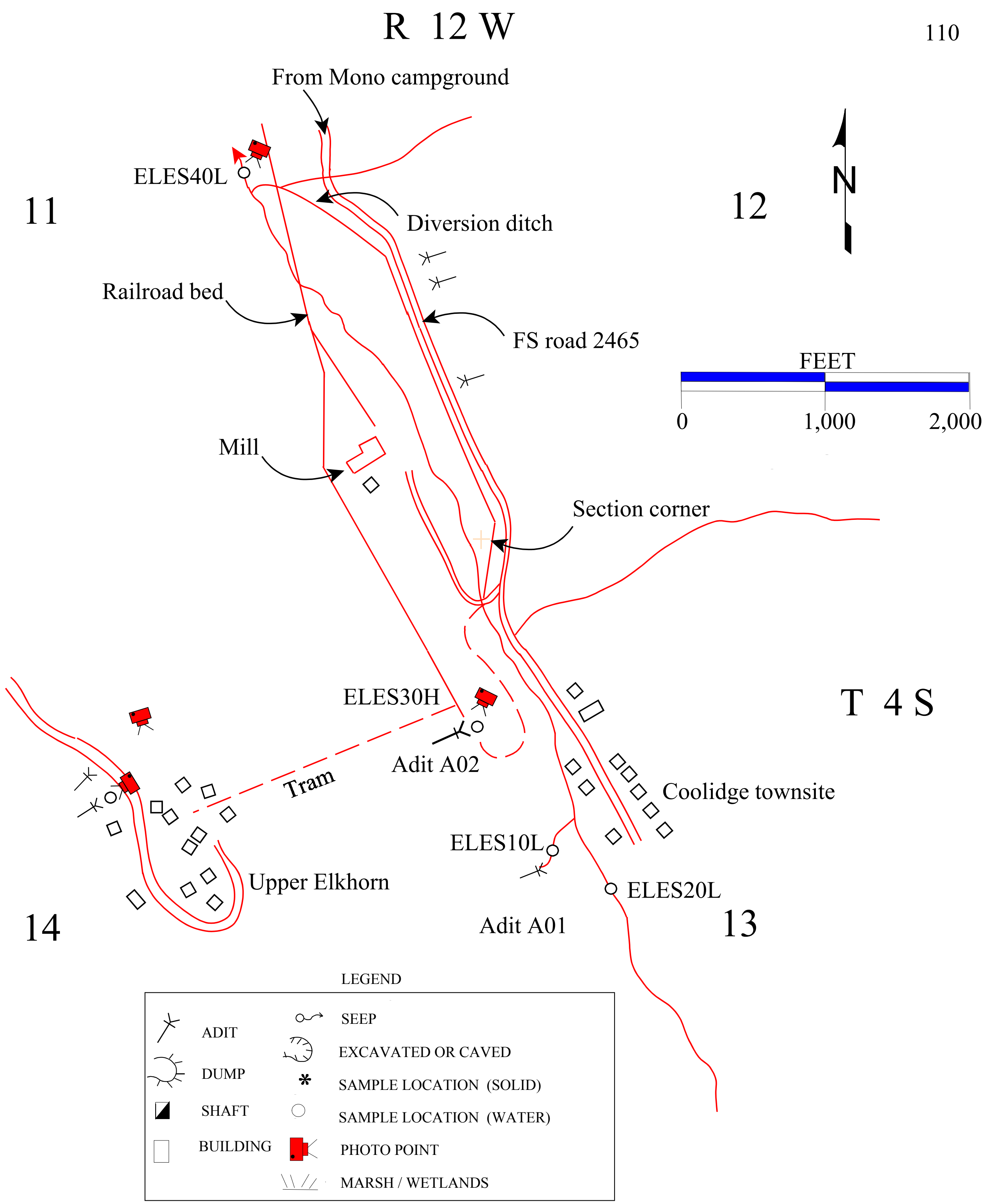

Figure 3.23 Schematic of the Elkhorn mine and mill on Elkhorn Creek taken from the Elkhorn Hot Springs 7.5-min. topographic map. The Upper Camp Elkhorn mine also is shown.

Figure 3.24 The discharge from the Elkhorn mine main adit splits into two channels; when the site was visited in September 1996, the flow was estimated at 150 gpm.

Figure 3.25 Seeps emerge from the toe of the Elkhorn mine's waste dumps.

3.11.3.4 Vegetation

The waste dumps at the Elkhorn are sparsely vegetated with Douglas fir. The area surrounding the main waste-rock dump did not have stressed or dead vegetation. A wet, boggy area is located at the northeast end of the dump; it is vegetated with grasses. As noted previously, the tailings at the site are generally devoid of vegetation.

3.11.3.5 Summary of Environmental Condition

The adit discharge and streamside tailings impact the water quality of Elkhorn Creek, resulting in elevated concentrations of copper and zinc downstream of the site. The waste dumps are out of the flood plain but are cut by rills and gullies suggesting erosion problems. The tailings in the natural Elkhorn Creek channel are being eroded by a small flow that is not captured by the upstream diversion. The environmental problems at the site are probably the most serious in the Big Hole River basin and warrant additional investigation.

3.11.4 Structures

The townsite of Coolidge has many standing buildings. The mill at Elkhorn is easily accessible and is considered hazardous. A USFS sign posted at Coolidge warns of the hazards and explains that the mill building is private; it requests that visitors stay out of the mill building. An ore bin and three small sheds remain at the mine site itself, but they are small and in good condition.

3.11.5 Safety

The doors at the main portal on BNF-administered land stood open at the time of the site visit, but the adit was flooded thereby discouraging the public from entering. The mill building (private but located on BNF-administered land) has been partially dismantled. It is still an inviting target of salvagers and sightseers. Coolidge has many open buildings that remain standing, but many of them could be unstable.

3.12 ELKHORN MINE - UPPER CAMP

3.12.1 Site Location and Access

The upper camp of the Elkhorn mine is reached by following the Pioneer Mountains Scenic-Byway/Forest Road 484, turning east onto road 2406, bearing right onto road 2406A, and following it to the end. The road is unpaved but is navigable by most 2-wheel drive vehicles in good weather. The site was located on the Elkhorn Hot Springs 7.5-min. topographic map in T4S

R12W Sec. 14 ACBA; it is entirely on BNF-administered land.

3.12.2 Site History - Geologic Features

The literature refers mainly to the lower (or 1,000-foot level) of the mine at the Elkhorn or Idanha workings, but some references to the 300-foot level are made. The same site history and geologic features as for the lower Elkhorn workings apply here. Ten thousand feet of development were attributed to the 300-foot level and a raise (No. 1 raise) from the 1,000-foot level connects the two (Geach 1972).

3.12.3 Environmental Condition

The site has two collapsed adits, one of which has a discharge. A large waste-rock dump at the site appears stable. The workings and waste are far removed from Elkhorn Creek.

3.12.3.1 Site Features - Sample Locations

One water sample (EUES10H) of the adit discharge was collected on September 9, 1996. The discharge flowed at about 1 gpm and soaked into the ground before reaching an active stream channel. Site features and sample locations are shown in figure 3.26; photographs of the site are shown in figures 3.27 and 3.28.

3.12.3.2 Soil

No soil samples were taken. The waste is not within a flood plain and does not appear to affect water quality in the area.

3.12.3.3 Water

The chronic aquatic life standard for copper was exceeded in the sample from the adit discharge (table 3.10). The secondary MCL for manganese also was exceeded. The water infiltrated the ground before reaching the active Elkhorn Creek drainage.

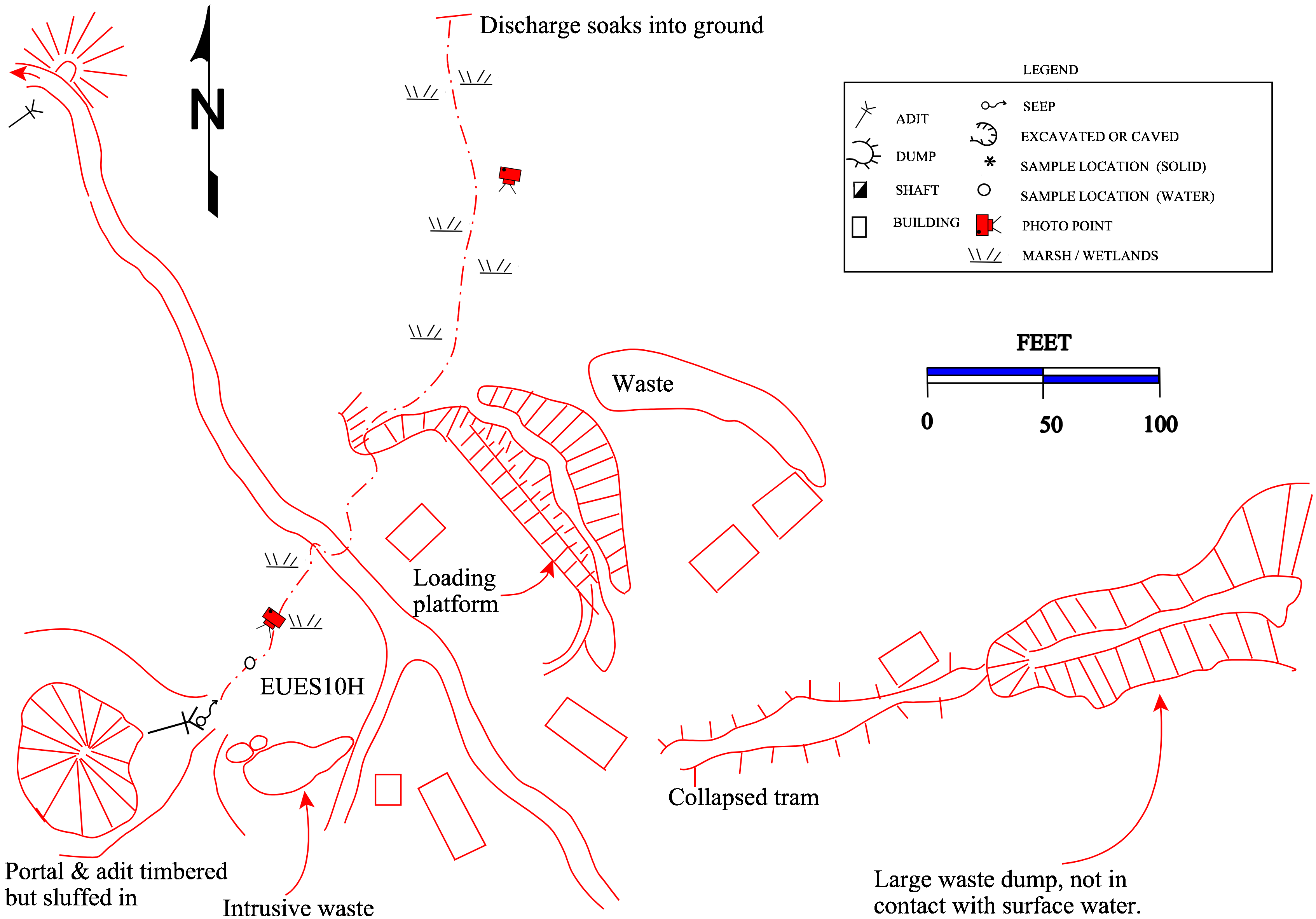

Figure 3.26 A small discharge flowed from one of the two adits at the upper camp of the Elkhorn mine, as mapped on September 12, 1996.

Figure 3.27 A small discharge flowed from the collapsed adit and soaked into the ground.

Figure 3.28 A flat area northeast of the adit was densely vegetated with sedges and grasses except for a barren swath that cut through the center of it. The barren area evidently is related to run off from the mine.

Table 3.10 Water-quality exceedences at the upper camp of the Elkhorn 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 discharge - EUES10H						C			S										

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

Note: The analytical results are listed in appendix V.

3.12.3.4 Vegetation

The site was surrounded by lodgepole pine/Douglas fir/spruce forest. The waste dump was unvegetated. A flat area northeast of the adit was densely vegetated with sedges and grasses except for a barren swath that cut through the center of it. The area may have been dammed for a water supply when the mine was active.

3.12.3.5 Summary of Environmental Condition

The upper camp of the Elkhorn mine covers an area of approximately 10 acres and is 2,500 feet uphill from Elkhorn Creek. The site’s adit discharge does not flow directly into Elkhorn Creek, but it may impact ground-water quality in the area. Vegetation along a channel in the flat area below the adit has been killed, apparently by runoff from the mine.

Old garbage dumps were scattered throughout the forest surrounding the site. They mainly consist of rusting metal cans and drums, and some broken glass. At the lower Elkhorn site, these dumps are considered as part of an interpretive display of how early miners disposed of their trash.

3.12.4 Structures

Many buildings at the site remain standing and appear to be used occasionally. Some of them have newer metal roofs and have been sheet-rocked in the recent past (possibly in the early 1980s). The tram tracks to the waste dump are partially collapsed and the tram to the lower workings are almost completely gone.

3.12.5 Safety

The waste dump has steep slopes, and an unstable ore bin stands to one side. Many of the buildings are accessible and may be considered hazardous. The adit is almost completely collapsed, so it poses no safety hazard.

3.13 ELM ORLU MINE

3.13.1 Site Location and Access

The Elm Orlu mine is reached by following Forest Road 187 west from Melrose, MT, bearing left at Glendale onto Forest Road 188 (the road up Trapper Creek), and then turning left (south) on an unmarked road just below Hecla in the southwest corner of section 1. Immediately after crossing Sappington Creek in section 1, the road degrades into four-wheel-drive-only condition (Forest Road 3965). The site is located in T3S R11W Sec. 11 BCAD on the Mount Tahepia 7.5-min. quadrangle. The mine workings are on both private and BNF-administered land.

3.13.2 Site History - Geologic Features

The Elm Orlu is part of the Keokuk-Elm Orlu group as described in Karlstrom (1948) and Geach (1972). Karlstrom (1948) described the general group as occurring along the basal contact of the Park quartzite as it occurs above a quartz monzonite sill. The mines in this group are categorized as replacement-types; the mineralizing fluids were trapped in the shattered limestones (actually the Cambrian Meagher dolomite) beneath the quartzite.

The area was prospected in the early to late 1880s. The mine consisted of eight inclined shafts (6- to 10-feet wide/15- to 20-feet deep) that were driven along the basal contact of the quartzite (Karlstrom 1948). The shafts followed a continuous quartz vein along the basal contact consisting of limestone, quartz, pyrite, and sphalerite with minor copper staining. Karlstrom (1948) described the workings as caved, but they were partially open in 1996 - perhaps from later work. The ownership of the workings and the waste is unclear; they are at least partially on BNF-administered land and partially on patented land.

3.13.3 Environmental Condition

The workings had no discharges, but a small, north-flowing tributary to Sappington Creek ran adjacent to the sulfide-rich waste dump. Erosion of the dump appeared minimal.

3.13.3.1 Site Features - Sample Locations

The site was visited on August 22, 1996. Because the site is largely on patented land, only upstream and downstream water-quality samples were taken from the Sappington Creek tributary. The upstream sample (TEOS10H) was taken south of the access road. The downstream sample (TEOS20H) was collected below the waste dump where the creek's gradient increases and where there was an appropriate site to estimate streamflow using a bucket and stopwatch. Site features and sample locations are shown on figure 3.29; a photograph of the site is shown in figure 3.30 (a panorama).

3.13.3.2 Soil

No soil samples were taken because most of the disturbance is on private, patented land. Also, the waste did not appear to affect the surrounding BNF-administered land.

3.13.3.3 Water

The water upstream from the site emerges from a wetlands area and becomes channelized just before it crosses the road south of the mine. There are numerous springs in the area upstream from the site and adjacent to the mine dump. The creek immediately downstream of the site has a fairly steep gradient; it cascades down a well-defined channel. At the time of the site visit, the water appeared clear and seemed unaffected by the mining activity upstream. The tributary enters a wetlands approximately 50 ft downstream of the site and then flows into Sappington Creek.

The pH upstream of the Elm Orlu was 8.0, and the SC was 264 µmhos/cm; downstream of the site, the pH was 8.2, and the SC was 265 µmhos/cm. The flow upstream was estimated at 50 gpm, and the flow downstream was measured at 60 gpm. An increase in the concentration of zinc from <2 µg/l upstream to 5.4 µg/l downstream was noted, but the increased level still met all water-quality standards.

3.13.3.4 Vegetation

No signs of stressed vegetation were observed at the site. The area's flora consists of limber pine, subalpine fir, Douglas fir, lodgepole pine, grasses, shrubs, and wildflowers. The waste dumps are largely unvegetated except for an occasional tree or some low brush.

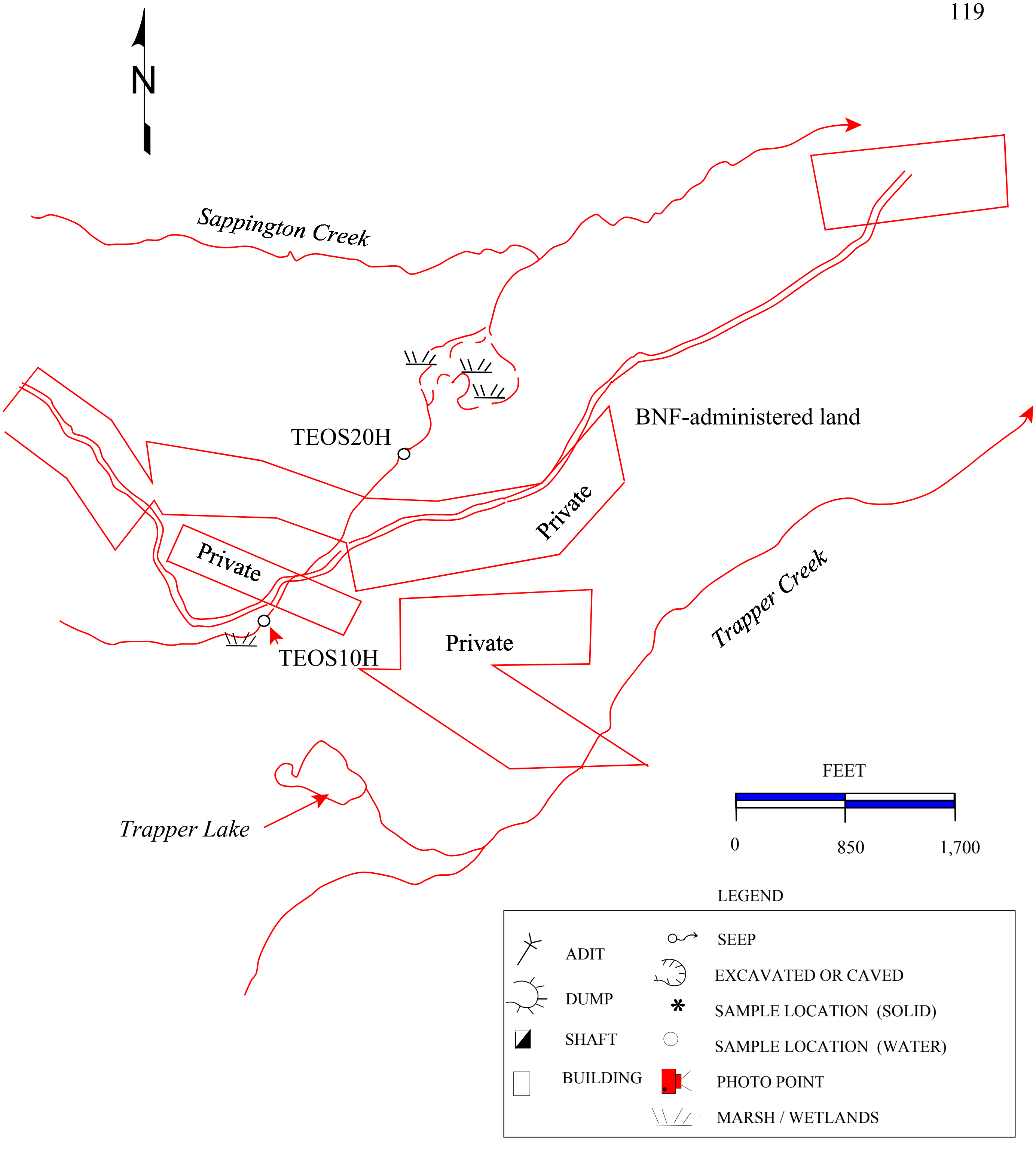

Figure 3.29 Samples for the Elm Orlu were taken upstream and downstream of the patented claims on August 29, 1996, as shown in this schematic drawing from the 7.5 min USFS ownership map.

Figure 3.30 The headwater of an unnamed tributary of Sappington Creek flowed around the margin of a waste dump at

The streamside waste at this small site may contribute a minor metal load to the unnamed tributary to Sappington Creek. Overall, the environmental impact of the site on BNF-administered land is minimal.

3.13.4 Structures

One log cabin in bad condition remains on the waste dump at the Elm Orlu. The roof is totally collapsed, and the walls are in bad shape.

3.13.5 Safety

The open inclined shafts on private land are a safety concern. Cattle grazing in the area are at some risk of injury. The openings did not appear very deep—probably not greater than the reported 15 to 20 feet— but they are steep sided. No other safety concerns were noted.

3.14 FARLIN GULCH ADIT

3.14.1 Site Location and Access

The Farlin Gulch adit is located a short distance from the Indian Queen mine (see section 3.17). The site is accessed by turning north off the Birch Creek Road and following a rough road up Farlin Gulch a short distance. The location of the site is shown on the Twin Adams Mountain 7.5 min. quadrangle in T5S R10W Sec. 15 ACDD. The site is on BNF-administered land.

3.14.2 Site History - Geologic Features

No specific information was found in the literature concerning the Farlin Gulch adit. This occurrence probably was mined at approximately the same time as the Indian Queen mine that lies to the east. Commodities may have been gold, silver, and/or copper.

3.14.3 Environmental Condition

The site is relatively small, with the disturbance limited to about 0.1 acre. A waste-rock dump associated with the adit is being actively eroded by the small stream in Farlin Gulch.

3.14.3.1 Site Features - Sample Locations

Upstream and downstream samples were collected on July 16, 1996 to evaluate the environmental impact of the streamside waste. Sample FWIS20H was taken approximately 400 feet upstream from the waste dump; sample FWIS10H was collected approximately 150 feet downstream from the site. No discharge from the mine workings was noted. Site features and sample locations are shown on figure 3.31; photographs of the site are shown in figures 3.32 and 3.33.

3.14.3.2 Soil

No soil samples were taken.

3.14.3.3 Water

Metal concentrations were nearly the same upstream and downstream of the site. No water-quality standards were exceeded.

3.14.3.4 Vegetation

Vegetation near the site did not appear stressed. The banks of the creek are lush with grasses and sedges. Willows vegetate the drainage immediately downstream of the waste dump. The dump itself is revegetating with grasses and brush.

3.14.3.5 Summary of Environmental Condition

The site is small and has no obvious effect on the environmental condition of Farlin Gulch. The site was sampled because it fit the study criteria (waste in contact with the stream), not because it appeared to adversely impact BNF-administered land.

3.14.4 Structures

No structures are associated with the adit in Farlin Gulch. The workers probably lived at Farlin, downstream and to the east of the mine.

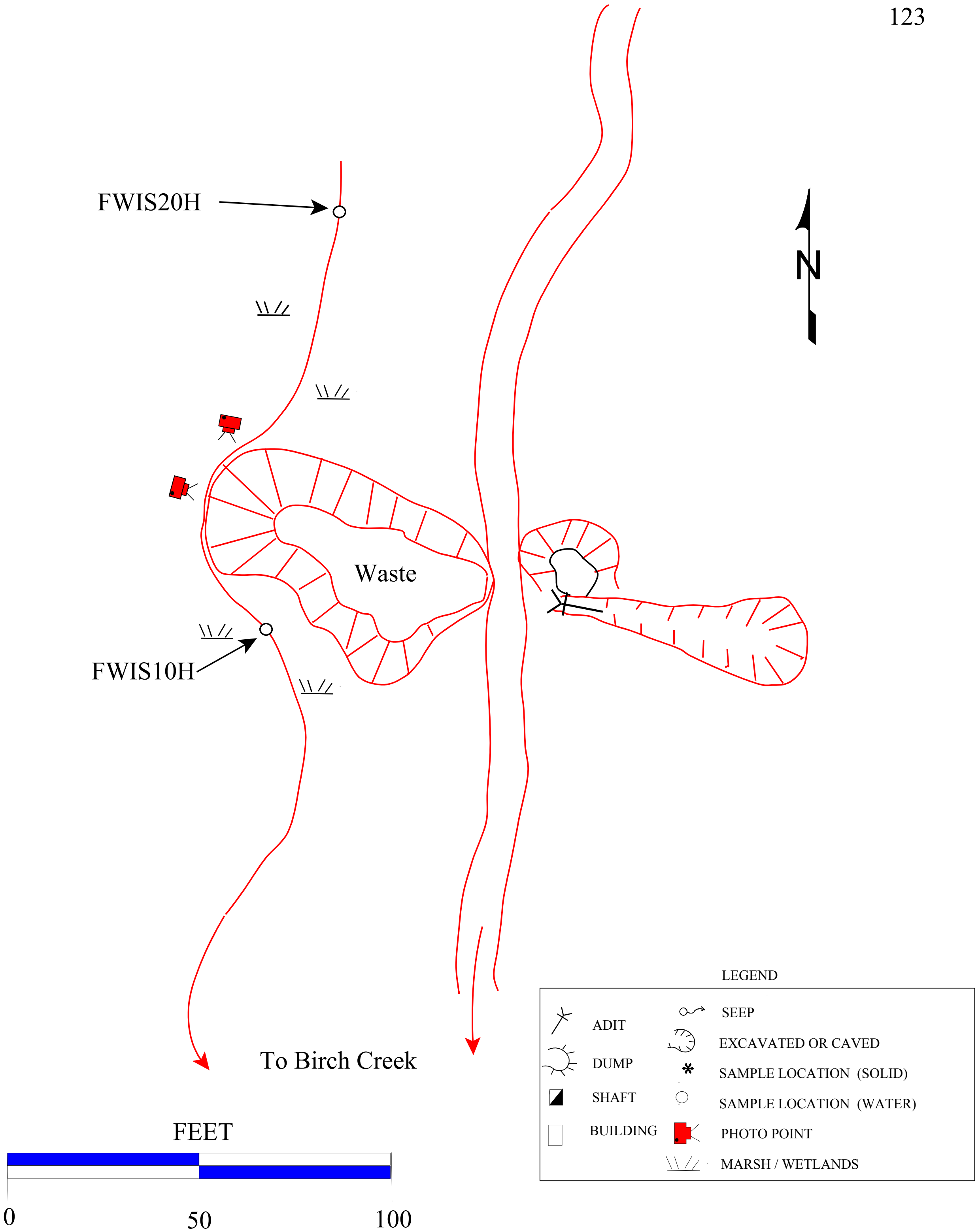

Figure 3.31 A small waste dump lies in the Farlin Gulch drainage and is actively being eroded, as mapped July 16, 1996.

Figure 3.32 Workings at the Farlin Gulch site include a collapsed adit and a small waste dump.

Figure 3.33 The small creek in Farlin Gulch cuts across and erodes the toe of the waste dump.

3.14.5 Safety

The adit in Farlin Gulch is completely caved; a steep-sided prospect pit or shaft located to the northeast of the adit may be a safety concern. The waste dump was small and not very steep. The site receives only slight to moderate use from the public.

3.15 GREENWOOD CONCENTRATOR

3.15.1 Site Location and Access

The Greenwood concentrator (mill) is located on Trapper Creek and can be reached by following Forest Road 187 west from Melrose, MT, bearing left at Glendale, and then following Forest Road 188 for seven miles. The road is passable by 2-wheel drive vehicle during the summer and early fall months; four-wheel drive is recommended for the rest of the year. The site location is shown on the Mount Tahepia 7.5-min. quadrangle in T3S R10W Sec. 6 ACAD.

3.15.2 Site History - Geologic Features

The mill was built in 1882 (Sassman 1941) and was reportedly the first concentrating mill to be built in Montana. It was built to handle increased production of low-grade ores and reduce the cost of haulage from the mines at Hecla. Its capacity was 100 tons per day from which 35 tons of concentrates would be produced. Sassman (1941) further states that from the years of 1882 through 1898, the mill concentrated 177,092 tons of second-class ore. After this period, the mines of Hecla declined, and it is unknown exactly when the concentrator ceased production. Karlstrom (1948) reported that during World War II (1941 and 1942), government subsidies and metal bonuses made it profitable to ship the tailings from the concentrator as well as the smelter slag from Glendale. This was probably what happened to much of the tailings from the site.

The mill is located on glacial till composed mainly of intrusive boulders and limestone. Charcoal kilns are located on the east side of Trapper Creek downstream from the concentrator. Many of the kilns are in an advanced state of disrepair.

3.15.3 Environmental Condition

The concentrator’s ruins are approximately 300 feet from Trapper Creek. A thin apron of gravel-sized tailings blankets the area between the road and the creek. A few shallow rills lead to the creek, and the tailings are locally in contact with the creek. No sulfides were noted; the primary distinguishing characteristic of the tailings was the occasional, green, copper-stained fragment.

3.15.3.1 Site Features - Sample Locations

An apron of tailings is spread from the east of the concentrator ruins to Trapper Creek. Some of the tailings are in contact with the creek. Two samples were taken from the creek on August 22, 1996: one upstream (TGCS10M) and one downstream (TGCS20M). Most of the tailings are on private, patented land (a 400-foot by 600-foot mill site?). Site features and sample locations are shown on figure 3.34; photographs of the site are shown in figures 3.35 and 3.36.

3.15.3.2 Soil

No soil sample was taken because the tailings are on private, patented land, and they did not appear to impact BNF-administered land.

3.15.3.3 Water

The concentration of zinc in Trapper Creek increased from <2.0 µg/l upstream to 3.7 µg/l downstream of the site; however, the downstream concentration was still well below any water-quality limits. The pH and SC remained the same above and below the site with the pH approximately 8.0 and the SC approximately 180 µmhos/cm.

3.15.3.4 Vegetation

The vegetation at the site is typical of a lodgepole pine/fir/spruce forest. The area to the east of the concentrator has scattered lodgepole pines and sparse grass. This area may be somewhat stunted because of the mining activity although none of the plants were dead or dying, merely smaller than normal. The banks of the creek are lined with bushes and grasses.

3.15.3.5 Summary of Environmental Condition

Most of the disturbance associated with the Greenwood Concentrator is on private, patented land. A small strip of federal land adjacent to Trapper Creek also has been disturbed. The water quality of Trapper Creek does not appear to be impaired by the streamside tailings under low flow conditions; however, sheet and rill erosion of the tailings during precipitation and spring runoff events may contribute metals to the creek.

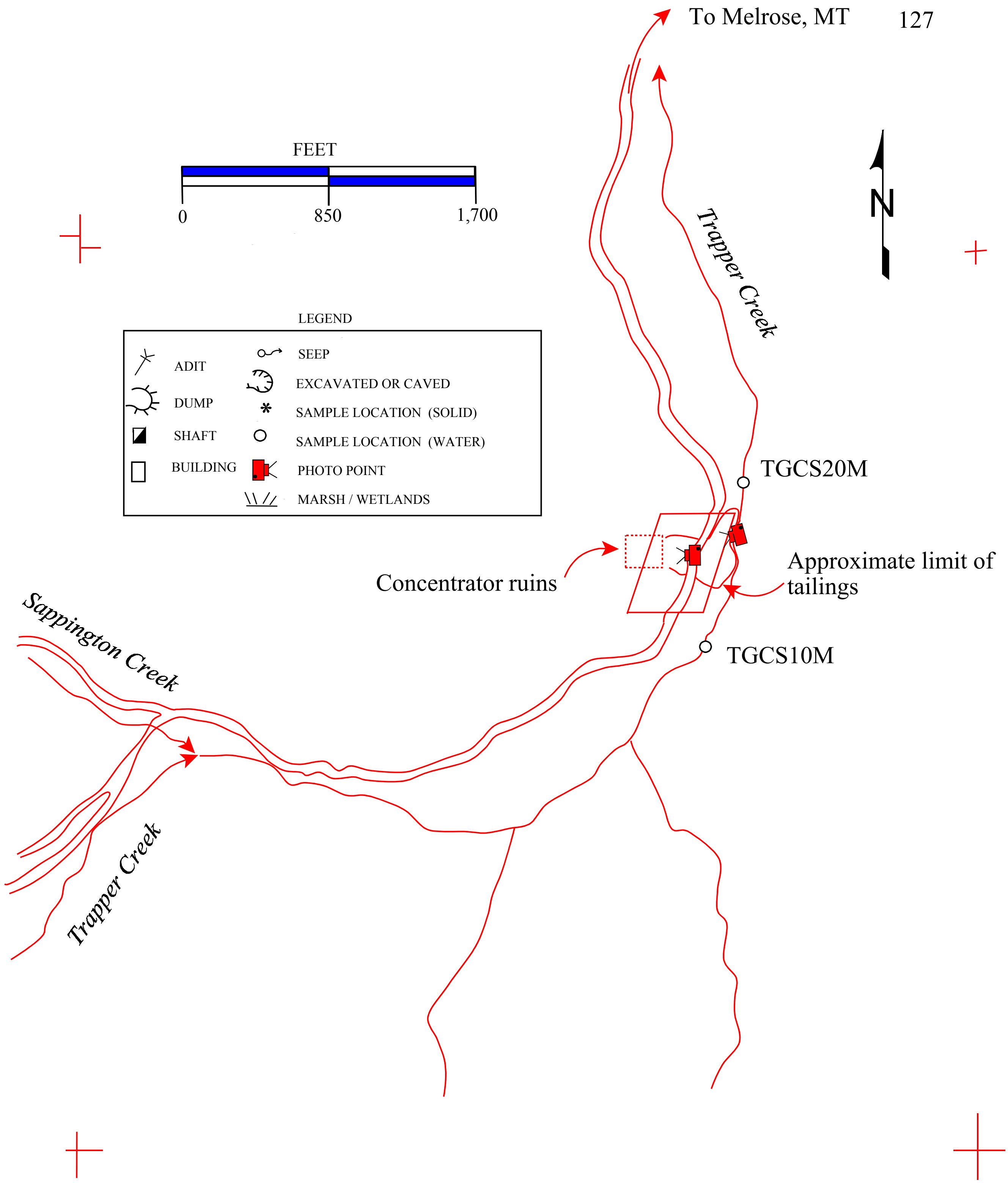

Figure 3.34 Samples for the Greenwood Concentrator were taken upstream and downstream of the patented claim on August 22, 1996, as shown in this schematic drawing from the Mount Tahepia 7.5 min USFS ownership map.

Figure 3.35 Only the foundation remains of the once massive Greenwood concentrator.

Figure 3.36 A flat area to the east of Forest Road 188 has scattered slag from the Greenwood concentrator.

3.15.4 Structures

Sassman (1941) contains an excellent photograph of the Greenwood mill in its heyday. The building is presently in ruins with only the foundation and a few boards remaining. There is some rusting junk and rubble around the site.

3.15.5 Safety

No safety concerns were noted on BNF-administered land. The building remains are on patented ground. The kilns to the north and east of the site are crumbling and may be considered somewhat of a hazard.

3.16 IBEX (BEAR PAW) MINE

3.16.1 Site Location and Access

The Ibex (Bear Paw) mine lies up Lacy Creek and can be reached by trail from the Lacy Creek (Pioneer Loop National Recreation Trail 750) trailhead. The mine is located along a small unnamed stream and is approximately 400 ft south of Schwinegar Lake,. The topography is moderately rugged and well forested. Three adit symbols for the mine are found on the Odell Lake 7.5-min. quadrangle in T3S R13W Sec. 8 CBCA. The mine is on BNF-administered land.

3.16.2 Site History - Geologic Features

Geach (1972) wrote a short description of the mine, but had no record of its production. The description includes a sketch map of the upper adit's workings that were open at the time. The mine was hosted by quartz monzonite and aplite with small quartz veins (two- to eight-inches wide) (Geach 1972). There were two sets of quartz veins: one northeast-trending, NW-dipping and another west-trending, S-dipping. Geach (1972) described two adits, but three are shown on the topographic map. Only two primary adits were found by MBMG during the site visit, but other surface cuts and beginnings of workings were identified.

3.16.3 Environmental Condition

When the site was visited in July 1997, a small discharge flowed from the lowermost adit. It split into two streams as it ran over the waste-rock dump, and then sank into the ground within a short distance. Few sulfides were noted on the dump.

3.16.3.1 Site Features - Sample Locations

The adit discharge (LIBS10L) was sampled near the portal. A soil sample (LIBD10H) was taken approximately 10 feet downhill from the toe of the waste dump. The small drainage west of the mine was sampled upstream (LIBS20L) from the workings; no downstream sample was collected because the stream disappeared beneath a boulder field. Site features and sample locations are shown on figure 3.37; photographs of the site are shown in figures 3.38 and 3.39.

3.16.3.2 Soil

The soil sample from downhill of the Ibex's waste dump had low metal concentrations; none exceeded phytotoxic levels (table 3.11).

Table 3.11 Soil sampling results (mg/kg) for the Ibex mine.

Sample Location	As	Cd	Cu	Pb	Zn
LIBD10H - downhill from waste dump	5.6[1]	4.5[1]	5.2[1]	58.1[1]	65.4[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3)
(2) Exceeds phytotoxic levels (table 1.3)

3.16.3.3 Water

The pH of the adit discharge (field=6.52, lab = 6.32) and the unnamed drainage (field=6.48, lab = 6.1) was slightly acidic and fell outside the acceptable secondary MCL range of 6.5 to 8.5 (table 3.12). The acidity may be caused by the water being in contact with the intrusive host rock or by organic acids released by the spruce and pine vegetation. Locally, there are no carbonate rocks to act as a buffer. Copper, iron, manganese, and zinc concentrations were higher in the adit discharge than in the background sample from the unnamed stream; however, no water-quality standards were exceeded.

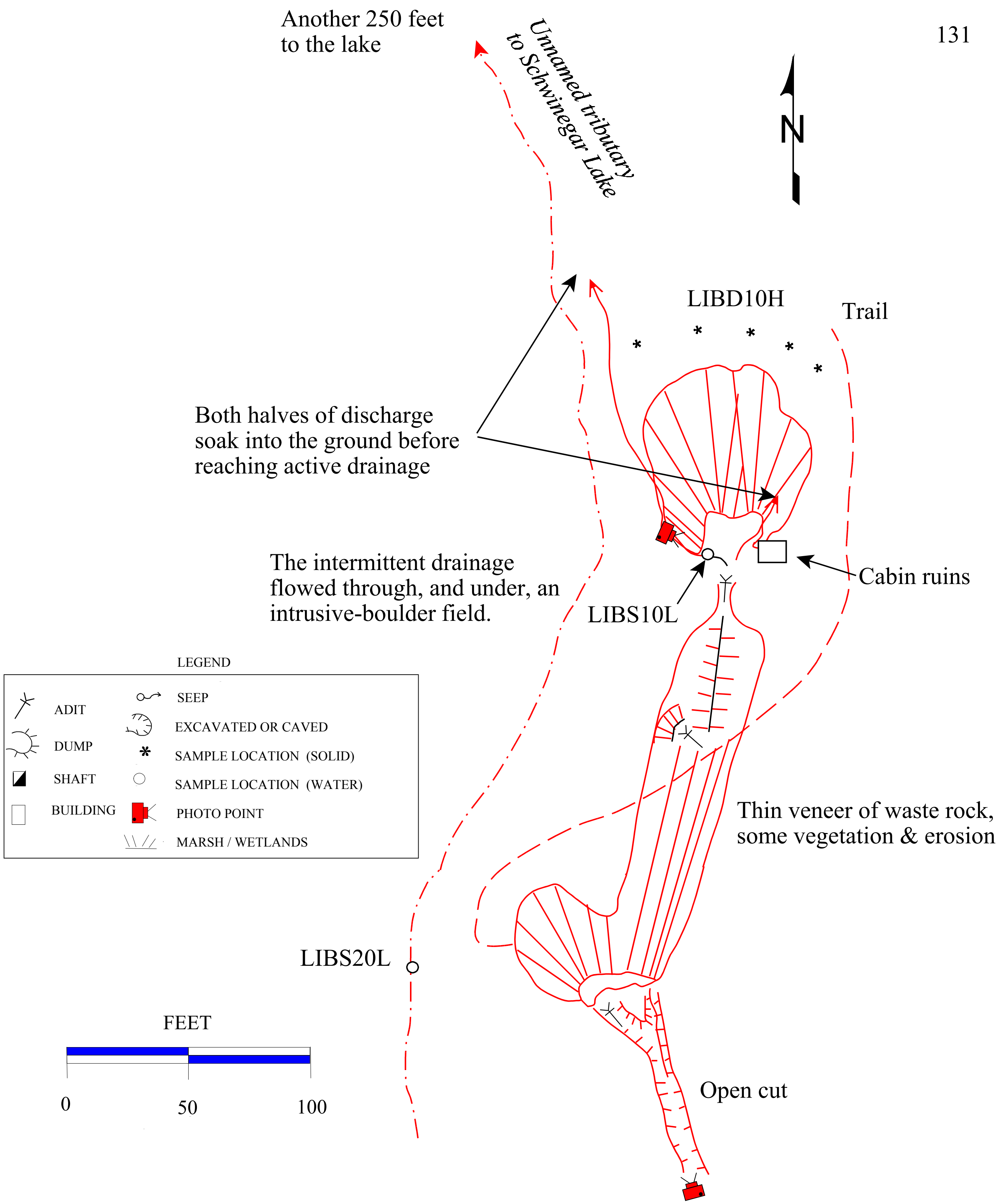

Figure 3.37 The Ibex mine consists of two or three collapsed adits, July 1997. The lowest adit has a small discharge that splits and soaks into the ground before reaching an active drainage.

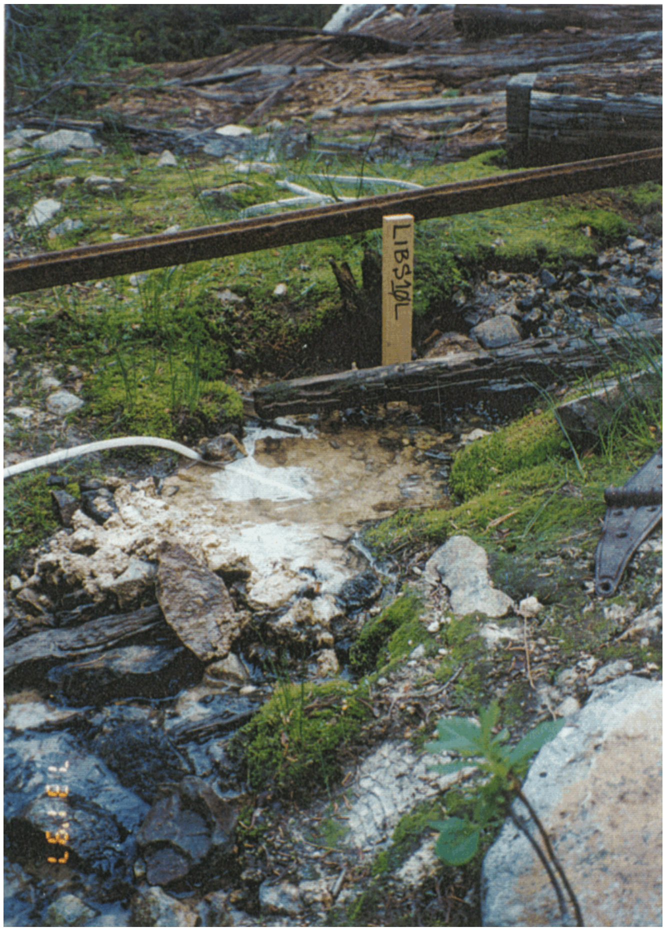

Figure 3.38 The Ibex mine had an adit discharge that flowed at 5 gpm; no signs of AMD were evident.

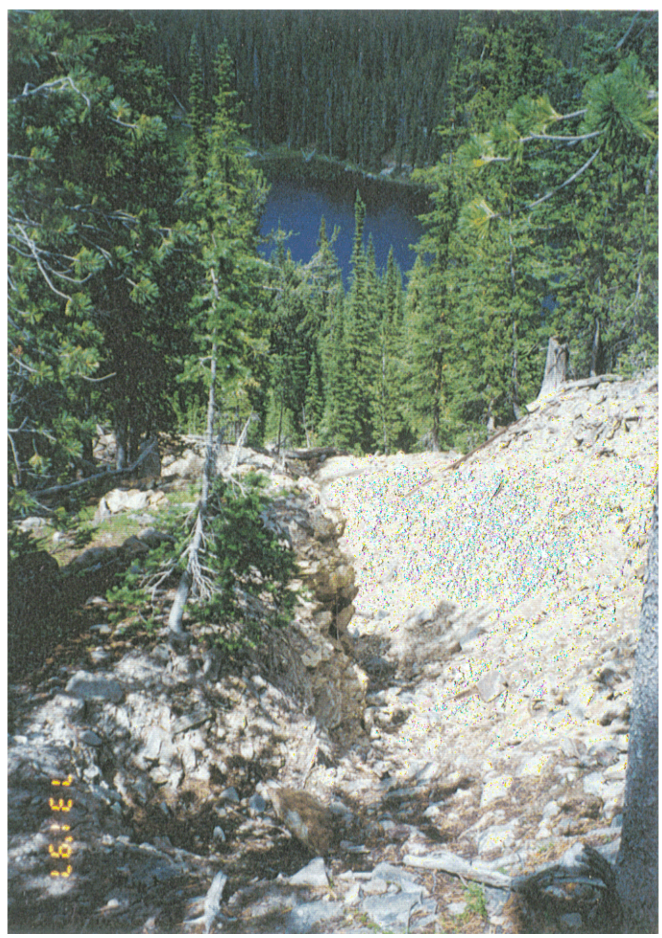

Figure 3.39 The upper adits of the Ibex were collapsed; Schwinegar Lake appears in the background.

Table 3.12 Water-quality exceedences at the Ibex 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 discharge (LIBS10L)																			S
Unnamed drainage - upstream of site (LIBS20L)																			S

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

Note: The analytical results are listed in appendix V.

3.16.3.4 Vegetation

The mine has no obvious detrimental impacts on the surrounding vegetation. The waste dump is moderately well revegetated with grasses, mosses, and other herbaceous plants.

3.16.3.5 Summary of Environmental Condition

The Ibex mine is not a site of great environmental significance. The adit discharge is small and never appears to reach the lake; the metal content of the waste material is relatively low; and no runoff channels lead from the waste dump to the lake.

3.16.4 Structures

The ruins of a small log cabin lie on the waste dump. A possible foundation of another building occurs downhill from the mine. No other structures were noted.

3.16.5 Safety

No open adits or other workings are present at the Ibex. The site is remote and probably does not see many visitors. The site does lie close to a recreational site (Schwinegar Lake) and the Lacy Creek trail.

3.17 INDIAN QUEEN MINE AND SMELTER

3.17.1 Site Location and Access

The Indian Queen is reached by exiting Interstate 15 at Apex and traveling west up Birch Creek approximately 5.5 miles. The site is adjacent to the road. The location of the smelter is shown in T5S R10W Sec. 15 DDBB on the Twin Adams Mountain 7.5-min. quadrangle.

3.17.2 Site History - Geologic Features

The Indian Queen was one of the largest producers of copper in the area. It was worked from 1867 to 1923 (Geach 1972). Production from 1902 to 1923 yielded 1,729,404 pounds Cu, 42,219 oz Ag, and 299 oz Au from 22,907 tons of ore (Geach 1972).

Host rock for the deposit is Mission Canyon limestone that was intruded by the Mount Torrey batholith to form a skarn. Originally, there were three adits, two shafts, and numerous prospects totaling 1,600 feet of workings (Geach 1972). Minerals at the Indian Queen included native copper, azurite, malachite, chrysocolla, cuprite, and melaconite; sulfide ore included chalcocite, chalcopyrite, and bornite (Geach 1972). The mineralization was developed along a north-south trending fault that also is the contact between the limestone and the intrusive.

Little information is available for the smelter near the mine. It presumably operated over approximately the same time span as the mine.

3.17.3 Environmental Condition

Smelter slag at the site is in contact with Birch Creek. Most of the slag heap appears to be on BNF-administered land. Road construction soon may have an effect on the site as the road is widened, cutting into the slag. Pioneer Technical Services (1995) did not collect water samples at the site but did note elevated concentrations of arsenic, cadmium, cobalt, copper, manganese, nickel, lead, and zinc in Birch Creek sediment downstream of the site. The volume of slag was estimated to be 2,600 cubic yards.

The waste rock from the mine is on patented land as are the collapsed and partially intact mine openings. Pioneer Technical Services (1995) estimated the volume of waste rock to be 15,490 cubic yards.

3.17.3.1 Site Features - Sample Locations

Water samples were collected at the site on May 3, 1996. One sample (BIQS20L) was taken from Birch Creek upstream of the slag; another (BIQS10L) was taken downstream. Site features are shown on figure 3.40; photographs of the site are shown in figures 3.41 and 3.42.

3.17.3.2 Soil

No soil samples were collected.

3.17.3.3 Water

Birch Creek, which was flowing at 18.7 cfs on the day of sampling, is in contact with the smelter slag over a reach of less than 120 feet. The slag does not appear to be eroding or leaching metals into the water. No metal concentrations exceeded water-quality standards, and the upstream and downstream concentrations were nearly identical.

3.17.3.4 Vegetation

Willows growing on and adjacent to the slag did not appear stressed. The smelter slag is nearly barren of vegetation, probably because of the lack of soil.

3.17.3.5 Summary of Environmental Condition

No differences in the water quality were noted between the upstream and downstream samples. The slag largely occurred in competent blocks and did not appear to be rapidly eroding even though Birch Creek was immediately adjacent to the slag pile. The metals in the slag may be silica encapsulated.

3.17.4 Structures

A partial stone foundation is the only remnant of the smelter. No other buildings could be found directly related to the mine. There are numerous cabins in the general area along Birch Creek.

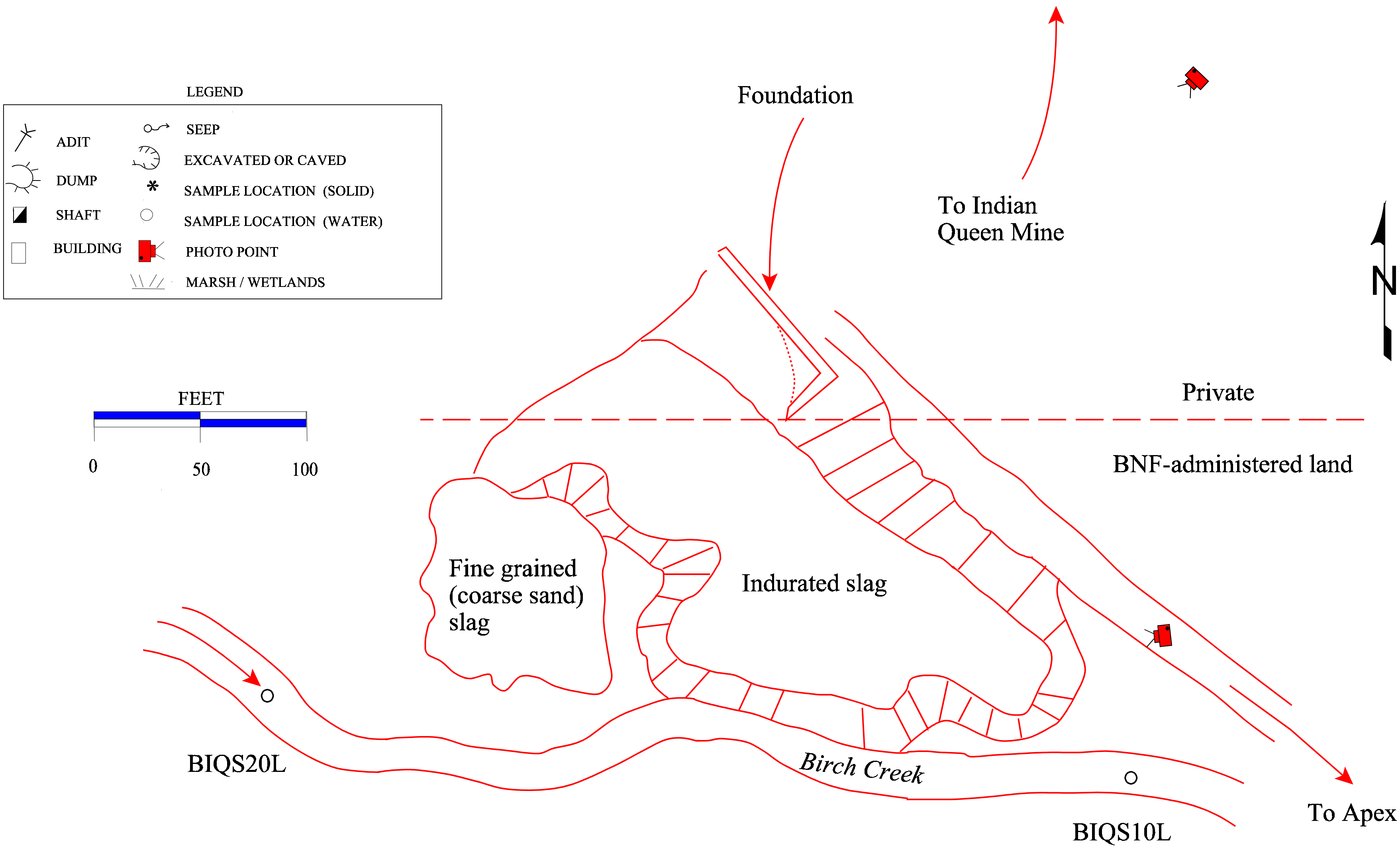

Figure 3.40 Birch Creek flows adjacent to the Indian Queen smelter slag, as mapped May 3, 1996.

Figure 3.41 Birch Creek flows by the smelter waste at the Indian Queen mine.

Figure 3.42 The waste rock from the Indian Queen lies on dry ground up slope from the smelter site.

3.17.5 Safety

All workings at the Indian Queen mine are on private land, and at least one open adit is present. The smelter slag is largely on BNF-administered land, but except for a fairly steep slope, it does not appear to be physically hazardous. The site is frequently visited and is noted by a Forest Service interpretative sign posted next to the road.

3.18 JAHNKE (STRAIGHT TIP) MINE

3.18.1 Site Location and Access

The Jahnke (Straight Tip) mine (T7S R16W Sec. 29 DCCD) is located in the Beaverhead Mountains, less than a half mile east of the Continental Divide. The mine workings and several cabins are several hundred feet south of Jahnke Lake. The site is accessed via a two and a half mile foot trail that follows the Jahnke Creek drainage. The site is privately owned but is surrounded by BNF-administered land.

3.18.2 Site History - Geologic Features

Lipton (1988) compiled an excellent summary on this mine. The deposit is associated with an altered mafic sill which can be traced for over 6,000 feet along strike. Veins contain quartz, chalcopyrite, galena, malchite, azurite, cuprite, chrysocolla, hematite, magnetite, scheelite, and native gold and silver (Winchell 1914; Walker 1963).

The property was discovered in 1898, and was extensively developed about 1909. A 3,064-foot crosscut was driven to intersect the deposit at depth. In 1996, a large volume of water was flowing from this adit. Associated dumps are composed of unaltered phyllitic quartzite and a little quartz-iron oxide vein. National Forest maps show the adit and dump as private land, but Winters *et al.* (1994) thought that it might actually be on BNF-administered lands.

Production records available for 3 years show that 106 tons of ore yielded 16 ounces of gold, 1,238 ounces of silver, 4,804 pounds of copper, and 17,129 pounds of lead (Lipton 1988).

3.18.3 Environmental Condition

A large, clear discharge flows from the mine's partially collapsed adit. The discharge quickly sinks into the top of the waste-rock dump. At the base of the dump, it re-emerges and descends steep mountain slopes before joining the main Jahnke Creek drainage.

3.18.3.1 Site Features - Sample Locations

Water-quality samples were collected at the site on September 10, 1996. Sample BJAS10L was collected from the adit discharge where it crosses onto BNF-administered land. The flow rate of the discharge was 26 gpm. Background sample BJAS20L was collected from a tributary to Jahnke Creek, above the confluence with the adit discharge. The flow rate of the tributary was 13 gpm. A third sample, BJAS30L, was collected from Jahnke Creek below the confluence with the discharge. The flow rate at this location was 26 gpm.

Although the adit discharge is in contact with waste rock at the site, erosion of the waste is a minor problem. No waste rock deposits were observed on BNF-administered land; hence, no soil samples were collected at the site.

Site features and sample locations are shown on figure 3.43; figures 3.44 and 3.45 are photographs of the site.

3.18.3.2 Soil

No soil samples were collected at the site.

3.18.3.3 Water

The concentration of silver at each of the three sample locations was 1.8 µg/l, which exceeded the chronic aquatic life standard of 0.012 µg/l (table 3.13).

Table 3.13 Water-quality exceedences at the Jahnke 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 discharge on BNF-administered land (BJAS10L)												C							
Tributary to Jahnke Creek, upstream of confluence with adit discharge (BJAS20L)												C							
Jahnke Creek, downstream of site (BJAS30L)												C							

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

Note: The analytical results are listed in Appendix V.

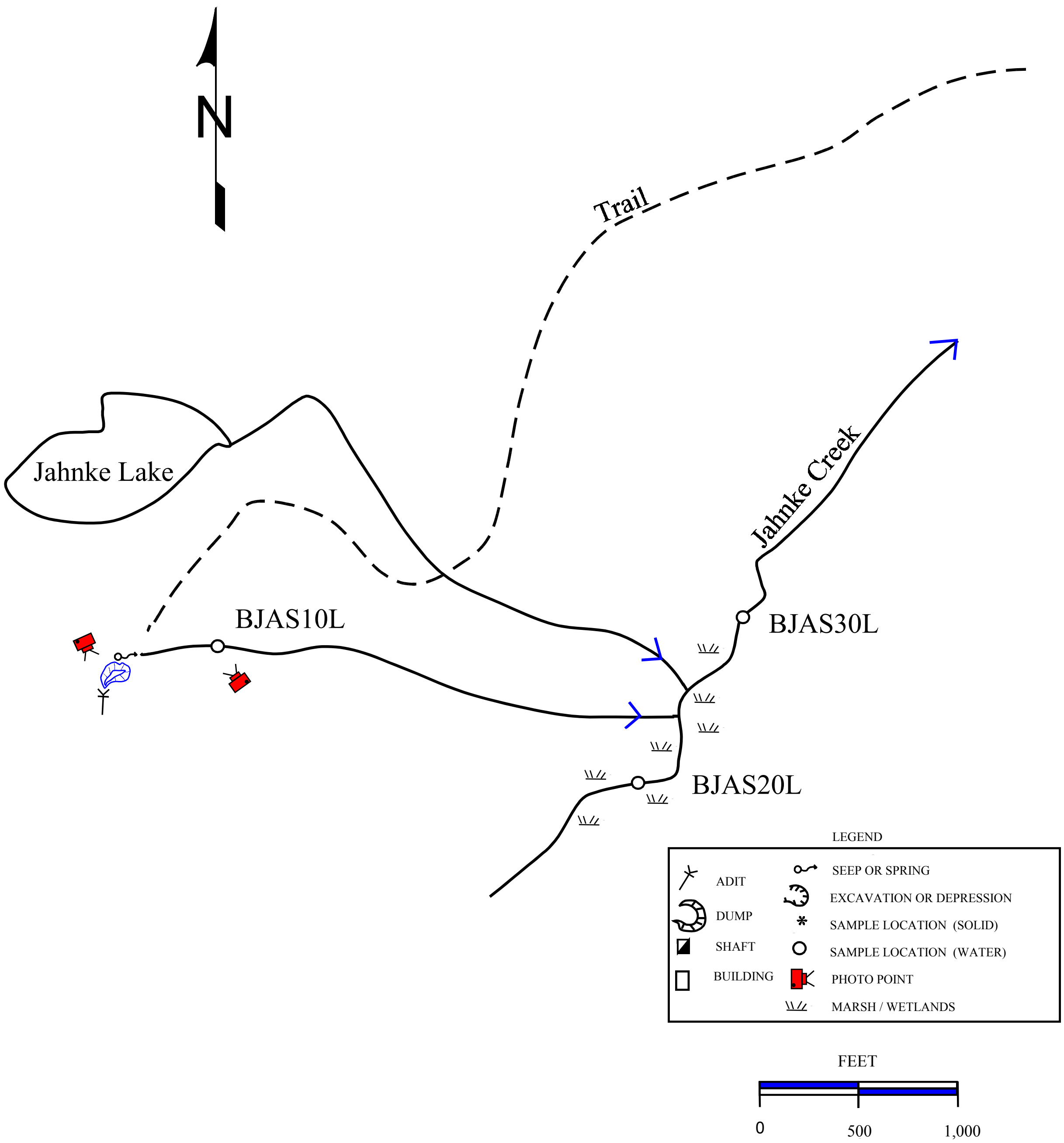

Figure 3.43 Site map of the Jahnke mine, September 1996.

Figure 3.44 The partially collapsed adit at the Jahnke mine has a large, clear discharge.

Figure 3.45 The adit discharge flows onto BNF-administered land a short distance below the mine. Sample BJAS10L was collected at this location.

3.18.3.4 Vegetation

Because the waste-rock dump is composed of coarse rock fragments, vegetation in this area is sparse. Along the path of the adit discharge, vegetation is abundant and healthy. In nearby undisturbed areas, vegetation consists of healthy grasses and conifers.

3.18.3.5 Summary of Environmental Condition

The silver concentration in the adit discharge exceeded the chronic aquatic life standard, but similar concentrations were found in a background sample collected from a tributary to Jahnke Creek. Therefore, silver may naturally occur at elevated concentrations in the vicinity of the mine. No other environmental problems were noted at the site.

3.18.4 Structures

Six cabins are located north of the adit and waste-rock dump. One of the cabins is in good condition. A mine building in poor condition is located on top of the waste-rock dump, close to the adit.

3.18.5 Safety

Although the adit apparently has been closed by blasting, entry still is possible by crawling through a hole between the boulders. The adit is on private land. No hazards were observed on BNF-administered land.

3.19 MARTIN MINE

3.19.1 Site Location and Access

The Martin mine (T3S R13W Sec. 19 BDCC) is located in the Pioneer Mountains near the head of the East Fork of Warm Springs Creek. The site is on BNF-administered land that is currently maintained as an active claim. Access to the site is via a 4.5-mile trail that begins near the head of the West Fork of Warm Springs Creek. A four-wheel-drive vehicle is required to reach the trail head.

3.19.2 Site History - Geologic Features

A 0.5- to 1.5-foot wide, N49˚E, vertical, quartz-pyrite-galena-tetrahedrite vein was mined at the Martin (Geach 1972). A select ore sample contained 0.56 ounces per ton gold, 70.8 ounces per ton silver, 1.33% copper, and 2.39% lead; in 1904, 70 tons of ore yielded 17 ounces of gold, 26,036 ounces of silver, and 3,101 pounds of lead (Geach 1972). Benham (1981) reported up to 0.15% molybdenum.

Workings extend more than 1,000 ft from a caved shaft and a caved adit (Winters *et al.* 1994).

3.19.3 Environmental Condition

At the lower end of the site, two adits discharge a small volume of water into a wetland adjacent to Warm Springs Creek. The waste-rock dumps associated with the adits are within the floodplain of the creek. At the base of one of the dumps, several iron-oxyhydroxide stained seeps are present. The East Fork of Warm Springs Creek is stained with iron-oxyhydroxides downstream of the site.

3.19.3.1 Site Features - Sample Locations

Soil and water-quality samples were collected at the site on September 11, 1996. Water samples BMTS20L and BMTS50L were collected from the two adit discharges (see figure 3.46). The discharge from the north adit had a pH of 6.4 and a flow rate of less than 1 gpm. The discharge from the south adit had a pH of 7.4 and a flow rate of 2 gpm. Sample BMTS30L was collected from one of the iron-stained seeps below the southernmost dump. The seep had a flow rate of 1 gpm and a pH of 5.7. Soil sample (BMTD10M) was collected from the barren slope of the dump where it closely bordered the creek. To evaluate the site's environmental impact on the East Fork of Warm Springs Creek, samples were collected upstream (BMTS10L) and downstream (BMTS40L) of the workings. The flow rate of the creek at the upstream sample location was 18 gpm; at the downstream location, the flow rate was 5 gpm.

Site features and sample locations are shown on figure 3.46; figures 3.47 and 3.48 are photographs of the site.

3.19.3.2 Soil

Soil around the streamside waste-rock dump has concentrations of copper, lead and zinc that are well above phytotoxic levels (table 3.14). Arsenic was found to be slightly above the phytotoxic concentration.

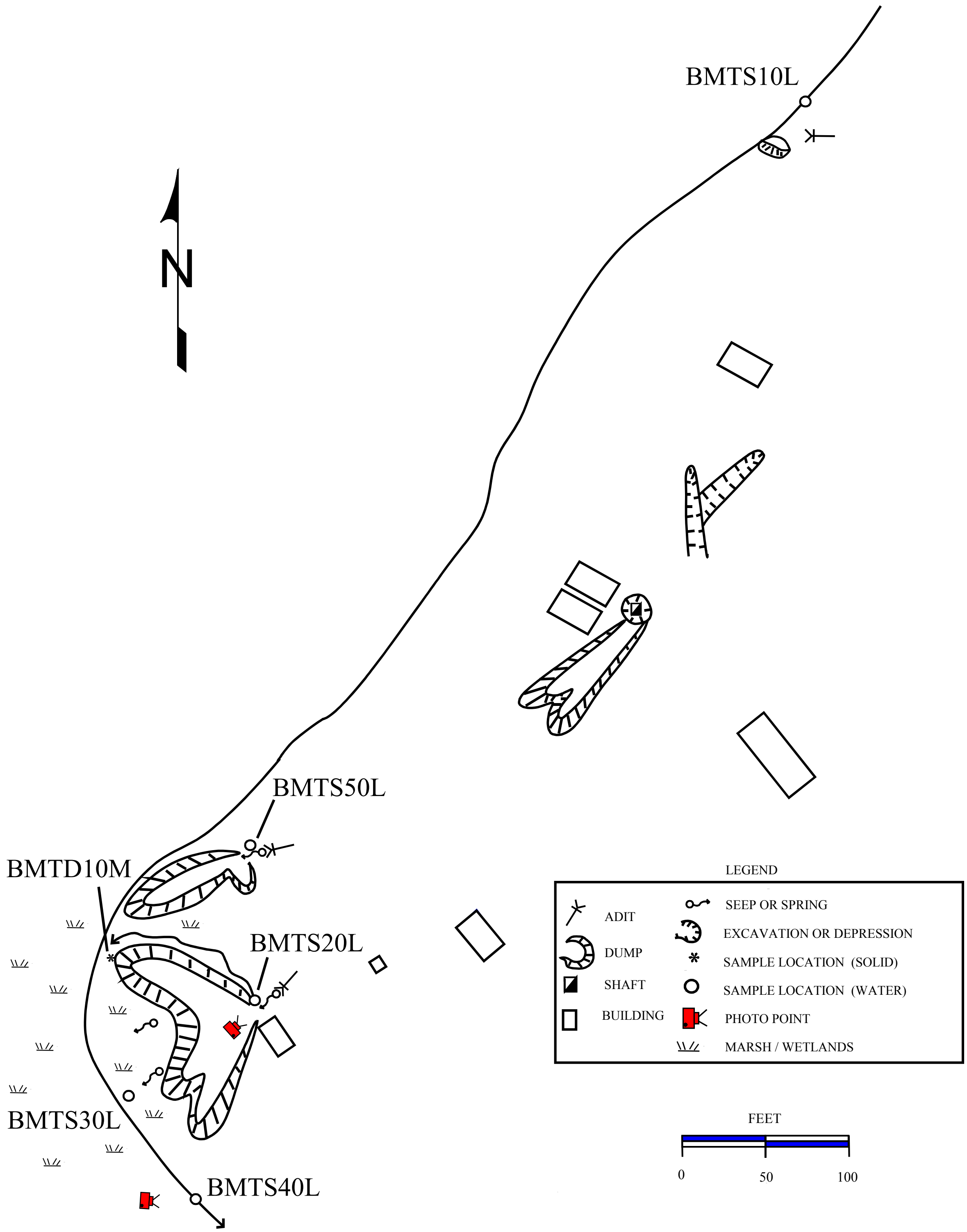

Figure 3.46 Site map of the Martin mine, September 1996.

Figure 3.47 A small discharge flows from the collapsed portal of the main lower adit.

Figure 3.48 An iron-oxyhydroxide precipitate coats the bottom of the East Fork of Warm Springs Creek a short distance downstream of the site.

Table 3.14 Soil sampling results (mg/kg) for the Martin mine.

Sample Location	**As**	**Cd**	**Cu**	**Pb**	**Zn**
Streamside waste-rock dump (BMTD10M)	104[1,2]	30[1]	551[1,2]	12,000[1,2]	1,330[1,2]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3)
(2) Exceeds phytotoxic levels (table 1.3)

3.19.3.3 Water

Both adit discharges at the site had concentrations of manganese that exceeded water-quality standards. In addition, concentrations of copper and lead in the southern adit discharge exceeded chronic aquatic life criteria. The seep at the base of the waste-rock dump had concentrations of iron, lead, and manganese that exceeded standards. Downstream of the site, the concentration of iron in the East Fork of Warm Springs Creek exceeded the secondary MCL. This exceedence is directly attributable to the site. All of the samples collected at the site contained silver at concentrations above aquatic life criteria.

Table 3.15 Water-quality exceedences at the Martin mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
E. Fk. Warm Springs Creek - upstream of site (BMTS10L)												C							S*
North adit discharge (BMTS50L)									S			C							S*
South adit discharge (BMTS20L)						C		C	S			A,C							
Seep at base of waste-rock dump (BMTS30L)							S,A	C	S			C							S*
E. Fk. Warm Springs Creek - downstream of site (BMTS40L)							S					C							

Exceedence codes: P - Primary MCL, S - Secondary MCL, A - Aquatic Life Acute, C - Aquatic Life Chronic
Note: The analytical results are listed in appendix V.
* Laboratory pH was within acceptable secondary MCL range.

3.19.3.4 Vegetation

The dumps associated with the shaft and the two lower adits are barren to sparsely vegetated. The small dump at the upper end of the site is densely vegetated.

3.19.3.5 Summary of Environmental Condition

The discharges and streamside waste at the Martin contain elevated concentrations of several metals, including lead, copper, and zinc. Impact to the East Fork of Warm Springs Creek downstream of the mine is visually evident. Removal of the streamside waste at this site should be a priority because of its erosion and leaching potential.

3.19.4 Structures

Six log buildings and an outhouse are present at the site. Five of the buildings are in bad condition. The sixth building is a well-maintained cabin.

3.19.5 Safety

Around the caved shaft, a 30-foot wide, 10-foot deep depression has developed. The slopes of the depression are steep and unvegetated. These conditions suggest that the ground near the shaft is unstable and that further collapse is possible.

3.20 PARK MINE

3.20.1 Site Location and Access

The Park mine is located on BNF-administered land in T4S R12W Sec. 14 DBCB which is shown on the Elkhorn Hot Springs 7.5-min. quadrangle. The elevation of the site is approximately 8,520 feet. To reach the site, take Forest Road 2406 which turns off the Pioneer Mountains Scenic By-way (Forest Route 484). After traveling 2.1 miles, turn right (southeast) in the NW¼ of section 14, T4S, R12W. The site is easily accessible on an improved dirt road in good weather.

3.20.2 Site History - Geologic Features

The Park mine is included in the Boston and Montana group, associated with the Elkhorn mining district. Loen and Pearson (1989) listed the mine as being associated with the Cretaceous granodiorite (quartz monzonite?) of the Pioneer batholith. Winchell (1914) stated that the Park group's fissure veins strike northeast and dip 75°NW with thickness in the 20- to 30-foot range. Winchell (1914) further stated that the veins are associated with aplite dikes in the quartz monzonite.

One sample taken by the U.S. Bureau of Mines (1995) ran 3.8 opt Ag, 0.67% Cu, 2.7% Pb, and 3.9% Zn; another ran 0.07 opt Au, 4.7 opt Ag, 0.17% Cu, 0.59% Pb, and 0.60% Zn; a third sample ran 1.05 opt Ag; a fourth ran 5.8 opt Ag, and a fifth ran 2.6 opt Ag, all with minor copper, lead, and zinc.

3.20.3 Environmental Condition

Workings at the site consist of two adits and three shafts (figure 3.49). One shaft with timbers over it may be open; another shaft is partially flooded. The upper adit at the site has a small iron-stained discharge that infiltrates the ground a short distance from the portal.

3.20.3.1 Site Features - Sample Locations

The site was sampled on September 12, 1996. A background water-quality sample was collected from a small spring that originates upgradient of the site. A second water sample was collected from the adit discharge, which had a flow rate of 2 gpm. Site features and sample locations are shown on figure 3.49; photographs of the site are presented as figures 3.50 and 3.51.

3.20.3.2 Soil

No soil samples were taken at the Park. The waste dumps are primarily marble, and no effects to the soil were visually discernable.

3.20.3.3 Water

Copper, iron, lead, manganese, mercury, silver, and zinc concentrations in the small adit discharge exceeded one or more water-quality standards (table 3.16). Also, the pH of the discharge (6.4) was outside the acceptable secondary MCL range of 6.5 to 8.5. The water collected from the spring upgradient of the site also had a low pH, but concentrations of dissolved metals did not exceed any standards.

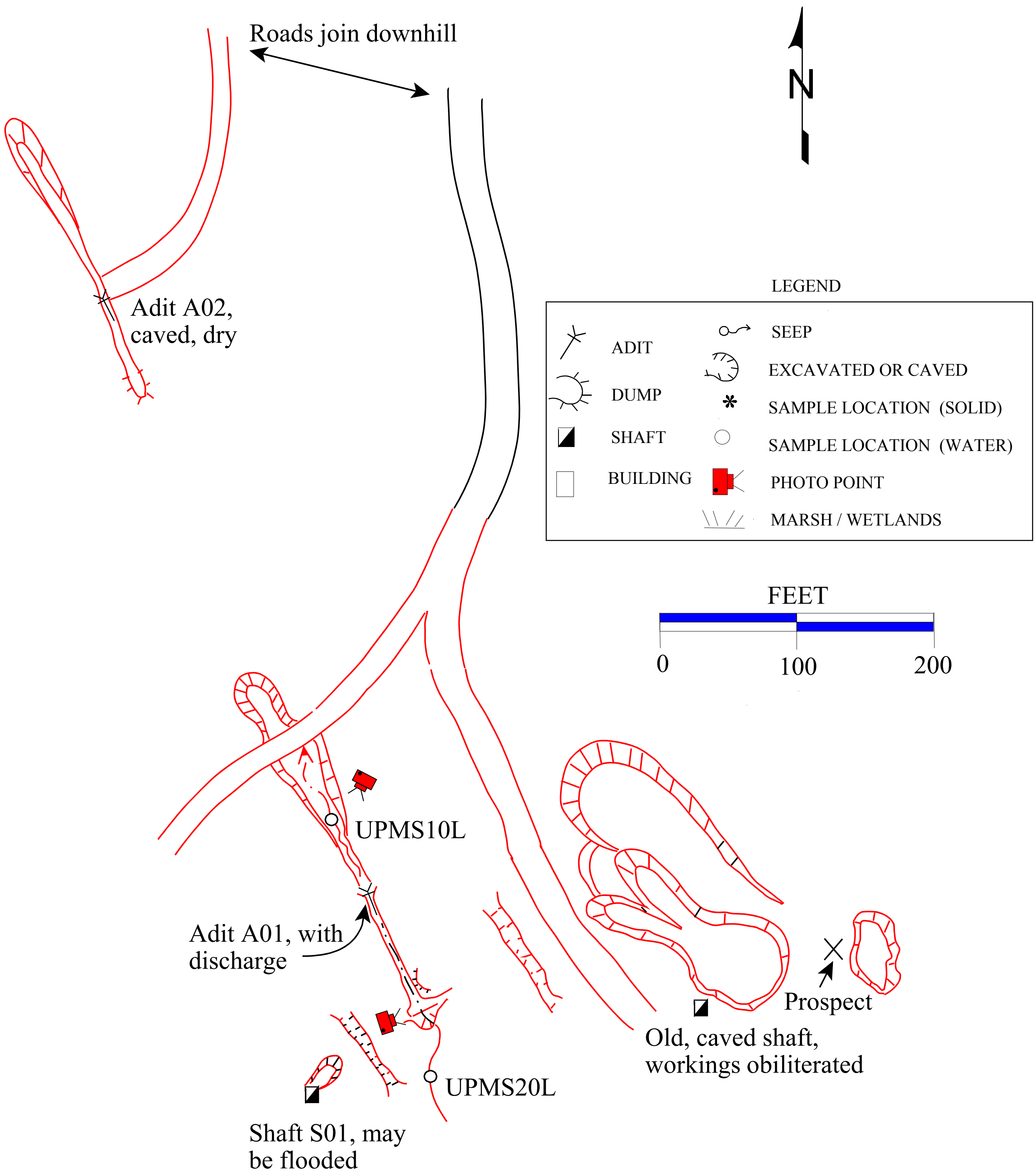

Figure 3.49 The Park mine taken from Geach (1972).

Figure 3.50 A shaft at the Park mine is flooded and has a small discharge at the north end.

Figure 3.51 The small adit discharge was iron stained but flowed at only 2 gpm.

Table 3.16 Water-quality exceedences at the Park mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Spring upgradient of site (UPMS20L)																			S
Adit discharge (UPMS10L)						A,C	S	C	S	C		C	A,C						S

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

Note: The analytical results are listed in appendix V.

3.20.3.4 Vegetation

Vegetation at the mine appeared to be healthy. The vegetation consisted of Douglas fir, with some spruce and pine. There was a large, dry meadow to the south of the site.

3.20.3.5 Summary of Environmental Condition

Although metal concentrations in the adit discharge exceed numerous water-quality standards, the discharge is small and does not flow into a receiving stream. In fact, the drainage in which the mine is located is dry for several miles below the site. Overall, the environmental impact of the site on BNF-administered land is small.

3.20.4 Structures

A two-room cabin in good condition and a one-room log cabin in bad condition remain at the site. Ruins of a structure that cover a shaft also are present.

3.20.5 Safety

Two shafts at the site are considered hazardous: one is open to an unknown depth and the other is partially flooded.

3.21 QUEEN OF THE HILLS MINE

3.21.1 Site Location and Access

The Queen of the Hills mine (T2S R11W Sec. 10 CDCA) is on the southeast flank of Sheep Mountain in the Queens Gulch drainage and can be accessed by a four-wheel-drive road. However, it is best to walk to the site. The site is on BNF-administered land.

3.21.2 Site History - Geologic Features

When the site was visited in 1996, there was evidence that recent development work had been done on the main adit (A-1, figure 3.52). The workings investigate a quartz-iron oxide vein near the contact of granite and phyllite of the Belt Supergroup. Both host rocks contain abundant sericite alteration products. Winchell (1914) reported native silver, argentite, cerussite, galena, pyrite, and chalcopyrite. The vein strikes N42˚E and dips 87˚NW (Geach 1972); it is 4-10 feet wide (Winters *et al.* 1994).

Winters *et al.* (1994) observed six caved shafts and 1,500 feet of underground workings. Production records from 1914 show that 10 ounces of gold, 39 ounces of silver, and 88 pounds of copper were produced from 9 tons of ore. The site is relatively small, covering an area of about one acre.

3.21.3 Environmental Condition

At this site, the collapsed A-1 adit has a discharge that flows at about 5 gpm. The discharge flows into a depression behind the adit's waste-rock dump and infiltrates the ground. At the base of the dump, the water re-emerges as a seep and runs down the hillside a short distance before sinking into the ground again. The adit and dump are approximately 600 feet from Queens Gulch Creek.

3.21.3.1 Site Features - Sample Locations

The site was sampled on August 16, 1996. A sample of the adit discharge (BQHS10M) was collected about 60 feet from the portal. The waste rock was not sampled because erosion did not appear to be a problem. Site features and sample locations are shown on figure 3.52; figures 3.53 and 3.54 are photographs of the site.

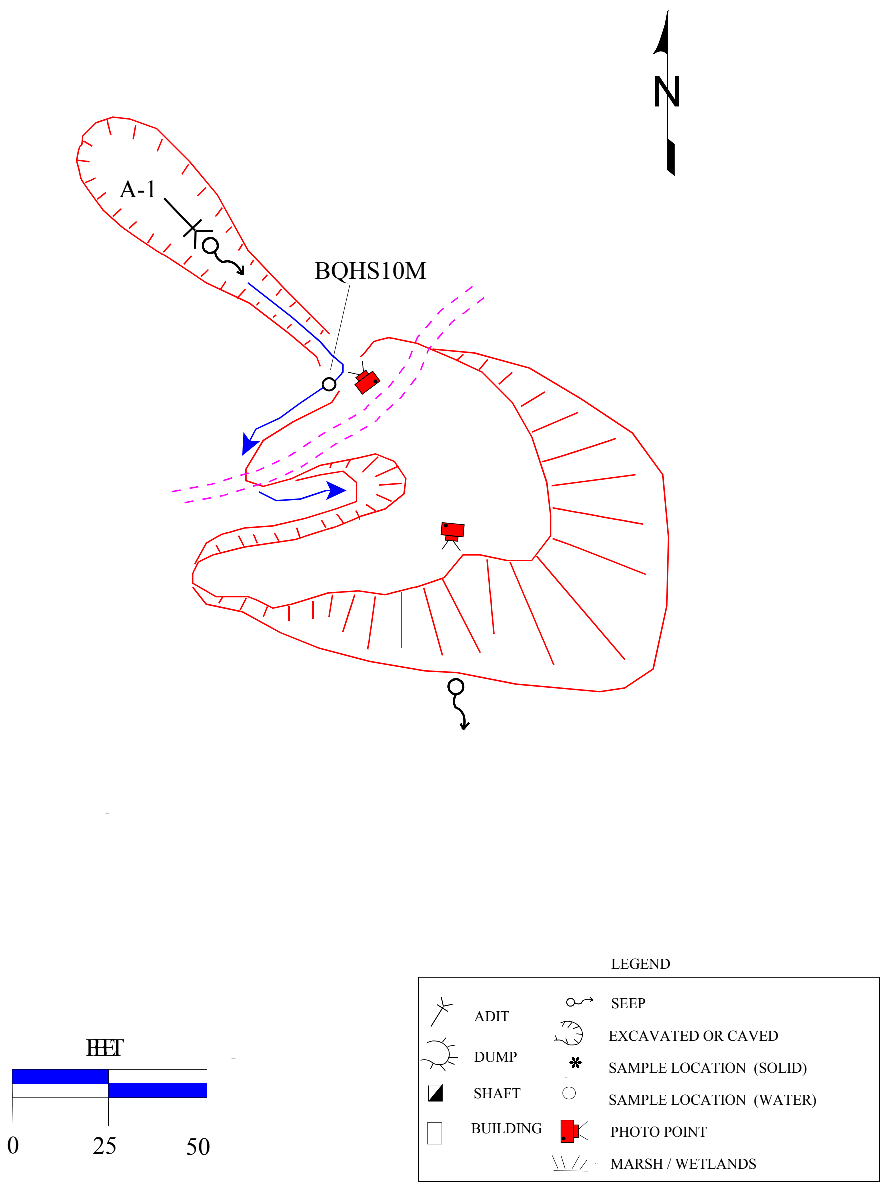

Figure 3.52 Site map of the Queen of the Hill mine, August 1996. The adit discharge sinks into the ground and re-emerges as a seep at the base of the waste-rock dump.

Figure 3.53 A 5-gpm discharge flows from the collapsed adit at the Queen of the Hills mine.

Figure 3.54 After infiltrating the ground behind the waste-rock dump, the water re-emerges as a seep at the base of the dump.

3.21.3.2 Soil

Soil samples were not collected at this site.

3.21.3.3 Water

With the exception of pH, there were no exceedances of water-quality standards for the analytes listed in table 3.17. The field pH of the discharge water was 8.6, which exceeds the secondary MCL by 0.1 standard units. The pH measured in the laboratory was 7.9, within the acceptable MCL range of 6.5 to 8.5.

Table 3.17 Water-quality exceedences at the Queen of the Hills 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 discharge (BQHS10M)																			S*

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic
- * - Laboratory pH was within the acceptable secondary MCL range of 6.5 to 8.5.

Note: The analytical results are listed in appendix V.

3.21.3.4 Vegetation

The waste rock dump is sparsely vegetated with grasses. The surrounding hillside is well vegetated with grasses and evergreens.

3.21.3.5 Summary of Environmental Condition

Water quality at the site appears to be good, and erosion is not a serious problem. Overall, the site has little adverse impact on BNF-administered land.

3.21.4 Structures

There are no structures near the adit; however, there are two cabins nearby that are in poor condition.

3.21.5 Safety

Because the adit has collapsed, it does not pose a safety risk. Debris on site consists of wooden beams and some scrap metal.

3.22 QUEEN OF THE HILLS TAILINGS

3.22.1 Site Location and Access

The Queen of the Hills tailings (T2S R11W Sec. 10 CDDD) are along Queens Gulch Creek, about a quarter mile from the Queen of the Hills mine. Access to the site is via a four-wheel-drive road that parallels Queens Gulch Creek. The site is on BNF-administered land.

3.22.2 Site History - Geologic Features

The 10-stamp Queen of the Hills mill was built in 1901 in the valley below the Queen of the Hills mine. Mineralogy of vein fragments on the Queen of the Hills mine dumps indicates that only oxidized ore was processed here.

3.22.3 Environmental Condition

At the site, pockets of tailings are scattered along the flood plain of Queens Gulch Creek for several hundred yards. Most of the tailings are well-vegetated.

3.22.3.1 Site Features - Sample Locations

The site was sampled on August 16, 1996. Water samples from Queens Gulch were collected upstream (BQTS10M) and downstream (BQTS20H) of the tailings deposits. The flow rate of the creek was about 70 gpm. A composite soil sample of the streamside tailings (BQTD10M) also was collected. Site features and sample locations are shown on figure 3.55; figures 3.56 and 3.57 are photographs of the site.

3.22.3.2 Soil

The results from the analysis of the streamside tailings (BQTS10M) show that arsenic, cadmium, copper, lead, and zinc exceed one or more of the Clark Fork Superfund background levels (table 3.18). Cadmium excluded, these constituents also exceed phytotoxic levels.

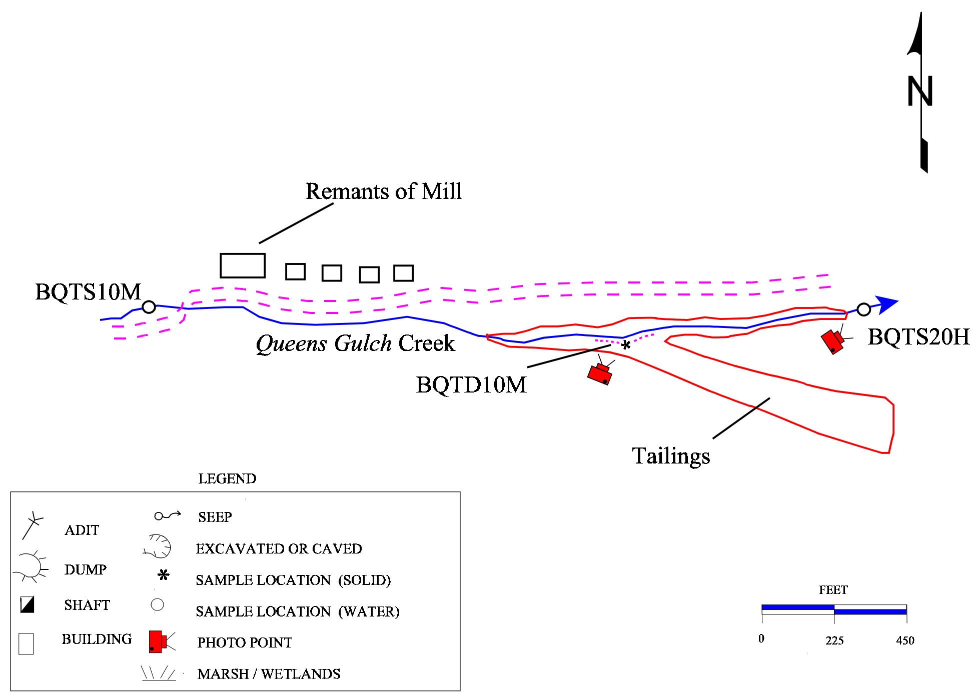

Figure 3.55 Site map of the Queen of the Hills tailings, August 1996.

Figure 3.56 Barren patches of tailings can be seen intermittently along the banks of Queens Gulch Creek.

Figure 3.57 Hydrogeologist Ginette Abdo collected water-quality sample BQTS20H downstream of the tailings deposits.

Table 3.18 Soil sampling results (mg/kg) for the Queen of the Hills mill tailings.

Sample Location	As	Cd	Cu	Pb	Zn
Streamside tailings (BQTD10M)	210[1,2]	14[1]	2,159[1,2]	15,196[1,2]	2,583[1,2]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3)
(2) Exceeds phytotoxic levels (table 1.3)

3.22.3.3 Water

Downstream of the tailings, the concentration of cadmium (3.5 µg/l) was above the chronic aquatic life limit (1.1 µg/l) and field pH (8.6) was slightly above the upper secondary MCL limit of 8.5 (table 3.19). Water quality upstream of the tailings was good; no standards were exceeded.

Table 3.19 Water-quality exceedences at the Queen of the Hills mill tailings.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Queens Gulch Creek - upstream of tailings (BQTS10M)																			
Queens Gulch Creek - downstream of tailings (BQTS20H)				C															S

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

Note: The analytical results are listed in appendix V.

3.22.3.4 Vegetation

Most of the tailings are vegetated with grasses and brush; however, there are intermittent patches where the tailings are barren.

3.22.3.5 Summary of Environmental Condition

The tailings at the site contain elevated concentrations of several metals and arsenic. The water quality of Queens Gulch Creek may be adversely impacted by the tailings as evidenced by the presence of cadmium in the downstream water sample. The site warrants further investigation to characterize the environmental impact of the tailings.

3.22.4 Structures

The remnants of a mill and four cabins are present upstream of the tailings deposits (figure 3.55). The structures are in bad condition, having partially or completely collapsed.

3.22.5 Safety

No significant safety hazards were noted at the site.

3.23 TRAPPER MINE AND MILL

3.23.1 Site Location and Access

The Trapper mine and mill (T3S R11W Sec. 1 CBCA) are reached by following Forest Road 187 west from Melrose, MT, bearing left on Forest Road 188 (the road up Trapper Creek) at Glendale, and turning left (south) on an unmarked road just below Hecla in the southwest corner of section 1. In the summer and fall months, the site is accessible by 2-wheel drive; in bad weather and when snow is present, four-wheel drive is needed. The location of the site is shown on the Mount Tahepia 7.5-min. quadrangle. Parts of the site are on BNF-administered land.

3.23.2 Site History - Geologic Features

Mineralization at the Trapper mine consists of white quartz, siderite/limonite, manganese, and malachite in the Meagher Formation (Karlstrom 1948). The mineralization here is similar to that of the Elm Orlu and many of the other mines in the area. The ore was found beneath a quartzite (Park Formation?), and thinly bedded dolomite that acted as a relatively impermeable cap. The ore bearing fluids deposited minerals in the shattered limestone beneath this cap.

Original workings included several tunnels driven in the hillside along Sappington Creek, and two later adits (still evident but caved). Recent bulldozer work is evident along the road leading up the hill on the northeast side of the claim. The remains of the workings at the Trapper appear irregular in their orientation, and some of the more recent work has partially opened dog holes. Karlstrom (1948) noted several open shafts, but today these workings are caved.

Production as listed in Karlstrom (1948) included (from discovery to 1877): 3,923 tons of ore yielding 286 ounces of gold, 579,680 ounces of silver, 210,000 pounds of copper, and 4,543,000 pounds of lead. The mine was worked again from 1897 to 1899 producing another 400 tons of ore.

3.23.3 Environmental Condition

The area has been extensively mined, and tailings are deposited in the flood plain of Sappington Creek. Obvious erosion channels and steep banks indicate that erosion of the tailings continues, especially during high water. The analyses of the tailings by Pioneer Technical Services (1995) showed that As, Cd, Hg, Ni, Sb, and Zn were all three times greater than background; however, water analyses showed no degradation of water quality downstream of the site.

3.23.3.1 Site Features - Sample Locations

A patented claim on the east side of the site has most of the underground workings. The mill building and tailings are on BNF-administered land . The site was visited and sampled on August 15, 1996. Sappington Creek was sampled upstream (STMS20H) and downstream (STMS10H) of the streamside tailings. Site features and sample locations are shown on figure 3.58; photographs are shown as figures 3.59.and 3.60.

3.23.3.2 Soil

No soil samples were taken by the MBMG. Pioneer Technical Services (1995) found that the tailings contained high concentrations of arsenic, copper, lead, zinc, and several other metals.

3.23.3.3 Water

Water quality upstream and downstream of the site appeared similar. No metal concentrations were found to exceed standards.

3.23.3.4 Vegetation

Healthy willows and grasses grow on the banks of Sappington Creek; none of the vegetation appeared stressed. The tailings are sparsely to moderately vegetated with willows, grasses, and wildflowers. Trees beginning to revegetate the tailings included subalpine fir, spruce, and lodgepole pine.

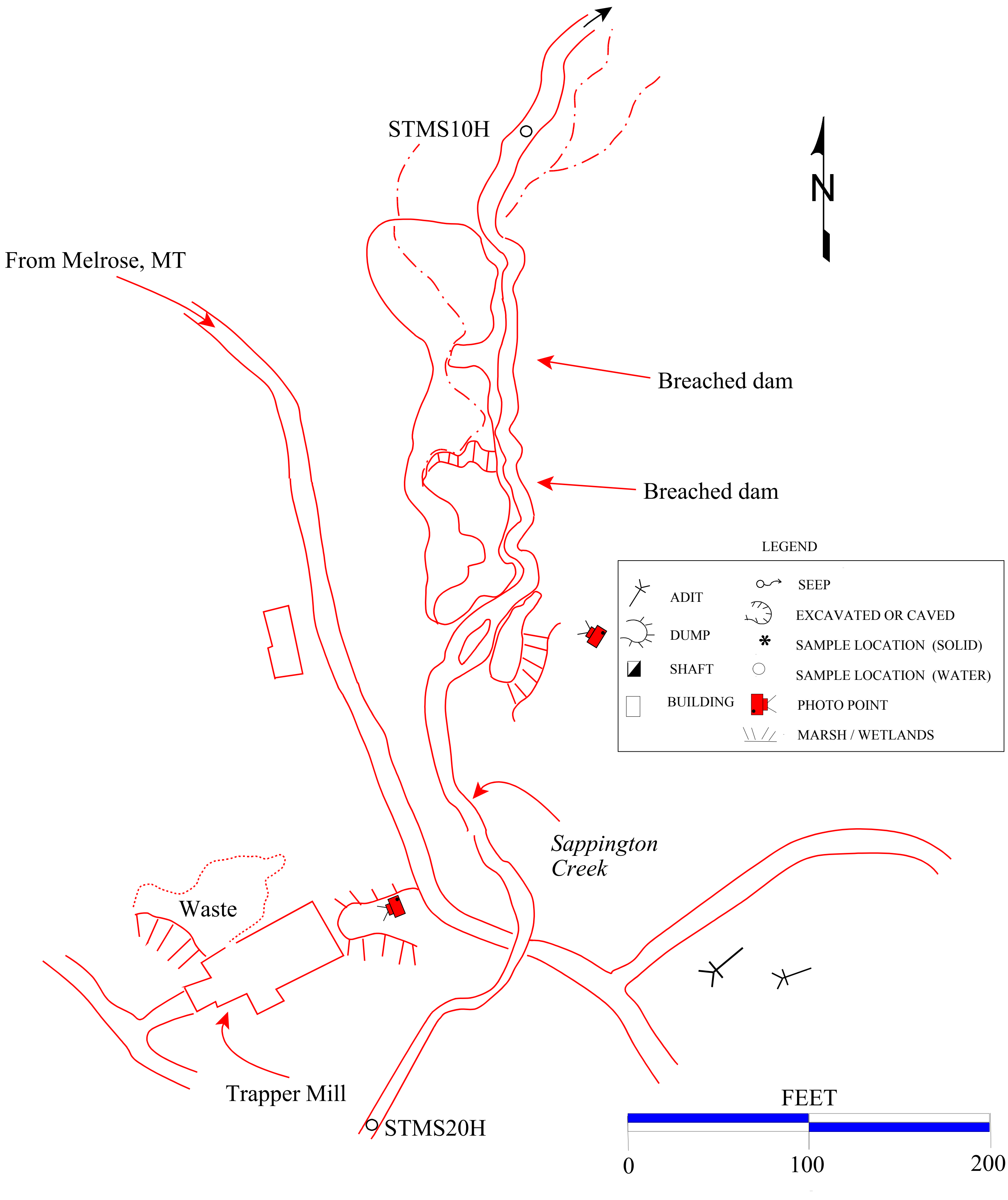

Figure 3.58 The Trapper mill tailings are adjacent to Sappington Creek, as mapped August 14, 1996.

Figure 3.59 The Trapper mill was still partially standing in August 1996. Because the structure is unstable, it poses a safety risk.

Figure 3.60 The tailings downstream of the mill are sparsely to moderately vegetated with willows, fir, and wildflowers.

3.23.3.5 Summary of Environmental Condition

The area was studied in the recent past by Pioneer Technical Services (1995) for the Montana Department of State Lands - Abandoned Mines Reclamation Bureau. Pioneer estimated the volume of tailings to be 1,460 cubic yards; the tailings contained elevated concentrations of arsenic, cadmium, chromium, copper, mercury, manganese, nickel, lead, antimony, and zinc. MBMG and Pioneer found that the water quality of Sappington Creek was not impacted by the tailings under low flow conditions.

3.23.4 Structures

A mill building at the site is in disrepair. The back is still standing, but the front has completely collapsed. Loose boards hang from the top and sides. The site is frequently visited by people exploring the general area. A cabin in good condition stands along the access road. The sides and roof are intact; cows have access to the interior.

3.23.5 Safety

The mill building, which appears to be on BNF-administered land according to the ownership map, is still partially standing and is considered a hazardous structure. The slope by the mill is steep, and the waste pile has loose, steep slopes. Several hazardous mine openings are present nearby. The small cabin adjacent to the road is intact and also might be considered hazardous.

4.0 JEFFERSON-MADISON-RUBY DRAINAGES

For the purpose of this investigation, the Jefferson River, Madison River, and Ruby River drainages have been combined and will be referred to as the JMR drainages. These drainages cover an area of approximately 5,650 mi^2 and contain the eastern portion of the Beaverhead National Forest. The Ruby River drainage is bounded by the Gravelly, Snowcrest, and Ruby ranges and the Tobacco Root Mountains. The Jefferson River drainage is bounded by the Highland and Tobacco Root mountains. The Madison River drainage, which is the easternmost, is bounded by Madison Range to the east and the Gravelly Range and Tobacco Root Mountains on the west.

The headwater of the Ruby River is at the south end of the Snowcrest and Gravelly ranges. The river flows northward, emptying into the Ruby Reservoir and then continuing northwestward to join the Beaverhead River at the town of Twin Bridges. Below Twin Bridges, the Beaverhead River joins the Big Hole to form the Jefferson River. The Jefferson flows northeastward until it reaches the town of Whitehall, where it turns to the east and continues on to join the Madison River at Three Forks. The headwater of the Madison River is in Yellowstone National Park. A short distance west of the park, the Madison empties into Hebgen Lake Reservoir and then Quake Lake. Below Quake Lake, the river follows a broad northward arc, passing through the Ennis Lake reservoir and Bear Trap Canyon Primitive Area before reaching Three Forks. At Three Forks, the Madison, Jefferson, and Gallatin rivers join together to form the Missouri River.

Most of the residents in the JMR drainages derive their livelihoods from ranching, recreation, forestry, or mining. BNF-administered lands in the upland portions of the drainages are managed to accommodate multiple uses, including livestock grazing, recreational activities, and timber harvest. Private lands in the valley bottoms are used primarily for grazing livestock and raising alfalfa and grain. Over 150,000 acres of land in the three basins are irrigated (Shields *et al.* 1996). Towns along the Ruby drainage include Alder and Sheridan; along the Jefferson drainage, towns include Silver Star, Whitehall, and Three Forks; and along the Madison drainage, the population centers are West Yellowstone and Ennis.

4.1 GEOLOGY

The only significant metal mining within the JMR drainage area occurred in the southern and eastern portions of the Tobacco Root Range, mostly in the Sheridan and Pony mining districts; therefore, only the geology of those areas is discussed here. Reconnaissance geologic maps of the area were produced by Tansley *et al.* (1933) and Reid (1957); Burger (1967), O'Neill (1983), and Vitaliano and Cordua (1979) mapped portions of the area in more detail. The entire area is underlain by Archean amphibolite-grade metamorphic rocks that are deformed into north-trending folds, cut by high-angle, recurrently-active, northwest-striking faults, and intruded by the late Cretaceous Tobacco Root batholith and its related stocks.

4.2 ECONOMIC GEOLOGY

Winchell (1914), Tansley *et al.* (1933), Lorain (1937), Burger (1967), Cather and Linne (1983), O'Neill *et al.* (1983), and Winters *et al.* (1994) all studied the economic geology of portions of the Sheridan and Pony districts. Winters *et al.* (1994) studied the mineral potential of the Beaverhead National Forest and summarized information available for individual mines. Mines of the area exploited mostly thin veins of quartz and gold-bearing pyrite, with minor galena, chalcopyrite, calcite, and siderite, hosted by metamorphic rocks and by the Tobacco Root batholith.

In the Sheridan district, Tansley *et al.* (1933) noted that productive veins have either east-west or north-northeast strikes that are consistent with regional joint trends (Burger 1967). Most deposits are aligned along north-northeast fracture zones which cut rocks of Archean and late Cretaceous ages, indicating a probable Cretaceous age for mineralization. Some of these fracture zones and accompanying mineralization extend for over two miles, but little displacement is evident.

In the Pony district, Archean amphibolite-grade metamorphic rocks are cut by northwest-striking high-angle faults that were active in Proterozoic time. Laramide compression reactivated some of these faults to form reverse left-lateral oblique-slip displacements in Precambrian and Paleozoic rocks (Schmidt and Garihan 1986). These recurrently active, northwest-trending fault systems played a large role in controlling the position of the dioritic to granitic, late Cretaceous Tobacco Root batholith and its satellite plutons, which in turn localized mineralization.

Everyone who has sampled veins in the Tobacco Roots has been impressed with the unusually high gold assay values. Winters *et al.* (1994) felt that the high values combined with the existence of a custom mill in Virginia City will someday stimulate exploration and small mine development.

4.3 HYDROLOGY AND HYDROGEOLOGY

In the JMR drainages, average annual precipitation ranges from 10 inches in the valleys to 50 inches in the mountain areas (SCS 1977). Three Forks, which is 4,075 ft above sea level, receives an average of 12 inches of precipitation annually (NOAA 1991).

Average monthly flow hydrographs for Ruby River above the Ruby Reservoir (figure 4.1) and the Madison River near West Yellowstone (figure 4.2) show that spring runoff usually begins in April and peaks during May and June. The Jefferson basin’s mean discharge is about 2,000 cfs, equivalent to about 1.4 million acre-ft per year (Shields *et al.* 1996). This figure includes discharge contributed by the Big Hole, Beaverhead, and Ruby drainages. The mean discharge of the Madison basin is about 1,700 cfs, or 1.2 million acre-ft per year.

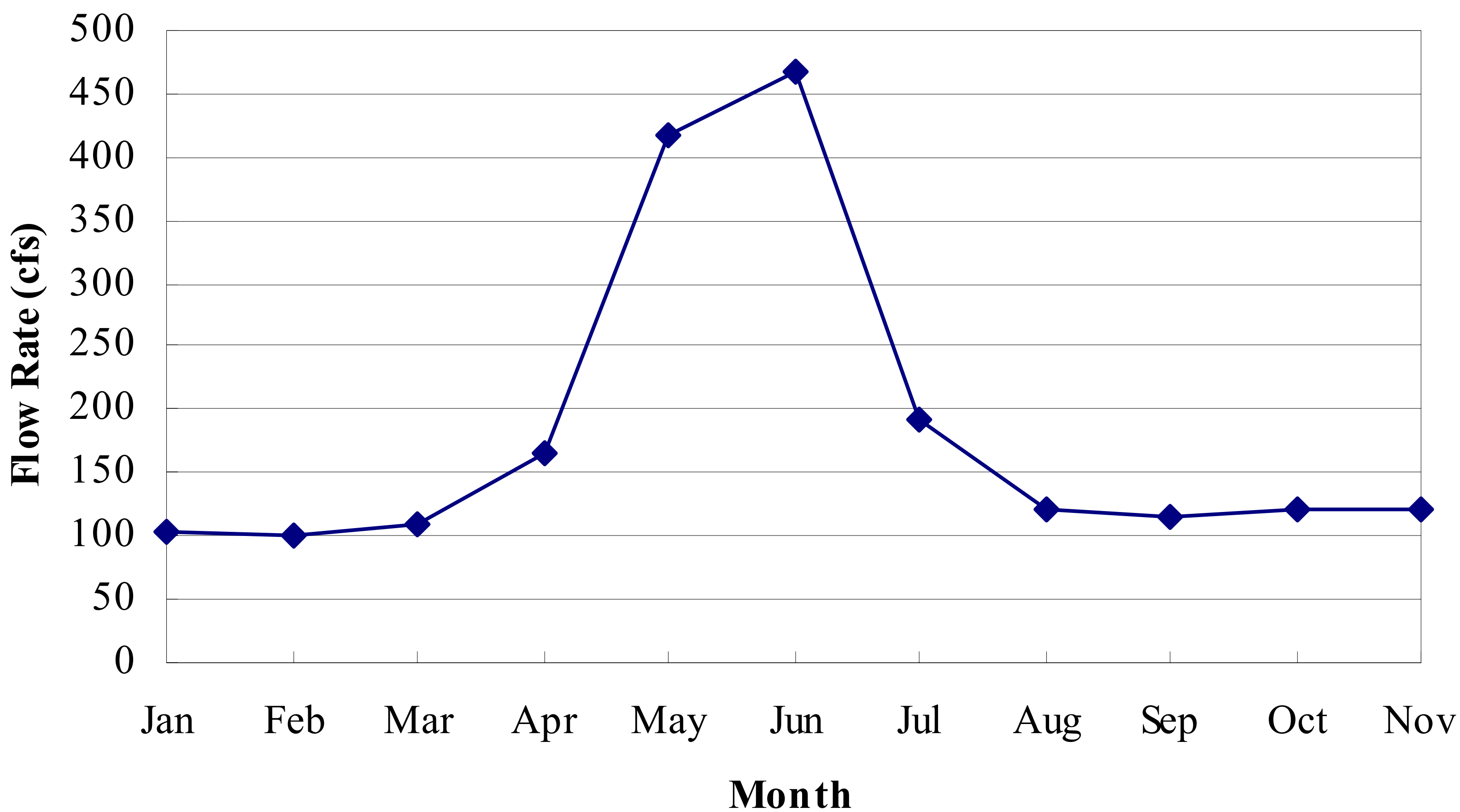

Figure 4.1 Average monthly flow, Ruby River above the Ruby Reservoir. (U.S. Geological Survey Station No. 06019500). Period of record: 1938 to 1995. Data source: Shields *et al.* (1996).

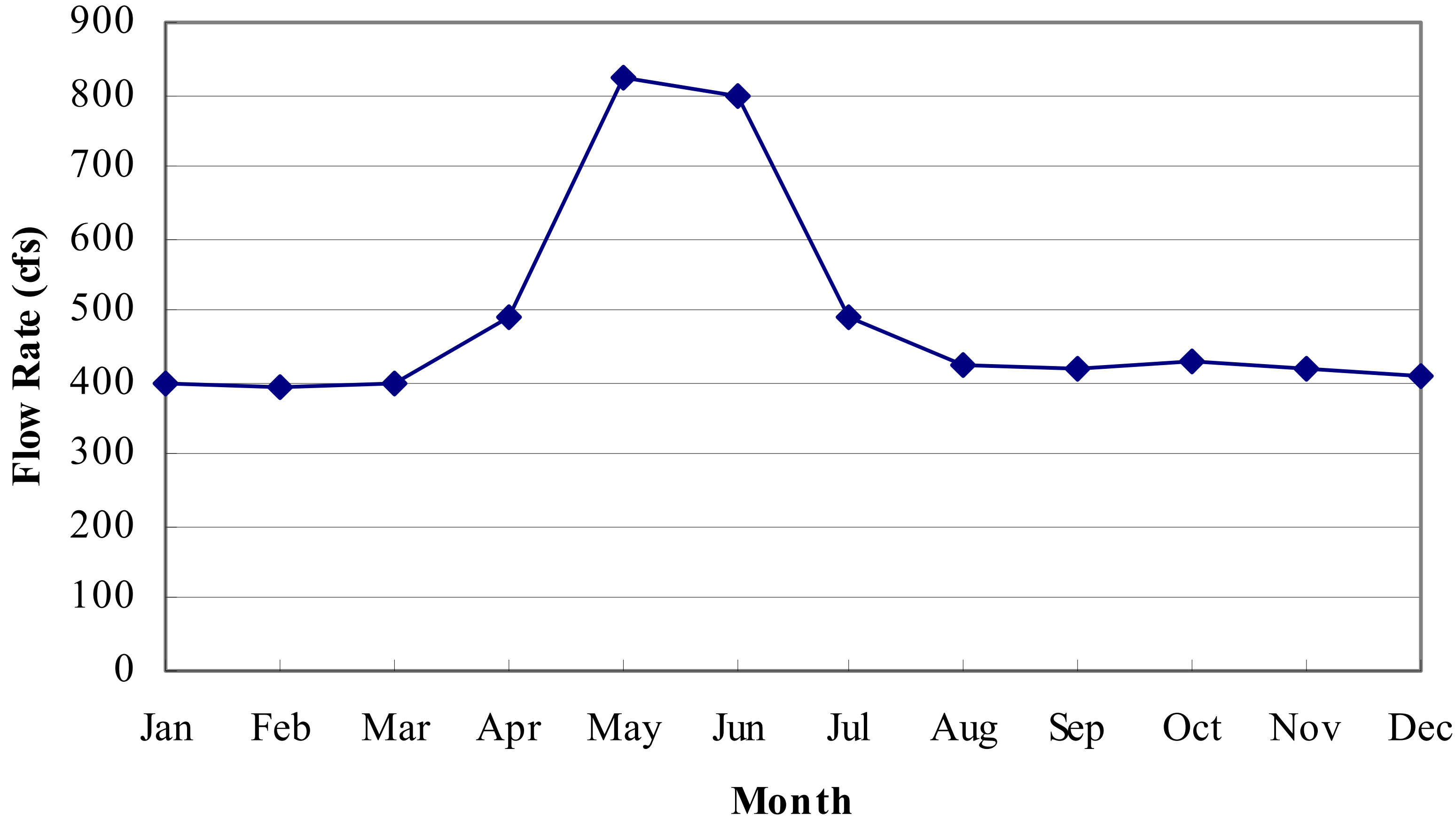

Figure 4.2 Average monthly flow, Madison River near West Yellowstone, Montana (U.S. Geological Survey Station No. 06037500). Period of record: 1913 to 1995. Data source: Shields *et al.* (1996).

Tertiary and Quaternary alluvial and glacial deposits are the most important hydrogeologic units in the basins and provide the most reliable supplies of ground water. The Tertiary materials are exposed mostly along the flanks of the mountains and consist primarily of sandstone and sandy siltstone. Quaternary deposits include glacial tills, glacial outwash, alluvial fans, and alluvium that occur mainly in the mountain valleys and along the central Ruby, Jefferson, and Madison basins. Paleozoic sedimentary rocks, Tertiary and Cretaceous igneous and metamorphic rocks, and Proterozoic and Archean metamorphic rocks that are exposed in the mountains also yield ground water, especially where they have been extensively fractured or faulted. Ground water is used extensively for irrigation and for rural and municipal water-supply throughout the region.

4.4 SUMMARY OF THE JEFFERSON-MADISON-RUBY DRAINAGES

Within the JMR drainages, 118 mine and mill sites are on or near the Beaverhead National Forest (figure 4.3 and table 4.1). Of these sites, 19 were found to have a potentially adverse effect on soil or water quality on BNF-administered land. These sites are listed in **bold** in table 4.1 and are discussed in alphabetical order in the following sections. Of the 19 sites, 13 have one or more discharges from workings or waste material, and 10 have potential erosion problems.

If mine openings or other dangerous features (unstable structures, highwalls, steep waste-rock dumps) were observed, the site has a bold-type **Y** under the hazard heading in table 4.1. In general, only those sites at which samples were collected were evaluated in detail. Of the 118 sites inventoried in the JMR drainages, 19 were identified that have safety problems.

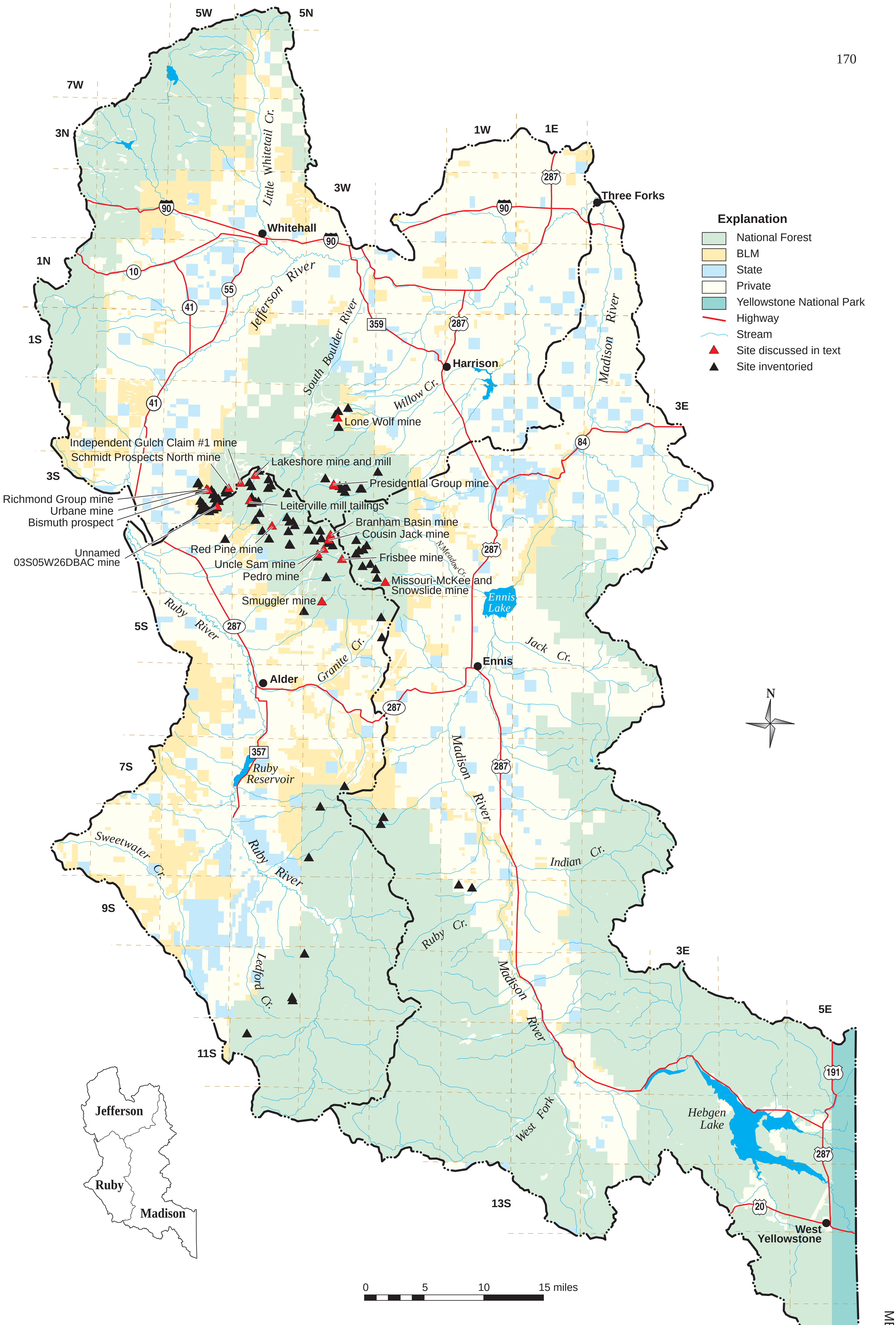

Figure 4.3. Abandoned / inactive mines inventoried in the Madison, Ruby, and Jefferson River drainage.

Table 4.1 Summary of sites inventoried in the Jefferson-Madison-Ruby drainages. Site name in **bold type** indicates potential environmental problems. Bold type **Y** in hazard column indicates a safety concern was noted at the site.

Name / ID[1]	**Owner**[2]	**Visit**	**Sample**[3]	**Hazard**[4]	**Remarks**
Argenta Adit 1 MA006884	PRV	Y	N	N	No impact. Collapsed adits.
Bedford MA003285	NF	N	N	NE	Screened out.
Belle MA003135	NF	Y	N	**Y**	Hazardous mine opening(s).
Ben Harrison Fraction/Never Sweat[5] MA003785	MIX	Y	N	**Y**	Hazardous mine opening(s).
Beulrh/Beulah MA003793	PRV	Y	N	N	Adit discharge, but no impact on BNF-administered land.
Big Chief MA004152	UNK	N	N	NE	Unable to locate using information from MILS.
Big Tom MA007100	UNK	N	N	NE	Unable to locate using information from MILS.
Bins MA007250	MIX	N	N	NE	Screened out.
Bismark-Nugget Adits MA006809	NF	Y	N	N	No impact.
Bismuth Prospect MA006785	NF	Y	Y	N	Streamside waste-rock dump. See section 4.16.
Branham Basin MA003748	NF	Y	Y	N	Adit discharge.
Buffalo Creek Placer MA003780	UNK	N	N	NE	Screened out. Placer.
Bullidick Prospect MA006803	NF	Y	N	**Y**	Hazardous highwall.
Bungalow MA008083	NF	Y	N	NE	No impact.
Calvert Claims MA000247	NF	N	N	NE	Screened out.
Carolina MA006836	PRV	Y	N	N	No impact.
Clark's Warm Springs/Potosi MA004512	PRV	N	N	NE	Screened out. Private hot springs.
Cop Prospect MA006857	NF	Y	N	N	No impact.
Copper Mountain Southeast MA008337	NF	Y	N	N	No visible impact.
Corncracker MA006842	NF	Y	N	**Y**	Open adit and partially caved adit.

Table 4.1 Summary of sites inventoried in the Jefferson-Madison-Ruby drainages (continued).

Name / ID[1]	Owner[2]	Visit	Sample[3]	Hazard[4]	Remarks
Cornelia MA003070	UNK	N	N	NE	Unable to locate using information from MILS.
Cousin Jack MA003145	NF	Y	Y	**Y**	Open adit with discharge.
Crown Point Claims MA004087	PRV	Y	N	N	No impact.
Crystal Lake MA006890	PRV	Y	N	N	No impact.
Daizy No. 1/Daisy No. 1 MA003575	UNK	N	N	NE	Unable to locate using information from MILS.
Democrat MA003305	NF	Y	N	N	Intact adit but boarded up. Diesel fuel and gasoline stored in drums.
Demos Group MA004092	PRV	Y	N	NE	Adit discharge but unlikely to impact BNF-administered land.
Dry Georgia Gulch MA003540	PRV	N	N	NE	Screened out. Viewed from a distance.
Dulea MA004137	NF	Y	N	N	No impact.
Elenora MA006833	PRV	Y	N	**Y**	Open adits.
Elkhorn MA008071	PRV	N	N	NE	Screened out.
Ella MA006863	NF	Y	N	**Y**	Open adits.
Empire State MA006821	NF	Y	N	N	No visible impact.
Frisbee MA003140	NF	Y	Y	**Y**	Mine waste in contact with alpine lake. Extremely hazardous flooded shafts, one adjacent to RV trail.
Garrison MA005560	NF	N	N	NE	Screened out.
Goodrich Gulch Gulpher Placer MA003535	PRV	N	N	NE	Screened out. Placer.
Gray Eagle MA003100	PRV	Y	N	N	No impact. Dry.
Grigg Group/Grigg Molybdenum MA004187	NF	Y	N	N	No impact.
High Ridge (Area) MA007226	MIX	Y	N	N	No impact.
Hogback Mountain Phosphate MA005592	MIX	N	N	NE	Screened out. Phosphate occurrence.

Table 4.1 Summary of sites inventoried in the Jefferson-Madison-Ruby drainages (continued).

Name / ID[1]	Owner[2]	Visit	Sample[3]	Hazard[4]	Remarks
Independence Gulch Claim No. 1 MA008040	NF	Y	Y	**Y**	Partially open adit with discharge. Waste-rock dump in wetland.
Johnny Gulch MA000379	PRV	N	N	NE	Screened out. Active talc mine in 1994.
Jonquil/Tonquil MA003090	PRV	Y	N	N	No impact.
Keystone Claim MA004102	PRV	N	N	NE	Screened out. Private.
Kidd MA005608	NF	Y	N	NE	No impact.
Krueger North Adit MA006770	STA	N	N	NE	Screened out. State land.
Lakeshore Mine and Mill[5] MA006905	PRV	Y	Y	**Y**	Adit discharges and waste and tailings on the shore of Crystal Lake. Open adits and hazardous building debris.
Leggat (Fake Uncle Sam) MA008362	PRV	Y	N	N	No visible impact.
Leiter MA003075	MIX	Y	N	N	No impact.
Leiter Mill Tailings[5]/ Leiterville Tailings MA008245	MIX	Y	Y	**Y**	Streamside tailings. Hazardous mill structure on private land.
Little Goldie MA003315	PRV	N	N	NE	Screened out. Private land.
Lone Star Prospect MA006866	NF	Y	N	N	No impact.
Lone Wolf MA003790	NF	Y	Y	N	Adit discharge.
Lottie MA006839	NF	Y	N	**Y**	Three open adits.
Lucky Silver MA007142	STA	N	N	NE	Screened out. State land.
Mainstreet MA006854	PRV	Y	N	N	No impact.
Manganese Occurrence MA000979	MIX	N	N	NE	Screened out. Manganese occurrence.
Missouri-McKee/Snowslide Mine and Mill[5] MA007166	MIX	Y	Y	**Y**	Streamside tailings. Hazardous mine opening(s).
Monitor MA000529	UNK	N	N	NE	Unable to locate using information from MILS.

Table 4.1 Summary of sites inventoried in the Jefferson-Madison-Ruby drainages (continued).

Name / ID[1]	**Owner**[2]	**Visit**	**Sample**[3]	**Hazard**[4]	**Remarks**
Montana MA003065	PRV	Y	N	N	No impact.
Monte Crisco/Monte Christo MA004097	MIX	N	N	NE	Unable to locate using information from MILS.
Mount Jackson MA008264	MIX	Y	N	N	No impact.
Mountain Meadow MA003788	NF	Y	N	N	No impact. Small prospect.
Mountain Rose Claim MA004067	PRV	N	N	NE	Screened out.
Nettie MA003320	UNK	N	N	NE	Unable to locate using location information from MILS.
New Deal[5] MA003695	NF	Y	N	N	No impact.
New York Prospect MA006791	NF	Y	N	N	No impact.
Noble Lower Adit MA003595	PRV	Y	N	N	No impact.
Occidental South MA003128	NF	N	N	NE	Observed from a distance. Small prospects only.
Oxidental/Occidental[5] MA007055	MIX	Y	N	**Y**	Discharges and mill site, but no affect on BNF-administered land. Hazards present.
Pedro (Pot Rustler) MA002993	NF	Y	Y	**Y**	Open adit with discharge.
Pedro Middle MA002998	NF	Y	Y	N	Adit discharge. See section 4.13.
Pony MA008070	MIX	Y	N	N	No impact.
Presidential-Demos Group MA004032	MIX	Y	Y	N	Small adit discharge.
Ranger MA005768	UNK	N	N	NE	Unable to locate using information from MILS.
Red Bell MA006818	NF	Y	N	N	No impact.
Red Pine[5] **MA004467**	NF	Y	Y	**Y**	Adit discharge. Hazardous structure and mine opening.
Richmond Group MA007187	NF	Y	Y	N	Streamside waste-rock dumps. No hazards on BNF-administered land.
Schmidt Prospect MA006815	PRV	Y	Y	N	Streamside waste-rock dump.
Section 13 Mill Site[5] MA008085	MIX	N	N	NE	Screened out.

Table 4.1 Summary of sites inventoried in the Jefferson-Madison-Ruby drainages (continued).

Name / ID[1]	Owner[2]	Visit	Sample[3]	Hazard[4]	Remarks
Section 14 Mill Site[5] MA008086	NF	Y	N	NE	No impact.
Sheridan MA003095	PRV	Y	N	N	No impact.
Sliderock Mountain MA000607	UNK	N	N	NE	Screened out. Mica occurrence.
Sliderock Mountain Phosphate MA003468	MIX	N	N	NE	Screened out. Phosphate occurrence.
Smuggler[5] MA007031	NF	Y	Y	N	Streamside tailings.
Snowstorm MA008365	MIX	Y	N	NE	No impact.
Spuhler Gulch Occurrence MA005464	NF	Y	N	N	Dry, reclaimed site.
Stasnos MA004072	PRV	N	N	NE	Screened out.
Sunbeam MA003942	MIX	N	N	NE	Screened out. Ridgetop.
Sunbeam Extension MA003173	PRV	N	N	NE	Screened out. Ridgetop.
Sunflower 1 MA006848	PRV	Y	N	N	No impact.
Sunlight MA005692	UNK	N	N	NE	Unable to locate using information from MILS.
Sunnyside[5] MA003168	PRV	Y	N	NE	Dry tailings.
Sunrise MA008278	NF	Y	N	N	No impact.
Texas Lode MA003867	UNK	N	N	NE	Unable to locate using information from MILS.
Topeka MA003310	MIX	Y	N	N	No impact.
Uncle Sam MA003493	NF	Y	Y	**Y**	Two adit discharges and mine waste in contact with stream. One open adit.
Unknown Prospects MA008084	NF	N	N	NE	Scattered prospects. No impact.
Unnamed 03S05W26DBAC MA008039	NF	Y	Y	N	Small adit discharge.
Unnamed Adit-Section 12 MA008363	NF	N	N	NE	Screened out.
Unnamed MA002983	UNK	N	N	NE	Screened out. Ridgetop location.
Unnamed MA002988	UNK	N	N	NE	Screened out. Ridgetop location.

Table 4.1 Summary of sites inventoried in the Jefferson-Madison-Ruby drainages (continued).

Name / ID[1]	**Owner**[2]	**Visit**	**Sample**[3]	**Hazard**[4]	**Remarks**
Unnamed MA003143	UNK	N	N	NE	Unable to locate using information from MILS.
Unnamed MA003148	MIX	Y	N	N	No impact.
Unnamed Sec 19 MA008265	MIX	Y	N	N	No impact.
Unnamed Sec 24 MA008266	NF	Y	N	N	No impact.
Unnamed Section 30 MA008364	MIX	N	N	NE	Screened out.
Upper Leiter MA008267	NF	Y	N	N	No impact.
Urbane **MA006812**	NF	Y	Y	**Y**	Streamside waste-rock dump and open adit. See section 4.16.
Washington Creek MA003872	MIX	Y	N	N	No impact.
West Bungalow MA008268	NF	Y	N	N	No impact.
White Angel Quarry MA003573	NF	Y	N	**Y**	Hazardous highwalls.
White Swan Property MA004142	PRV	Y	N	N	Dry, small prospect.
Wigwam North Fork Placer MA003775	UNK	N	N	NE	Screened out. Placer.
William Fly MA004077	NF	Y	N	N	No impact.
Willow Creek MA003073	UNK	N	N	NE	Screened out.
Wisconsin Creek Placer MA003525	PRV	N	N	NE	Screened out. Placer.
Yellowstone MA004482	PRV	N	N	NE	Active talc mine downstream of federal land.

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 visited).
2) Administration/Ownership Designation
   NF: BNF-administered land
   PRV: Private
   MIX: Mixed (BNF-administered land and private)
   UNK: Owner unknown
3) Solid and/or water samples (including leach samples)
4) Y: Physical and/or chemical safety hazards exist at the site.
   NE: Physical and chemical safety hazards were not evaluated.
5) Mill site present

4.5 BRANHAM BASIN

4.5.1 Site Location and Access

The site is about a half mile from the main road that parallels Mill Creek and is accessed by foot because the road is closed to motorized vehicles. The mine is located on the lower southwest flank of Lady of the Lake Peak (T4S R3W Sec. 4 CDCA) and is on BNF-administered land.

4.5.2 Site History - Geologic Features

Workings trend N30°W in tonalite of the Tobacco Root batholith. A few hundred feet of workings are probably present. According to Lorain (1937), 15 tons of ore yielded $1,700 worth of metals.

4.5.3 Environmental Condition

This site has two discharges, one from a lower adit and the other from an upper adit, designated A-1 and A-2, respectively, on figure 4.4. The two discharges merge and then flow over some waste rock into a marsh/wetland area. The mine discharge combined with ground water from the marsh/wetland eventually flows into an unnamed tributary to Mill Creek.

4.5.3.1 Site Features - Sample Locations

The site was visited and sampled on August 23, 1996 and September 20, 1996. A water-quality sample (JBBS10L) was collected downstream of where the lower and upper adit discharges merge. The combined discharge at this location was flowing at about 5 gpm. A second sample (JBBS02L) was collected downstream of the site just above where the wetland discharges into the unnamed tributary to Mill Creek. The discharge at this location was flowing at about 10 gpm.

Finally, a soil sample (JBBD01L) was collected where the waste rock is in contact with the adit-discharge stream.

Site features and sample locations are shown on figure 4.4; figures 4.5 and 4.6 are photographs of the site.

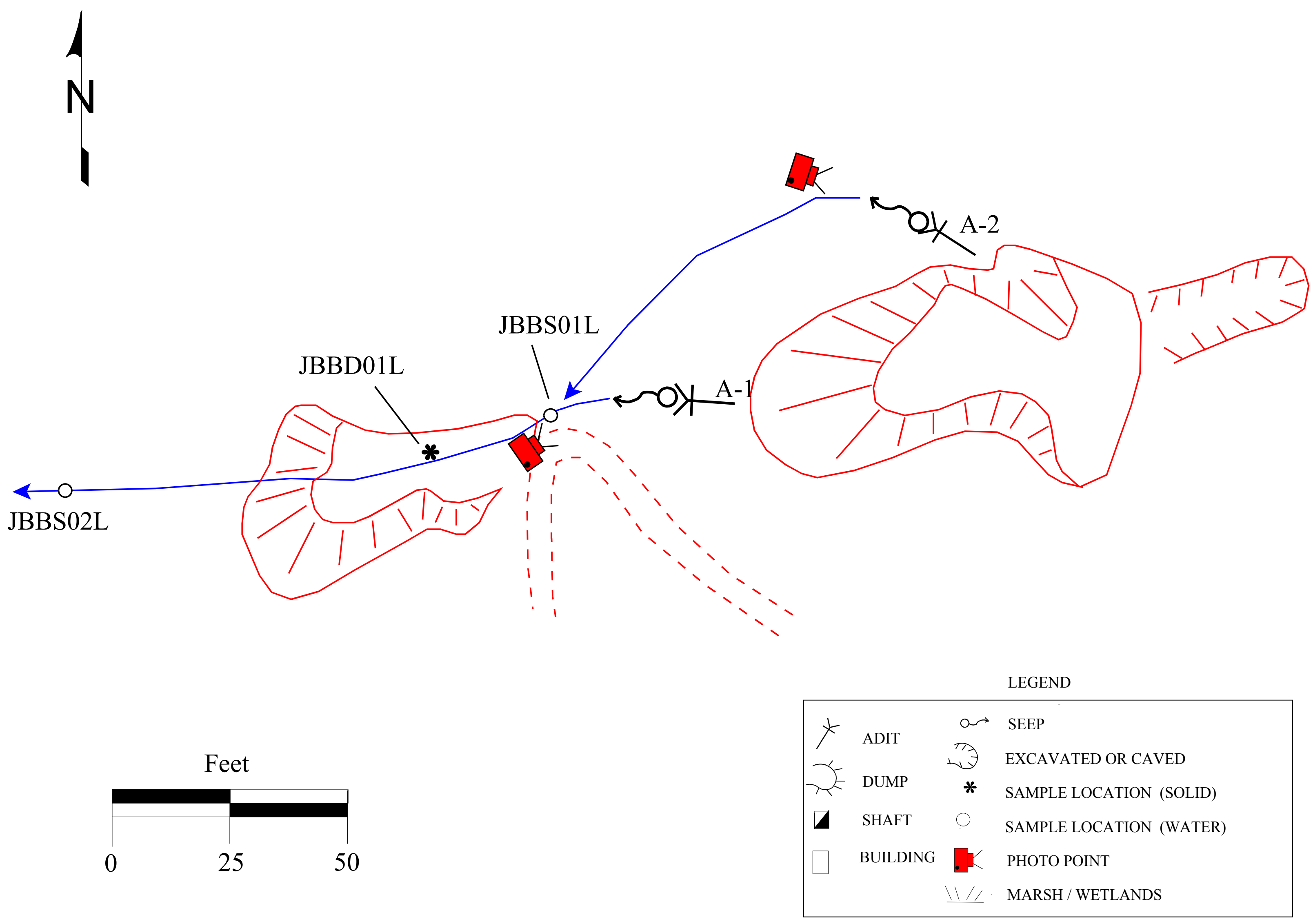

Figure 4.4 Site map of the Branham Basin mine, September 1996. The adit discharges join and flow into a marshy area.

Figure 4.5 A small discharge flows from the portal of the collapsed upper adit.

Figure 4.6 The discharge from the lower adit eventually joins the discharge from upper adit. The combined flow rate of the discharges is about 5 gpm.

4.5.3.2 Soil

The soil sample results are shown in table 4.2. Arsenic and copper concentrations exceed Clark Fork Superfund background and phytotoxic levels. Cadmium, lead, and zinc exceed one or more of the Clark Fork Superfund background levels.

Table 4.2 Soil sampling results (mg/kg) for the Branham Basin mine.

Sample Location	As	Cd	Cu	Pb	Zn
Waste-rock in contact with mine discharge (JBBD01L)	109[1,2]	0.52[1]	192[1,2]	106[1]	67[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3)
(2) Exceeds phytotoxic levels (table 1.3)

4.5.3.3 Water

The metal concentrations in both the adit discharge (JBBS01L) and downstream sample (JBBS02L) met all applicable standards (table 4.3). The field pH (8.8) of the downstream sample exceeded the secondary MCL for drinking water by 0.3 standard units. However, the pH measured in the laboratory (7.2) was within the acceptable secondary MCL.range of 6.5-8.5.

Table 4.3 Water-quality exceedences at the Branham Basin 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 discharge (JBBS01L)																			
Wetland discharge downstream of site (JBBS02L)																			S*

Exceedence codes:

P - Primary MCL
S - Secondary MCL
A - Aquatic Life Acute
C - Aquatic Life Chronic
* Laboratory pH was within acceptable secondary MCL range of 6.5-8.5

Note: The analytical results are listed in appendix V

4.5.3.4 Vegetation

The waste-rock dumps associated with the adits are moderately vegetated.

4.5.3.5 Summary of Environmental Condition

Although metal concentrations in the waste-rock material are elevated, the mine discharge in contact with this material is not adversely impacted. Furthermore, the discharge from the site does not appear to adversely impact the surface-water drainage below the site.

4.5.4 Structures

There are no structures on this site.

4.5.5 Safety

No hazardous wastes were observed at the site. The only potential safety concern is the steep walls near the adits where footing is loose.

4.6 COUSIN JACK MINE

4.6.1 Site Location and Access

The Cousin Jack mine is located along a secondary road that is a quarter mile east of the main road that follows Mill Creek. The secondary road is about 1.3 miles east of the Balanced Rock Campground. The site is located near an unnamed tributary to Mill Creek (T4S R3W Sec. 9 BCAA). It is only accessible by foot since the Forest Service has closed the road to motorized vehicles. The site is on BNF-administered land.

4.6.2 Site History - Geologic Features

Poor exposure prevented any geologic assessment. The deposit is hosted by fine grained gray-green biotite- and feldspar-rich rock that is probably related to the Tobacco Root batholith. Workings consist of an open adit about 200 feet long and an open cut. U.S. Bureau of Mines records show that a small tonnage of high-grade gold ore was mined in the 1930's.

4.6.3 Environmental Condition

The adit at the site (A-1, figure 4.7) has a small discharge that seeps into the ground about 75 feet from the mouth of the adit. The adit is about 300 feet from a tributary to Mill Creek.

The adit discharge flows over the site's waste-rock dump, but there is no significant erosion problem.

4.6.3.1 Site Features - Sample Locations

The site was visited and sampled on August 21, 1996 and September 10, 1996. A water-quality sample (JCJS10L) was collected from the adit discharge about 40 feet from the adit portal. The discharge was flowing at about 2 gpm. Site features and the sample location are shown on figure 4.7; figure 4.8 is a photograph of the site.

4.6.3.2 Soil

No soil samples were collected at this site.

4.6.3.3 Water

The water quality of the adit discharge was good; no standards were exceeded.

4.6.3.4 Vegetation

The waste rock dumps are sparsely vegetated.

4.6.3.5 Summary of Environmental Condition

The adit discharge and waste-rock dumps do not appear to adversely impact BNF-administered land.

4.6.4 Structures

A storage structure (B-1) at the site houses mine machinery. The structure consists of two walls and a roof.

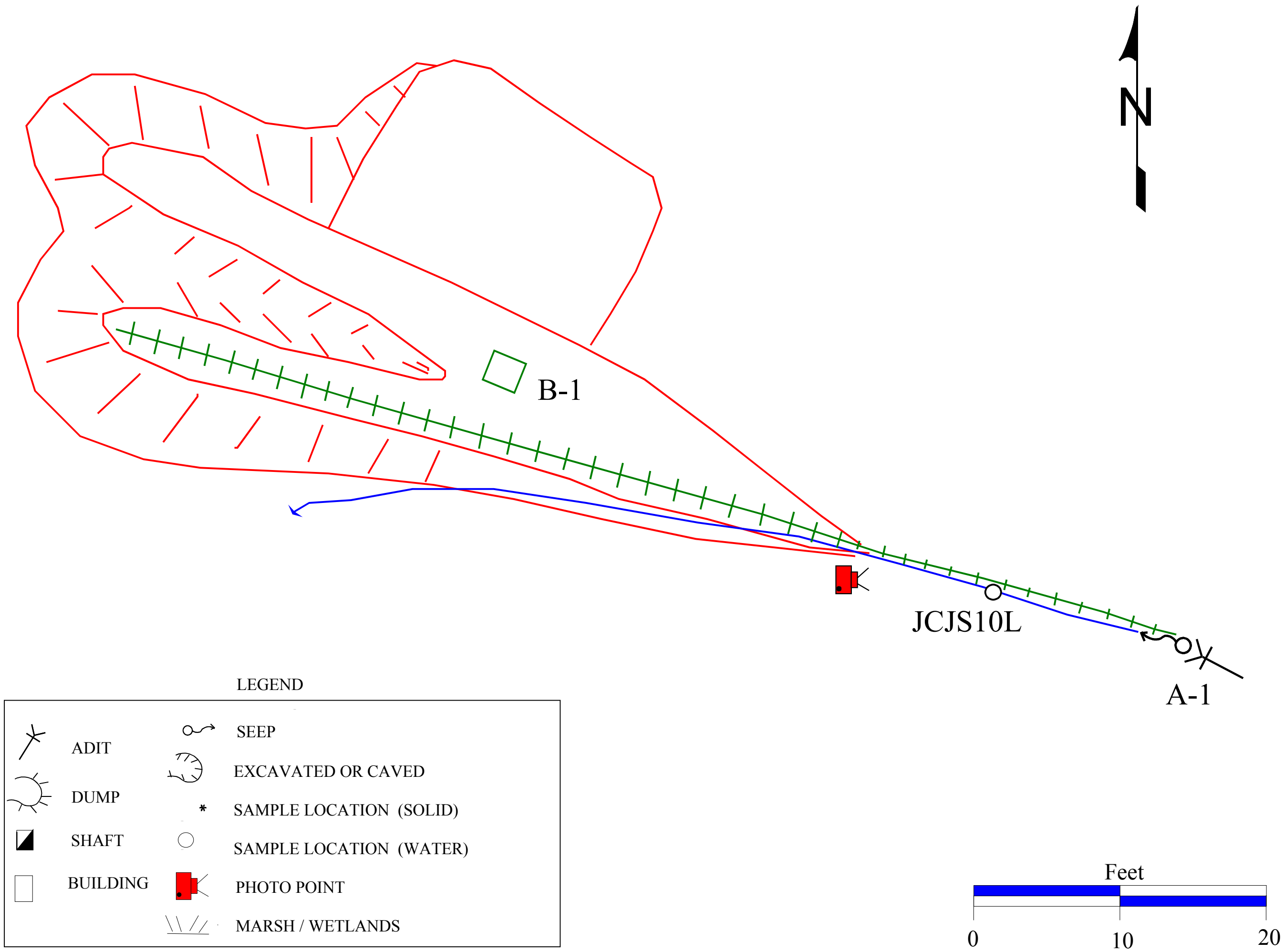

Figure 4.7 Site map of the Cousin Jack mine, September 1996. The discharge sinks into the ground about 50 feet from the adit.

Figure 4.8 A small discharge from the adit at the Cousin Jack mine flows over some waste rock before sinking into the ground.

4.6.5 Safety

Although the adit has a gate, access to the inside is possible and presents a safety hazard. A 25-gallon barrel is present on site. Its contents are unknown, and it is in good condition.

4.7 FRISBEE MINE

4.7.1 Site Location and Access

The site is on BNF-administered land adjacent to Alpine Lake (T4S R3W Sec. 11 DCAC) in the Tobacco Root Mountains. Alpine Lake is also known as Mine Lake, depending on the revision date of the topographic map. The site can be accessed by four-wheel-drive vehicle on a road that parallels North Meadow Creek. However, the road is in poor condition, and it is probably safer to walk to the site.

4.7.2 Site History - Geologic Features

The Frisbee (Frisbie) mine, in the Washington mining district, has no record of production in the literature. The mine was developed on a N10°W series of fissure veins (up to 30 feet wide) which dip steeply west (Tansley *et al.* 1933). Original workings included only shallow shafts and a 700 ft tunnel (Tansley *et al.* 1933). The same author described the workings as straddling a gneiss/gabbro contact with the workings to the north in gneiss and the workings to the south in gabbro. The ore minerals included galena, sphalerite, bornite, and pyrite. Lorain (1937) made brief mention of the Frisbee mine but did not give any details.

4.7.3 Environmental Condition

The site has two partially collapsed, flooded shafts (S-1 and S-2, figure 4.9) and a pit. Shaft S-1 and the pit are located on the south shore of a small unnamed lake south of Alpine Lake; shaft S-2 is located on the narrow bedrock ridge between the two lakes. At the time of the site visit, standing water was noted at 10 to 15 feet below ground in shaft S-1 and about 6 feet below ground in shaft S-2. No water was present in the partially collapsed pit.

Waste rock from shaft S-1 and the pit is in contact with the unnamed lake. Waste rock generated from shaft S-2 is in contact with both lakes.

4.7.3.1 Site Features - Sample Locations

The site was sampled on September 9, 1996. Water samples were collected from shaft S-2 (MFRS20M) and the unnamed lake (MFRS10L). Although water was noted in shaft S-1, a sample was not collected because of the hazards associated with sampling. A composite soil sample was collected near shaft S-2 where waste rock was in contact with the unnamed lake. Site features and sample locations are shown on figure 4.9; figures 4.10 and 4.11 are photographs of the site.

4.7.3.2 Soil

Soil sampling results are presented in table 4.4. The concentration of copper exceeded phytotoxic levels. The concentrations of all the listed analytes were greater than Clark Fork Superfund background levels.

Table 4.4 Soil sampling results (mg/kg) for the Frisbee mine.

Sample Location	As	Cd	Cu	Pb	Zn
Waste rock on shore of unnamed lake (MFRD10M)	82[1]	1.2[1]	177[1,2]	474[1]	113[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3)
(2) Exceeds phytotoxic levels (table 1.3)

4.7.3.3 Water

The primary MCL for lead and the secondary MCL for aluminum and manganese were exceeded in the sample from shaft S-2 (table 4.5). The pH of the water in the shaft was 4.8, below the acceptable secondary MCL range. Aluminum, cadmium, copper, lead, and zinc exceeded chronic aquatic life criteria. Copper and zinc also exceeded the acute aquatic life criteria.

The lake water did not have any water-quality exceedences.

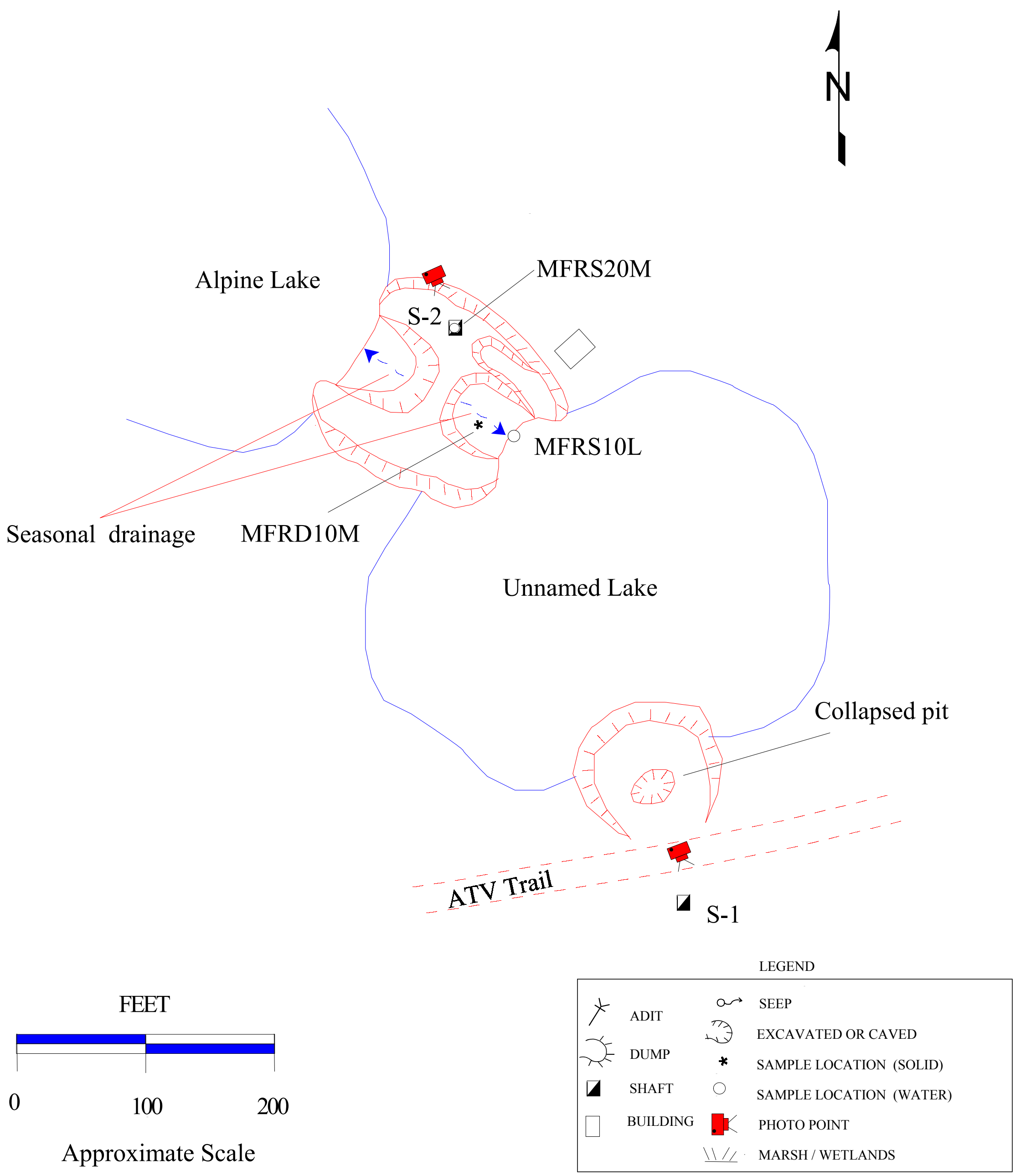

Figure 4.9 Site map of the Frisbee mine showing waste rock in contact with the lakes and the location of shafts, September 1996.

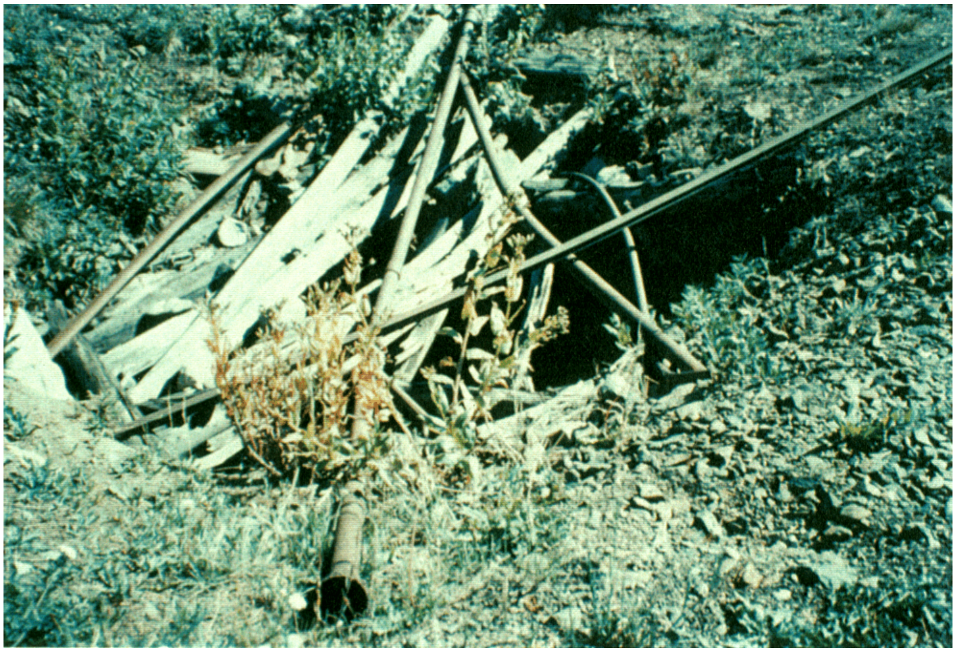

Figure 4.10 The poorly marked S-1 shaft is a safety concern because it is located next to a heavily used ATV trail.

Figure 4.11 Soil sample MFRD10M was collected from the waste rock along the shore of the unnamed lake south of shaft S-2.

Table 4.5 Water-quality exceedences at the Frisbee 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 S-2 - standing water (MFRS20M)	S,C			C		A,C		P,C	S				A,C						S
Unnamed lake (MFRS10L)																			

Exceedence codes:

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

Note: The analytical results are listed in Appendix V

4.7.3.4 Vegetation

The mine waste is devoid of vegetation. The surrounding areas are vegetated with evergreens, grasses, and alpine plants.

4.7.3.5 Summary of Environmental Condition

The water quality in shaft S-2 is probably indicative of ground-water quality in the immediate area of the mine workings. It is likely that the shaft and the nearby lakes are hydraulically connected; therefore, the lakes may be receiving some AMD. Because the lakes are so large, dilution probably masks any impacts from the contaminated ground water.

The waste rock on the shore of the unnamed lake has a high copper concentration, but again, any impact to the lake is probably masked by dilution.

4.7.4 Structures

Near shaft S-2, there is an old log cabin in bad condition.

4.7.5 Safety

Both shafts (S-1 and S-2) present safety risks since they are partially open. Shaft S-1 is particularly dangerous because it is next to a heavily traveled ATV trail. A fence with warning signs should be placed around this opening.

4.8 INDEPENDENCE GULCH CLAIM NO. 1

4.8.1 Site Location and Access

The Independence Gulch Claim No. 1 (T3S R4W Sec. 18 DBBC) is on BNF-administered land at the head of Independence Gulch. The gulch is a tributary to Wisconsin Creek. Access to the site is via a one-mile foot trail that leads up the Independence Gulch drainage from Wisconsin Creek.

4.8.2 Site History - Geologic Features

Workings at the site consist of several adits and waste-rock dumps. Host rock is Precambrian granitic gneiss. The dumps are iron-stained and contain some pyrite and a little sphalerite. A claim marker found at the site was inscribed with the following information: Independence Gulch Claim No. 1, D. Hoffman and D. Pearson, 9-19-76.

4.8.3 Environmental Condition

A small, clear discharge flows from the lowermost adit. The water flows around the northwest side of the associated waste-rock dump and into a marshy area adjacent to a small cirque lake. The dump extends into the marsh and may therefore be a source of leachable metals.

4.8.3.1 Site Features - Sample Locations

The site was sampled on August 27, 1996. Water-quality sample RINS10L was collected from the adit discharge. The flow rate of the discharge was 2.5 gpm. Sample RINS20L was collected from Independence Gulch at the outlet of the cirque lake. The flow rate of the stream was 12.4 gpm. Soil sample RIND10L was collected around the edge of the waste-rock dump that was in contact with the marsh. Site features and sample locations are shown on figure 4.12; figures 4.13 and 4.14 are photographs of the site.

4.8.3.2 Soil

The concentration of copper in the soil around the mine’s waste-rock dump exceeds the phytotoxic level (table 4.6). This waste material is in contact with water flowing from a nearby spring and the marsh adjacent to the cirque lake. Therefore, there is some potential for metals to leach from the waste and impact water quality.

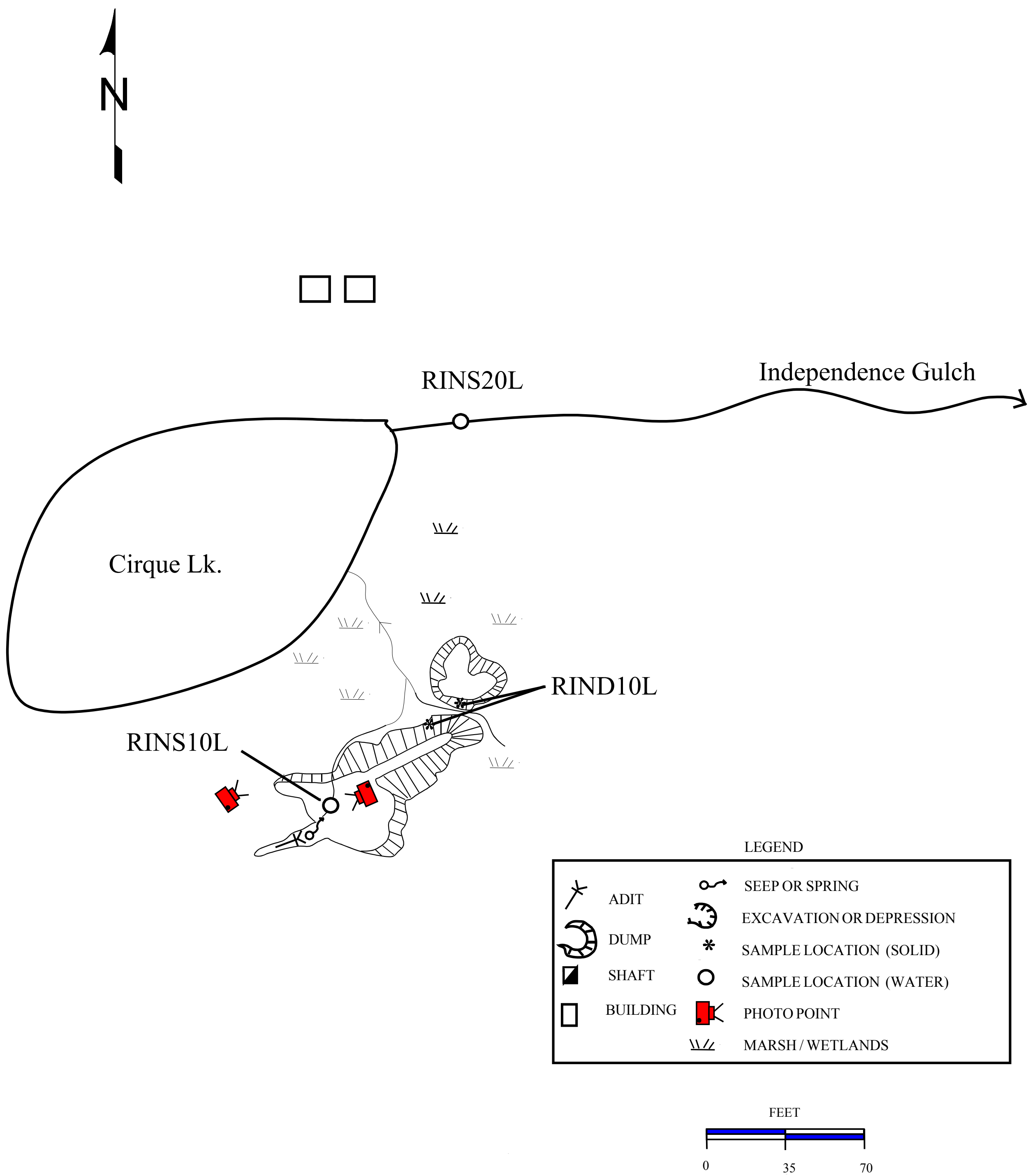

Figure 4.12 At the Independence Gulch Claim No. 1, an adit discharge flows into a marsh adjacent to a small cirque lake (8/27/96).

Figure 4.13 Sample RINS10L was collected from the adit discharge.

Figure 4.14 A waste-rock dump extends into a marsh adjacent to a small cirque lake.

Table 4.6 Soil sampling results (mg/kg) for the Independence Gulch Claim No. 1.

Sample Location	**As**	**Cd**	**Cu**	**Pb**	**Zn**
Waste rock in marsh (RIND10L)	38.0[1]	2.5[1]	164[1,2]	41.0[1]	308[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3)
(2) Exceeds phytotoxic levels (table 1.3)

4.8.3.3 Water

The concentration of mercury in the adit discharge was 0.11 µg/l, ten time greater than the chronic aquatic life standard of 0.012 µg/l (table 4.7). No other standards were exceeded.

Table 4.7 Water-quality exceedences at the Independence Gulch Claim No. 1.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Adit discharge (RINS10L)										C									
Independence Gulch - below cirque lake (RINS20L)																			

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

Note: The analytical results are listed in Appendix V

4.8.3.4 Vegetation

Most of the waste-rock dump is moderately vegetated with grasses and brush. Vegetation in the marsh adjacent to the dump appears healthy.

4.8.3.5 Summary of Environmental Conditions

Metals from the small waste-rock dump and adit discharge only appear to impact soil and water in the immediate vicinity of the site. The wetlands surrounding the cirque lake probably have the capacity to handle the small metal load. No environmental problems were observed along Independence Gulch downstream of the mine.

4.8.4 Structures

Two dilapidated cabins are located on the north side of the cirque lake.

4.8.5 Safety

On the slope above the collapsed adit portal, there is an opening through which the workings can be accessed. Also, the cabins at the site could be hazardous because of their poor condition.

4.9 LAKESHORE MINE AND MILL

4.9.1 Site Location and Access

The Lakeshore mine and mill (T3S R4W Sec. 8 DDCC) are on patented land at the north end of Crystal Lake. The 5-acre lake is at the head of Wisconsin Creek, a tributary to the Ruby River drainage. The site is accessed by following a Forest Service road north of Sheridan. Just beyond Spuhler Gulch, the road becomes nearly impassable. It is easiest to hike the last 2 miles to the site. A gate has been installed about three-quarters of a mile from the site to protect the wildlife habitat in the area.

4.9.2 Site History - Geologic Features

At the Lakeshore site, a vein with a N25˚E 80˚NW attitude was mined (Winchell 1914). The vein contained quartz, pyrite, and minor arsenopyrite and chalcopyrite. Siderite and dolomite are abundant in vein fragments present on the dump. The dump material also indicates that amphibolite, quartzofeldspathic gneiss, meta-diabase, and marble surround the vein. Loen and Pearson (1989) believed that the deposit is associated with a Cretaceous diorite intrusion. Select samples from the site had up to 49.5 oz/ton gold, 0.03 oz/ton silver, 0.02% copper, 3.5% lead, and 4.6% zinc (Winters *et al.* 1994).

Workings at the site include two adits and a large dump on the shore of Crystal Lake. The size of the dump suggests that more than a mile of workings are present. The remnants of a cyanide mill are located next to the dump.

The mine and mill have apparently been idle since 1929. Production between 1910 and 1929 was 2,426 ounces of gold, 7,288 ounces of silver, and 7,154 pounds of copper from 4,317 tons of ore (Lorain 1937).

4.9.3 Environmental Condition

A large volume of tailings and waste rock are located on the northeast shore of Crystal Lake (figure 4.15). Long-shore wave action has transported some of the tailings several hundred feet along the north shore. Discharges flow from the two adits located at the top of the waste dump. Both discharges infiltrate the dump and re-emerge as seeps that flow into the lake.

4.9.3.1 Site Features - Sample Locations

Water-quality sample RLSS10L was collected at the south end of Crystal Lake on August 27, 1996. A second sample (WLSS10L) was collected on October 7, 1996 for cyanide analysis.
Site features and the sample locations are shown on figure 4.15; figures 4.16 and 4.17 are photographs of the site.

4.9.3.2 Soil

Soil on BNF-administered land was not visibly impacted by waste rock or tailings; therefore, no soil samples were collected.

4.9.3.3 Water

The field pH of sample RLSS10L was 9.0 and therefore did not meet the secondary MCL (table 4.8). The concentration of cyanide in the lake water was less than the laboratory detection limit of 5 µg/l.

Table 4.8 Water-quality exceedences at the Lakeshore mine and mill.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Crystal Lake - south end (RLSS10L)																			S*

Exceedence codes: P - Primary MCL, S - Secondary MCL, A - Aquatic Life Acute, C - Aquatic Life Chronic
Note: The analytical results are listed in appendix V
* Laboratory pH was within the acceptable secondary MCL range.

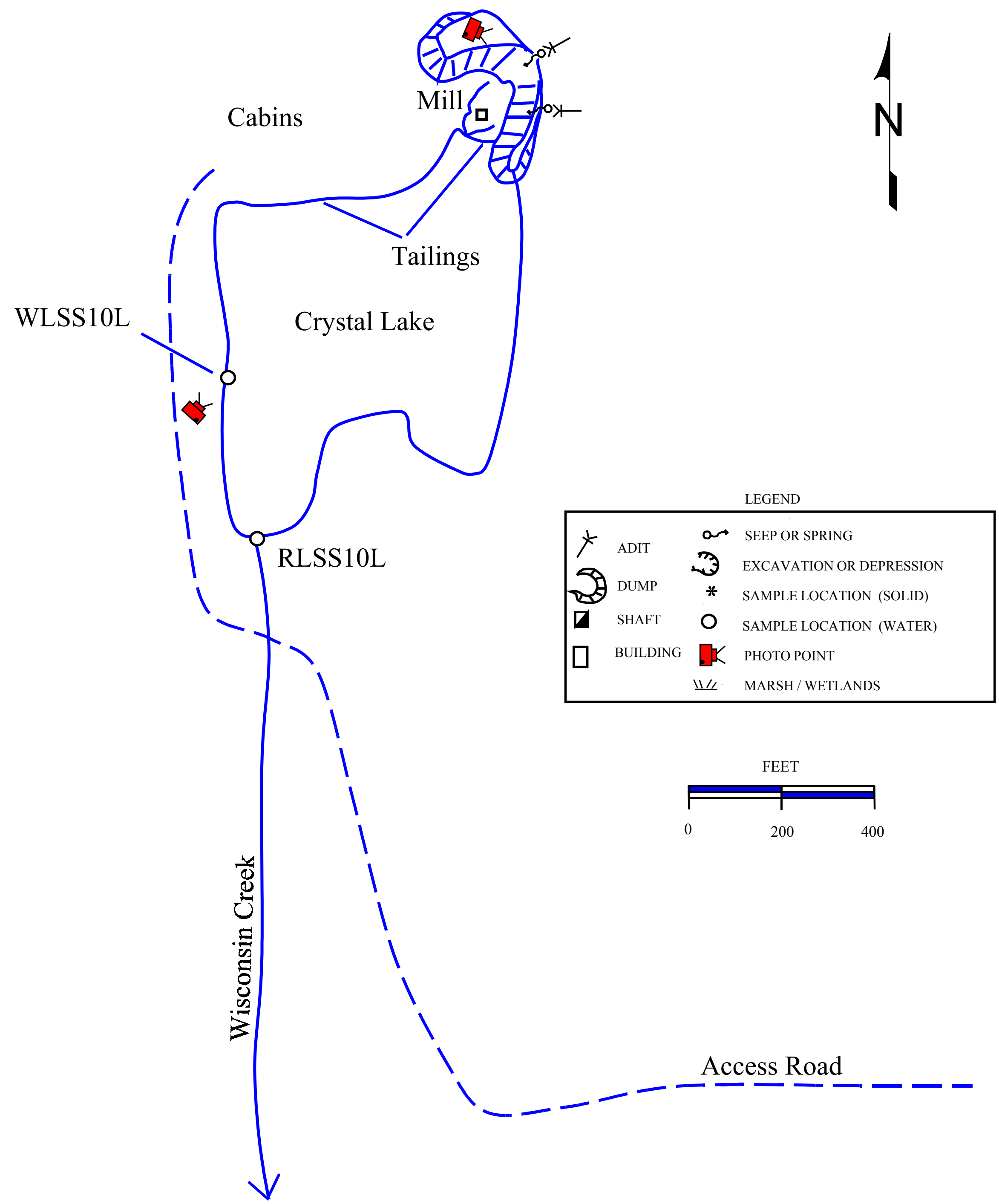

Figure 4.15 Tailings and waste rock from the Lakeshore mine and mill are located at the northeast end of Crystal Lake (8/27/96).

Figure 4.16 A large waste-rock dump and mill ruins are located at the northeast end of Crystal Lake.

Figure 4.17 The northern adit at the Lakeshore mine is open and has a substantial discharge.

4.9.3.4 Vegetation

Vegetation on the waste-rock dump is sparse. Most of the tailings are moderately vegetated, but some barren spots still remain. Vegetation on the BNF-administered land at the south end of the lake appears healthy.

4.9.3.5 Summary of Environmental Conditions

Private land on the northeast end of Crystal Lake appears heavily impacted by the Lakeshore mine and mill; however, no soil or water-quality problems were noted on BNF-administered land. Tailings that are being transported along the north shore of the lake by wave action are evidence of ongoing erosion. This eroded mine waste may threaten aquatic life in the lake, especially if it contains high concentrations of metals. The site probably warrants further investigation because of its size and complexity.

4.9.4 Structures

All that remains of the mill is a pile of lumber and a couple of wooden water tanks. There are about a dozen cabins along the north shore of the lake. Most of the cabins are in good condition. All of these structures are on private land.

4.9.5 Safety

The north adit is open and therefore is a safety concern. Also, the unstable remnants of the mill could be dangerous. Both of these features are on private land. No hazards were observed on BNF-administered land.

4.10 LEITER MILL TAILINGS

4.10.1 Site Location and Access

The Leiter mill tailings (T3S R4W Sec. 29 BAAC) are located adjacent to Wisconsin Creek. Most of the tailings are on private land, but some deposits on the west side of the creek appear to be on BNF-administered land. Access to the site is via the Wisconsin Creek Road that leads north from Sheridan.

4.10.2 Site History - Geologic Features

The Leiter mill processed oxidized ore and was active in the 1890's. Facilities at the site included an aerial tram, a stamp mill, and a cyanide plant (Winchell 1914). By 1902, operations had ceased (Winchell 1914; Tansley *et al.* 1933). The tailings consist of fine sand-sized particles of quartz and iron oxide.

4.10.3 Environmental Condition

Tailings from the Leiter cyanide mill are spread over several acres of marshy ground on the east side of Wisconsin Creek (figure 4.18). Springs that surface near the ruins of the old mill flow through the tailings impoundments and into the creek. Smaller tailings deposits are found on the west side of the creek. No seeps flow from these tailings, but they are actively eroded by Wisconsin Creek.

4.10.3.1 Site Features - Sample Locations

The site was sampled on August 28, 1996. Water-quality samples RLTS10L and RLTS20L were collected from Wisconsin Creek upstream and downstream of the site, respectively. The flow rate at the upstream location was 3.6 cfs; at the downstream location, the rate was 6.0 cfs. Soil sample RLTD10M was collected from some of the streamside tailings deposits on the west side of the creek. Site features and sample locations are shown on figure 4.18; figures 4.19 and 4.20 are photographs of the site.

4.10.3.2 Soil

Arsenic and copper concentrations in the streamside tailings were well above phytotoxic levels (table 4.9). Streamside tailings were only observed in close proximity to the site, but it is likely that additional tailings deposits are located in slack water areas downstream.

Table 4.9 Soil sampling results (mg/kg) for the Leiter mill tailings.

Sample Location	**As**	**Cd**	**Cu**	**Pb**	**Zn**
Streamside tailings on west bank of Wisconsin Creek (RLTD10M)	1,100[1,2]	0.77[1]	197[1,2]	493[1]	66.0[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3).
(2) Exceeds phytotoxic levels (table 1.3).

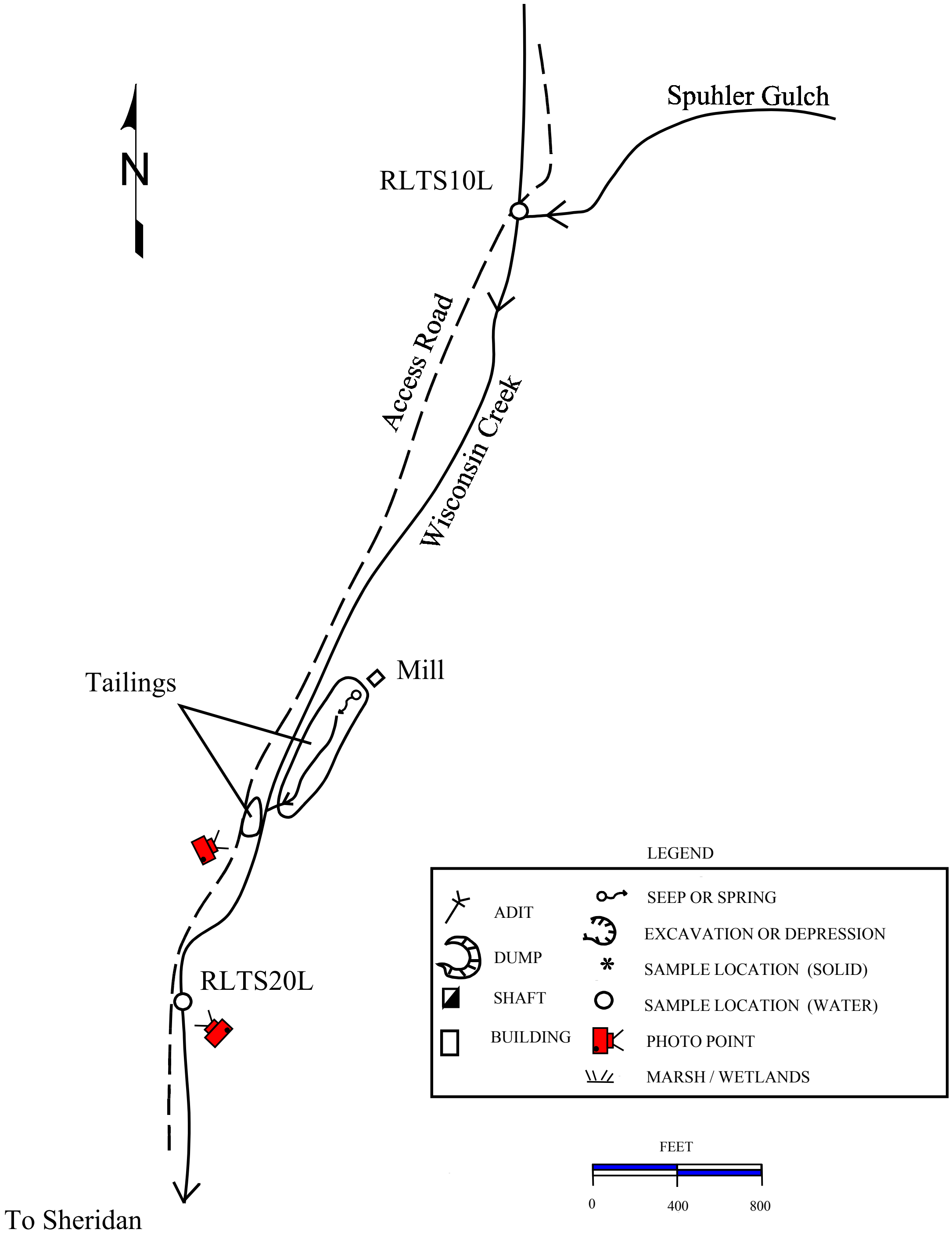

Figure 4.18 At the Leiter mill tailings site, streamside tailings on the west bank of Wisconsin Creek appear to be on both private and BNF-administered land (8/28/96).

Figure 4.19 Sample RLTD10M was collected from streamside tailings deposits on the west side of Wisconsin Creek.

Figure 4.20 Sample RLTS20L was collected downstream of the site where Wisconsin Creek crosses back onto BNF-administered land.

4.10.3.3 Water

The water quality of Wisconsin Creek was good both upstream and downstream of the site. No standards were exceeded.

4.10.3.4 Vegetation

The tailings impoundments on the east side of the creek are vegetated with grasses and brush. On the west side of the creek, some of the tailings are barren where active erosion is occurring.

4.10.3.5 Summary of Environmental Conditions

The streamside tailings and discharge at this site do not appear to impact the water quality of Wisconsin Creek under low-flow conditions. However, during heavy rainfall and runoff events, it is likely that poorly vegetated tailings on private and BNF-administered land are being washed into the creek. No streamside tailings were observed along the half mile section of creek below the site, perhaps because the stream gradient is steep. The possibility that additional tailing deposits exist in slack-water areas further downstream should be investigated in the future.

4.10.4 Structures

A mill building which is in bad condition is located on private land on the east side of Wisconsin Creek. No structures were observed on BNF-administered land.

4.10.5 Safety

No safety problems were observed on BNF-administered land.

4.11 LONE WOLF MINE

4.11.1 Site Location and Access

The Lone Wolf mine (T3W R2S Sec. 16 DDCC) is on BNF-administered land approximately 3.5 miles west of Pony, Montana. The site is accessed by a four-wheel drive road that goes past Cataract Lake. The site's waste dump can be seen on the mountainside approximately a half mile north of the access road. It is best to park on the road and walk to the site.

4.11.2 Site History - Geologic Features

Features at the Lone Wolf mine include a caved adit and small waste-rock dump. The dump does not contain any material that would be classified as ore. Many small prospects are scattered across the mountainside near the site. A sketch map of the area is presented as figure 4.21.

4.11.3 Environmental Condition

The site consists of a collapsed adit with a discharge flowing about 3 gpm. The discharge traverses the waste-rock dump and then seeps into the ground. It re-emerges about 75 feet downgradient where it flows into an unnamed tributary to Cataract Creek. Erosion of the dump may occur during spring runoff or when the discharge rate is higher. There is no evidence of eroded material along the unnamed tributary.

There was also a seep/spring southeast of the mine site. It is unknown if this seep is related to mining activities.

4.11.3.1 Site Features - Sample Locations

The site was visited and sampled on September 24, 1996. Sample MLWS01L was collected from the adit discharge just before it flows over the waste-dump embankment. The seep southeast of the site also was sampled (MLWS03L).

The spring that forms the headwater of the unnamed tributary to Cataract Creek was sampled to characterize water quality upgradient of the mine site (MLWS02L). A downstream sample (MLWS04L) was collected by the access road.

Soil sample MLWD01M was collected where the adit discharge may potentially erode the waste-rock dump. Evidence of potential contamination consisted of a lack of vegetation and a difference in color compared to surrounding material.

Site features and sample locations are shown on figure 4.21; figures 4.22 and 4.23 are photographs of the site.

4.11.3.2 Soil

The soil sample results show that the arsenic concentration exceeds both Clark Fork Superfund background and phytotoxic levels (table 4.10). Cadmium, lead and zinc exceeded one or more Clark Fork Superfund background levels.

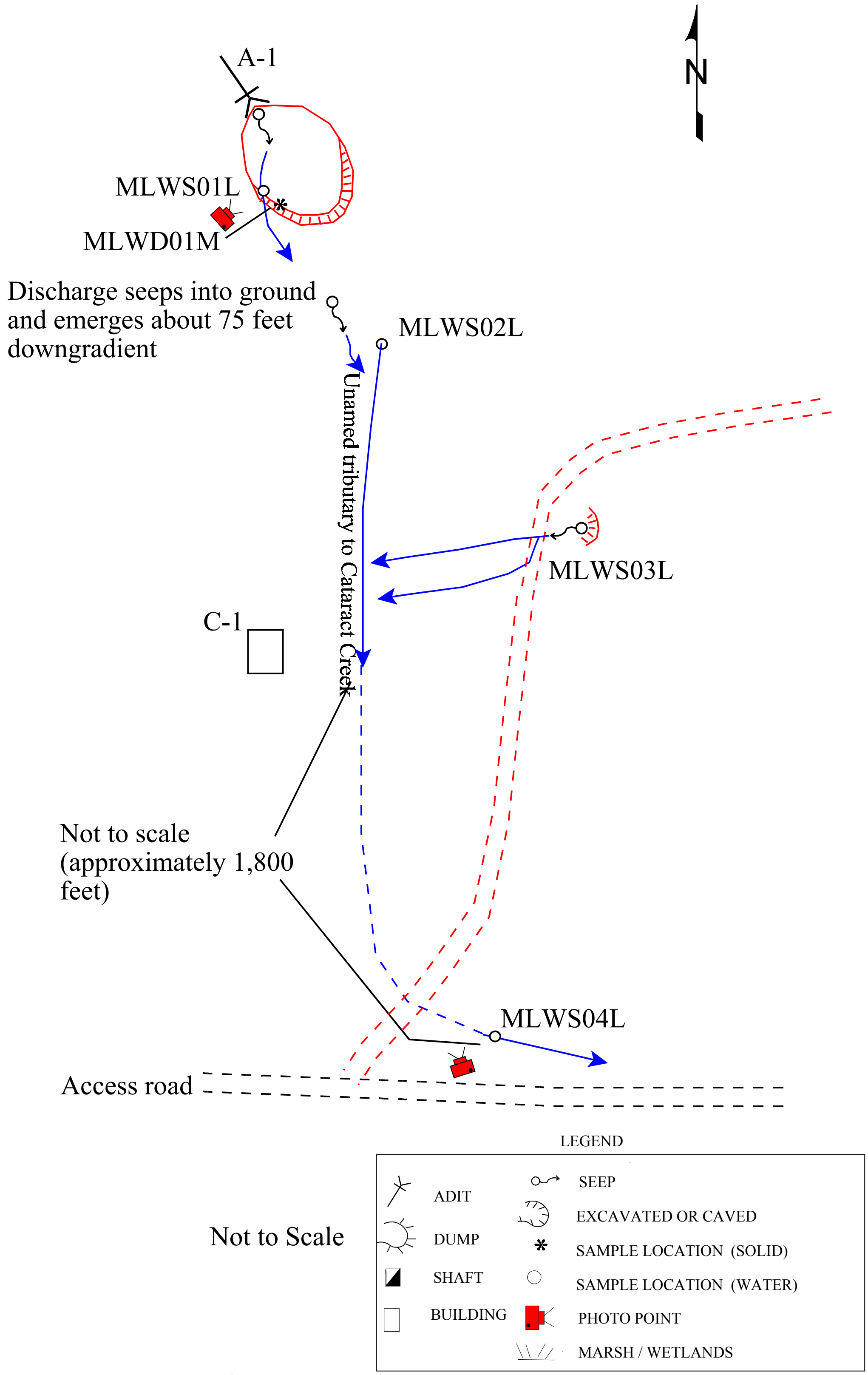

Figure 4.21 Site map of the Lone Wolf mine, September 1996.

Figure 4.22 The Lone Wolf mine is located near the headwater of an unnamed tributary to Cataract Creek. The site is shown in the upper center of the photograph.

Figure 4.23 Soil sample MLWD01M was collected where the waste-rock dump is in contact with the adit discharge.

Table 4.10 Soil sampling results (mg/kg) for the Lone Wolf mine.

Sample Location	As	Cd	Cu	Pb	Zn
Waste-rock composite (MLWD01M)	194[1,2]	0.7[1]	1.8	62[1]	117[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3)
(2) Exceeds phytotoxic levels (table 1.3)

4.11.3.3 Water

Metal concentrations in all the water samples were very low; no standards were exceeded.

4.11.3.4 Vegetation

Mine waste at the site is barren to sparsely vegetated.

4.11.3.5 Summary of Environmental Condition

The water issuing from this site is of good quality, and there is no obvious adverse impact to the Cataract Creek drainage. Although surface runoff may cause some erosion, the waste-rock dump is relatively small and does not appear to be an environmental problem.

4.11.4 Structures

There is a cabin in bad condition located south of the adit. Wood debris in the vicinity of the seep southeast of the mine suggests that there may have been a structure there as well.

4.11.5 Safety

The waste rock has a slope that can make for loose footing.

4.12 MISSOURI-MCKEE/SNOWSLIDE MINE AND MILL

4.12.1 Site Location and Access

The Missouri-McKee/Snowslide mine and mill (T4S R2W Sec 29 CCCA) are located on a steep south-facing slope near South Meadow Creek. The site is on BNF-administered land and is accessed by turning west onto the South Meadow Creek Road at McAllister and following the road for approximately seven miles. The last mile to the site is on a very narrow road that turns southwest off a better maintained road. Only one or two locations exist where a vehicle can be turned around.

4.12.2 Site History - Geologic Features

The Missouri-McKee/Snowslide group, in the Washington mining district, was the largest producer in the district (Lorain 1937). Over 14,300 tons of ore yielded 16,664 ounces of gold, 41,958 ounces silver and minor Cu and Zn between 1905 and 1936 (Lorain 1937). The ore was all oxidized with mineralization consisting of quartz, limonite, and cerussite. Original mineralization was inferred to be galena and pyrite with the gold and silver associated with the galena (Tansley *et al.* 1933). One- to four-foot thick quartz veins follow the contact between a "sill-like andesite intrusive" and gneiss (Lorain 1937). The structure varied in dip, ranging from nearly flat-lying to a maximum of 40°; the intrusive followed the bedding planes of the gneiss (Tansley *et al.* 1933). The ore occurred in the synclinal features resulting from the folding of the gneiss and andesite.

A small hydroelectric plant provided power for a 35-ton cyanide plant (Lorain 1937); Tansley *et al.* (1933) reported that the milling facility was a 30-ton amalgamation and cyanidation plant; Trauerman and Waldron (1940) listed the equipment as a 35-ton gravity, amalgamation and cyanide plant. According to Trauerman and Waldron (1940), the site consisted of two patented claims (the Missouri and the Tucker), 12 unpatented claims, and 4 mill sites. Altogether, the claims had 17 tunnels with about 5,000 feet of workings.

4.12.3 Environmental Condition

Several seeps emerge at the base of a tailings pile located close to South Meadow Creek (figure 4.24). Tailings have been transported down the seep channels and released into the creek. A small clear discharge flows from the partially collapsed adit portal just east of the mill ruins. The discharge sinks into the ground within a short distance and does not appear to have any adverse environmental impact.

4.12.3.1 Site Features - Sample Locations

Soil and water-quality samples were collected at the site on May 19, 1998. Water sample MMRS10L was collected from one of the seeps at the toe of the tailings pile. The water had a field pH of 6.3 and an SC of 127 µmhos/cm. Samples also were collected from South Meadow Creek upstream (MMRS20L) and downstream (MMRS30L) of the tailings- impacted area. At both stream locations, the field pH was 7.1, and the SC was 30 µmhos/cm. A soil sample (MMRD10M) was collected along one of the seep channels to characterize the heavy metal content of the sediments being transported into the creek. Site features and sample locations are shown on figure 4.24. Photographs of the site are presented as figures 4.25 and 4.26.

4.12.3.2 Soil

The concentration of arsenic in the eroding tailings is more than 40 times the phytotoxic level (table 4.11). The concentrations of copper and lead also exceed phytotoxic levels.

Table 4.11 Soil sampling results (mg/kg) for the Missouri-McKee/Snowslide mine and mill site.

Sample Location	As	Cd	Cu	Pb	Zn
Tailings along seep channel (MMMD10M)	4,192[1,2]	8.33[1]	258[1,2]	6,150[1,2]	394[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3)
(2) Exceeds phytotoxic levels (table 1.3)

4.12.3.3 Water

Metal concentrations in the seep from the tailings seep and in South Meadow Creek did not exceed water-quality standards (table 4.12). However, the seep was slightly acidic (field pH: 6.3), and the concentrations of arsenic and chromium were significantly higher than in the creek.

Table 4.12 Water-quality exceedences at the Missouri-McKee/Snowslide mine and mill.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
South Meadow Creek - upstream of site (MMMS20L)																			
Tailings seep (MMMS10L)																			S*
South Meadow Creek - downstream of site (MMMS30L)																			

Exceedence codes: P - Primary MCL, S - Secondary MCL, A - Aquatic Life Acute, C - Aquatic Life Chronic
Note: The analytical results are listed in appendix V.
* Laboratory pH was within acceptable secondary MCL range.

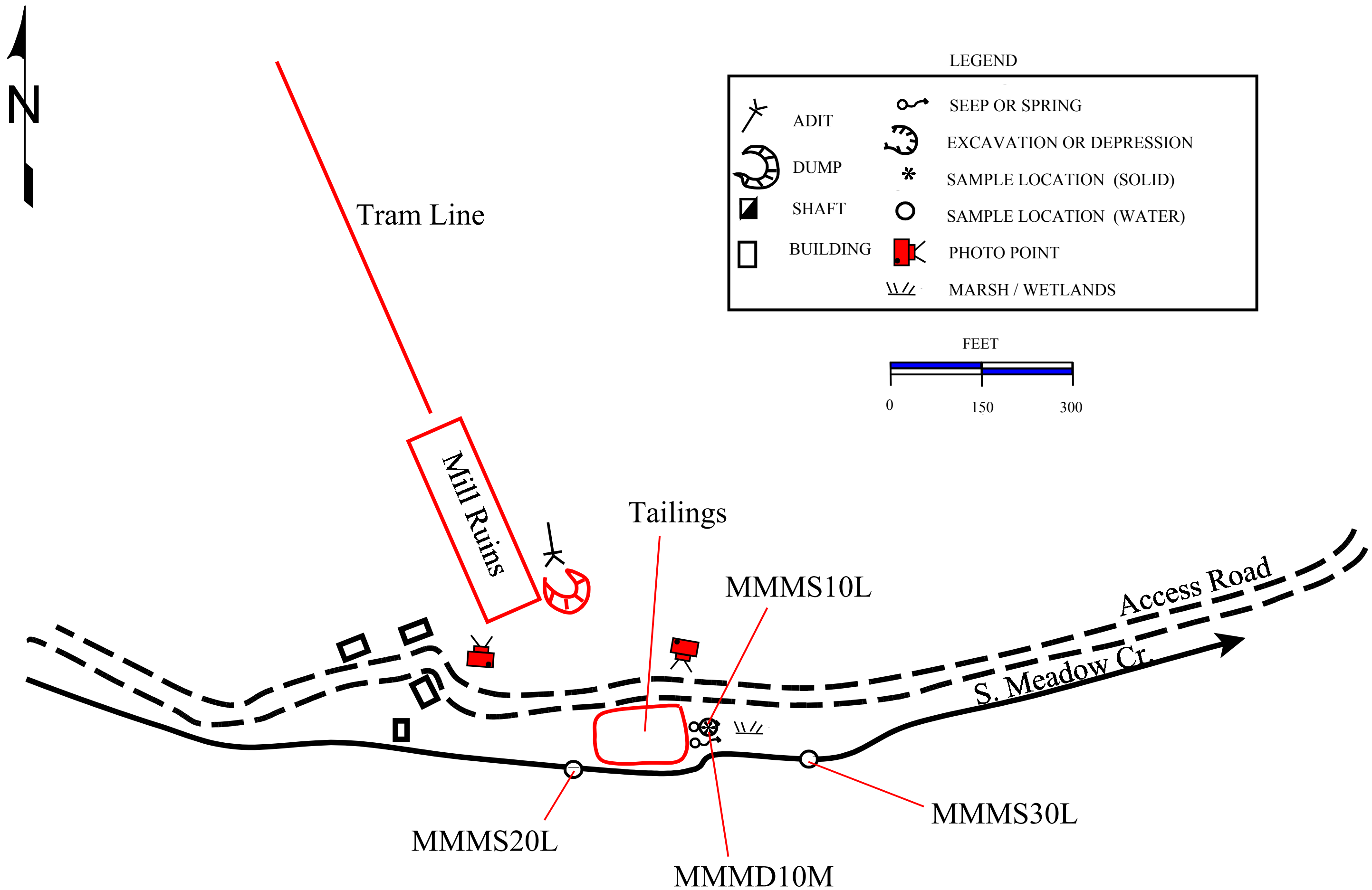

Figure 4.24 Site map of the Missouri-McKee mine and mill, May 1998.

Figure 4.25 The ruins of the Missouri-McKee/Snowslide mill are spread down the mountainside just east of the open adit.

Figure 4.26 The tailings pile at the Missouri-McKee/Snowslide site is partially vegetated with grasses.

4.12.3.4 Vegetation

The tailings pile is moderately well vegetated with grasses, willows, and a few conifers (figure 4.26); however, fine material continues to wash off the pile onto the creek flood plain. Vegetation along the seep channels is less dense than at other locations. The waste-rock dump near the adit portal is sparsely vegetated with grasses.

4.12.3.5 Summary of Environmental Condition

Tailings at the site contain elevated concentrations of arsenic, copper, and lead and are being transported into South Meadow Creek along seep channels that begin at the base of the tailings pile. Concentrations of metals dissolved in the seep water did not exceed standards; however, the site was sampled in the spring when the flow rate was high. Under low-flow conditions, the metal concentrations may be significantly higher. In conclusion, the site has the potential to significantly impact the environmental quality of the watershed and should be slated for further investigation.

4.12.4 Structures

Several cabins and the ruins of a mill are present at the site. The cabins are in fair to good condition. One of the cabins looks like it might be used by hunters. The mill is completely collapsed, but the stamp rods and machinery are still in reasonably good condition (figure 4.25). Supports and cables for a tramline can be seen running up the mountain slope above the mill.

4.12.5 Safety

The partially collapsed adit east of the mill has a hazardous opening. The slopes above the portal have failed, but the workings are still accessible by scrambling over the rubble. The mill ruins also are a hazard because they are unstable and contain sharp wood and metal objects. The cabins at the site appear to be stable but were not inspected thoroughly.

4.13 PEDRO (POT RUSTLER) AND PEDRO MIDDLE MINES

4.13.1 Site Location and Access

The Pedro (Pot Rustler) and Pedro Middle mines (T4S R3W Sec. 17 CA) are hard to find and are accessible only by foot. Approximately one mile east of the Balanced Rock Campground, there is a trail/road on the south side of the main road that parallels Mill Creek. The lower adit is located about one-quarter mile down this trail which crosses the South Fork of Mill Creek. The middle adit (Pedro Middle) is located approximately a half mile up a steep trail north of the lower adit. The site is on BNF-administered land.

4.13.2 Site History - Geologic Features

At the Pedro mine, quartz veins and lenses were mined from a marble-gneiss contact. The best assay results from select samples were 0.36 oz/ton gold, 17.1 oz/ton silver, 0.12% copper, 42.3% lead, and 2.78% zinc (Winters *et al.* 1994). Although the site is on BNF-administered land, it may be covered by a plan of operation.

At the Pedro Middle, a quartz-pyrite vein hosted in a north-northeast striking structure was mined. The caved adit was probably several hundred feet long.

4.13.3 Environmental Condition

The site consists of a lower, middle and upper adit (figure 4.27). The lower adit (A-1) is open and has a discharge that flows at about 1.6 gpm. The discharge runs across a waste-rock dump and sinks into the ground about 200 feet from the adit. A 5-gallon drum that may contain motor oil is present near the portal.

The middle adit (A-2) has collapsed and has a discharge that flows at about 1.2 gpm. The discharge flows across the waste rock and sinks into the woods a short distance from the adit. A building related to the mine operations is present near the adit and is in good condition.

There is no discharge from the upper adit (A-3).

4.13.3.1 Site Features - Sample Locations

The site was sampled on August 21, 1996 and September 23, 1996. Sample JPES02M was collected from the lower adit discharge, about 50 feet from the portal. Sample JPES01M was collected from the middle adit discharge. Site features and sample locations are shown on figure 4.27; figures 4.28 and 4.29 are photographs of the site.

4.13.3.2 Soil

No soil samples were collected at the site.

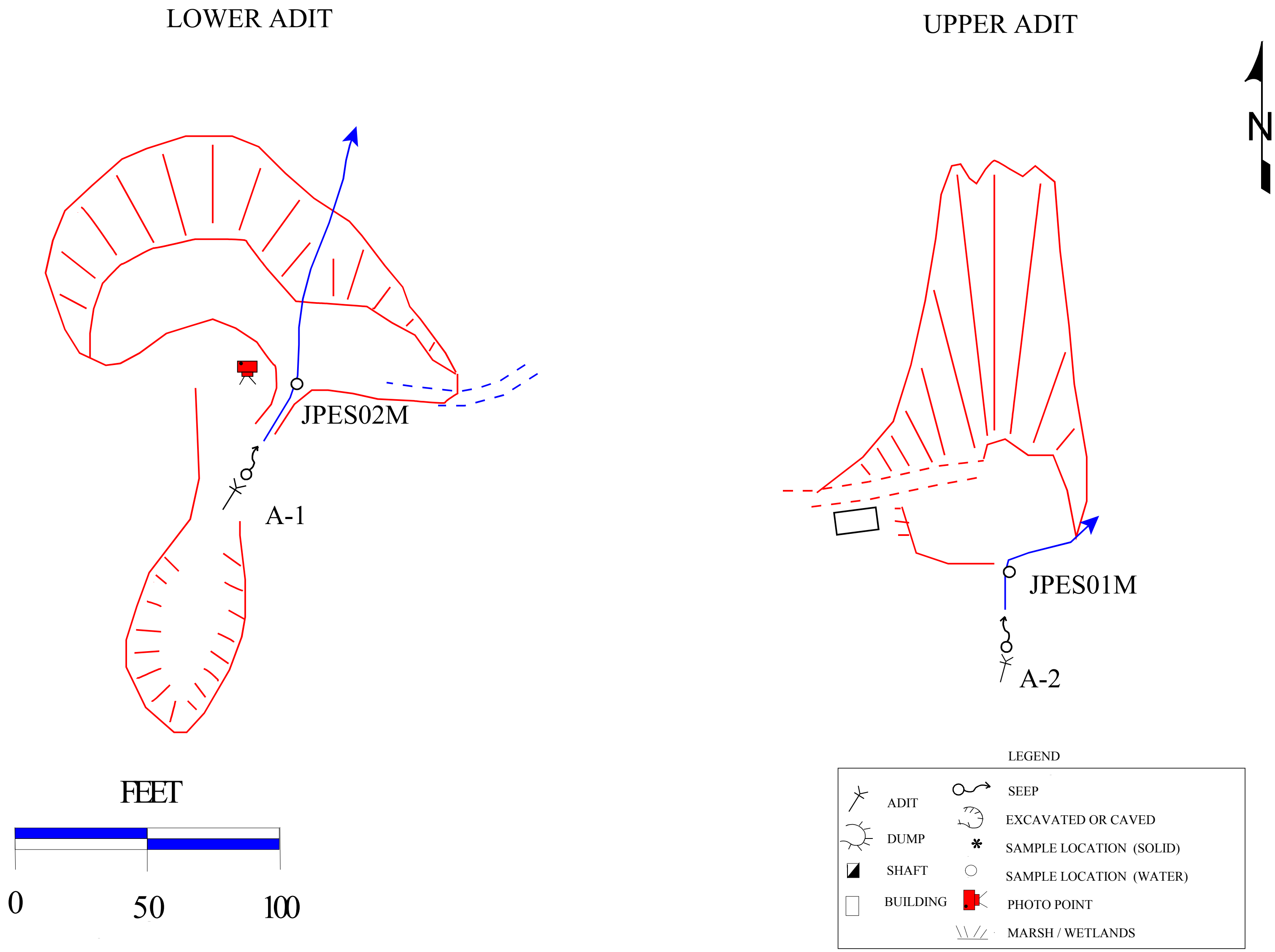

Figure 4.27 Site map showing adits of the Pedro (Pot Rustler) and Pedro Middle mines, September 1996.

Figure 4.28 The Pedro (Pot Rustler) and Pedro Middle mines are located on a thickly wooded mountainside along the South Fork of Mill Creek.

Figure 4.29 The lower adit has a small discharge that flows across the waste-rock dump before sinking into the ground. An old truck, a trailer, and some other equipment are located near the portal.

4.13.3.3 Water

The water-quality of the discharges from the lower and middle adits was good; no standards were exceeded.

4.13.3.4 Vegetation

The waste-rock dumps at the site are devoid of vegetation. The surrounding areas are densely forested.

4.13.3.5 Summary of Environmental Condition

The adit discharges and waste-rock dumps do not appear to adversely impact BNF-administered land.

4.13.4 Structures

There is smashed trailer located near the lower adit. A mine building located near the middle adit is in good condition.

4.13.5 Safety

The open lower adit poses a safety risk because it provides easy access to the mine workings. Also, a lot of debris including garbage, pipes, machinery, and 5-gallon drum of motor oil(?) is scattered around the lower site.

4.14 PRESIDENTIAL-DEMOS GROUP

4.14.1 Site Location and Access

The Presidential-Demos Group mines are located on private land in the South Willow Creek drainage (T3W R3S Sec. 16 CBD), about 5.3 miles west of Potosi Hot Springs. The site is accessed by a road that parallels South Willow Creek.

4.14.2 Site History - Geologic Features

The Presidential and Demos groups are two separate groups of claims in the Potosi mining district, but they are nearly contiguous; they all lie predominantly within T3S R3W Sec. 16. The Presidential Group lies west-northwest of the Demos Group. The USGS mineral resources data system (MRDS) included the patented claims Margie, Roger(s), Lucky Joe, Rockefeller, and Independent in the Demos Group; the Washington, Lincoln, Roosevelt, Grant and Wilson patented claims are assumed to comprise the Presidential Group. The Presidential Group was described as the Grigg Group or Grigg molybdenum by Eyde (1958). The patented claims along with the geology of the area are shown on Eyde's (1957) field map.

The Potosi mining district has been prospected since 1874 when it was considered a silver camp; tungsten was discovered in 1911 (Eyde 1957). The Demos Group was discovered in 1906 and was named after Henrietta Demos of Butte. The Potosi Mining Company acquired the Demos Group in 1930 and shipped tungsten ore in 1933 (Eyde 1957).

Tansley *et al.* (1933) described the Potosi district as being entirely within the "granite belt" with some apophyses of alaskite. The commodities found in the district were primarily tungsten and silver. Other commodities listed for the area in the MRDS database include manganese, copper, lead, and antimony. The minerals huebnerite, tetrahedrite, anglesite, cerargerite, and tungstite were listed as the primary ore minerals found in the district. Mineralization was found in two or three vein systems: N60° to 80°E, N10°E., and a lesser northwest-trending vein system. The MRDS database listed the occurrence as quartz veins in lenses mined from shafts, adits and numerous pits. The host rock was Cretaceous quartz monzonite that was intruded into pre-Belt gneisses. The deposit lies to the east of the northwest-trending Bismark fault (Eyde 1957); the Bismark fault is locally mineralized itself.

4.14.3 Environmental Condition

Environmental concerns at this site focus on two collapsed adits (A-1 and A-2, figure 4.30) with small discharges . The discharge from the A-1 adit seeps into the ground approximately 200 feet from the portal. A discharge from a PVC pipe near a new cabin on site also was noted, but since the pipe is on private land, the source of the discharge was not investigated. Downgradient of the A-1 adit, a spring issues from a road cut. The flow rate of this spring was about 6.4 gpm.

The second adit (A-2) has a small discharge of less than 1 gpm. About 40 feet from the adit portal, the discharge seeps into the ground.

4.14.3.1 Site Features - Sample Locations

The site was visited and sampled on October 8, 1997. A sample of the discharge water from the A-1 adit was not collected because the adit is on private land. However, a sample was collected from the road-cut spring (MPGS01L) to determine if ground water is impacted by the upgradient mining activities.

A sample also was collected from the A-2 adit discharge (MPGS02L) where the discharge crosses onto Forest Service land.

Site features and sample locations are shown on figure 4.30; figures 4.31 and 4.32 are photographs of the site.

4.14.3.2 Soil

The waste-rock dumps surrounding both adits are small in size (less than 1,600 ft^2) and were not sampled because they are located on private land and do not appear to impact BNF-administered land.

4.14.3.3 Water

The water-quality of the road-cut spring was good; no standards were exceeded (table 4.13). The A-2 adit discharge exceeded the secondary MCL and chronic aquatic life standard for aluminum. The pH of the discharge was 6.4, which is outside the secondary MCL range for drinking water.

Table 4.13 Water-quality exceedences at the Presidential-Demos Group mines.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Road-cut spring - downgradient of adit A-1 discharge (MPGS01L)																			
Adit A-2 discharge (MPGS02L)	S,C																		S

Exceedence codes: P - Primary MCL, S - Secondary MCL, A - Aquatic Life Acute, C - Aquatic Life Chronic
Note: The analytical results are listed in appendix V.

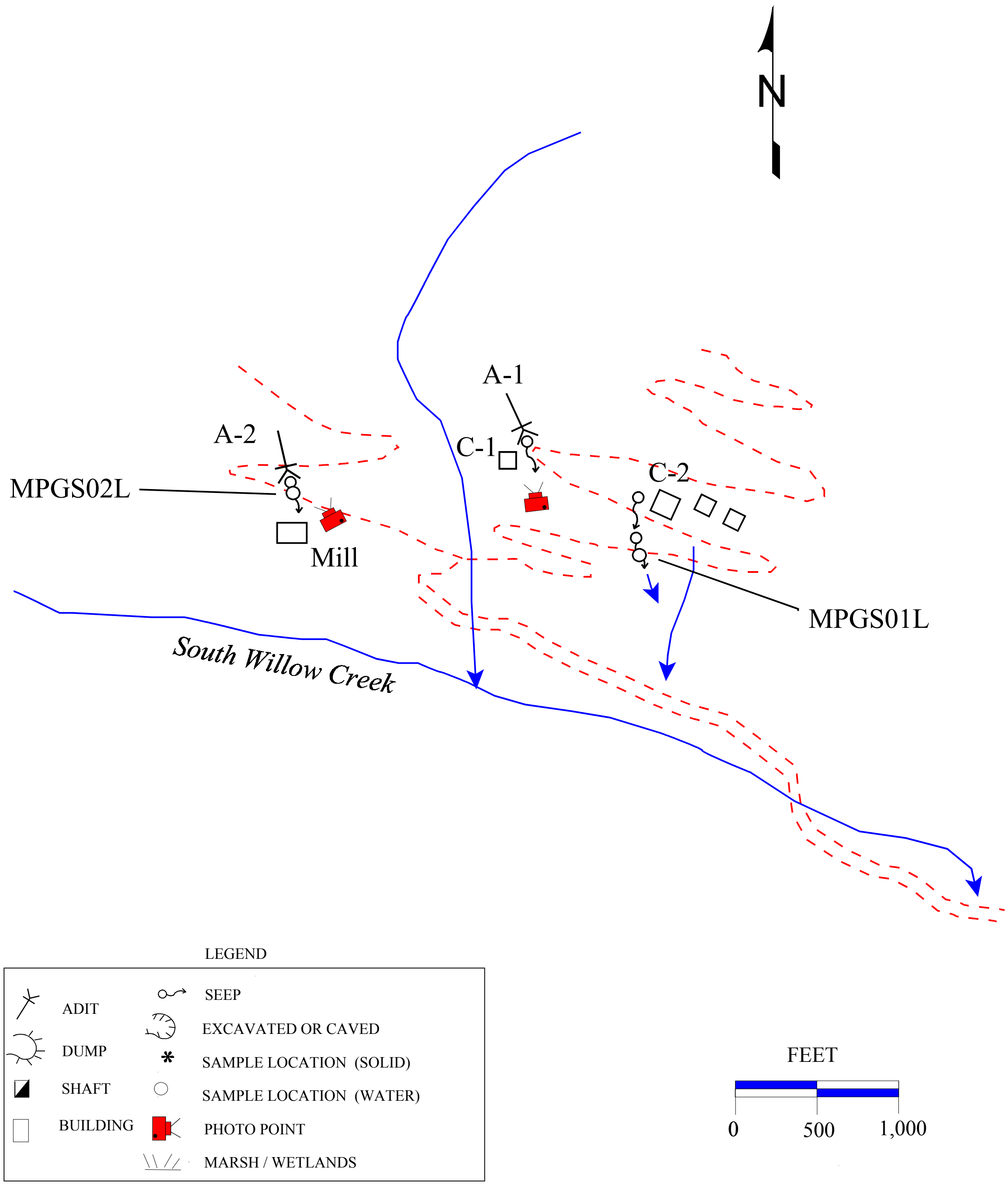

Figure 4.30 Site map of the Presidential-Demos Group, October 1997.

Figure 4.31 Sample MPGS01L was collected from a spring that emerges from a road cut downgradient of the A-1 adit.

Figure 4.32 The discharge from the A-2 adit was sampled where it crosses onto BNF-administered land.

4.14.3.4 Vegetation

The waste dumps were sparsely vegetated with grasses.

4.14.3.5 Summary of Environmental Condition

The water-quality of the spring downgradient of the A-1 adit discharge was good, suggesting that the discharge from the adit has minimal impact on BNF-administered land. Although the A-2 adit discharge is slightly acidic and contains an elevated concentration of aluminum, it is very small and seeps into the ground within a short distance. Its impact on BNF-administered land also appears minimal.

4.14.4 Structures

Near the upper adit (A-1) there are several old cabins that are in poor condition. A new cabin (C-2, figure 4.31) also is located in this area. Downhill from the A-2 adit, there are the remnants of a mill. All of the structures appear to be on private land.

4.14.5 Safety

No significant safety risks were noted on BNF-administered land.

4.15 RED PINE MINE AND MILL

4.15.1 Site Location and Access

The Red Pine mine and mill (T4S R4W Sec. 3 BACA) are located on a southeast-facing slope above Indian Creek near Sheridan. Access to the site is via a bumpy road that parallels the creek; the last three miles must be covered on foot or ATV because of a bridge in poor condition. The site is on BNF-administered land

4.15.2 Site History - Geologic Features

A N45˚E 50˚NW vein containing quartz, black microcrystalline quartz, pyrite, chalcopyrite, tetrahedrite, gold, calcite, and graphite, up to 10 feet thick, and hosted by Archean marble and the marble-gneiss contact, was mined (Lorain 1937; Winters *et al.* 1994). Select samples assayed up to 1.7 oz/ton gold, 2.7 oz/ton silver, 0.07% copper, 0.006% lead, and 0.04% zinc. Kinley (1987) reported up to 8 oz/ton gold.

Workings consist of 1,500 feet of cross-cuts and 1,000 feet of drifts (Kinley 1987). The main adit is intact. A large volume discharge issues from it and flows into Indian Creek. A flotation mill (Lorain 1937) is present on the site, as are several breached tailings impoundments.

4.15.3 Environmental Condition

A large, clear discharge flows from an open adit above the mill (figure 4.34). The water runs down the mountainside and into Indian Creek. Tailings from the mill are located in several impoundments and are generally dry. The lowermost impoundment is 100 to 200 feet from Indian Creek and has been breached. When the site was visited in August 1997, the bottom of the impoundment contained a puddle of standing water. No streamside tailings were observed along Indian Creek.

4.15.3.1 Site Features - Sample Locations

The site was sampled on August 29, 1997. Water-quality sample RRPS10L was collected from the adit discharge. The discharge was flowing at approximately 400 gpm and had a pH of 8.0 and an SC of 97 µmhos/cm. Samples RRPS20L and RRPS30L were collected from Indian Creek upstream and downstream of the site, respectively. The flow rate of the creek was estimated to be 10 cfs. The pH of the creek was 8.0, and the SC was approximately 110 µmhos/cm. Soil sample RRPD10M was collected from the muddy tailings in the lowermost impoundment. Site features and sample locations are shown on figure 4.33; figures 4.34 and 4.35 are photographs of the site.

4.15.3.2 Soil

The copper concentration in the lowermost tailings impoundment is four times greater than phytotoxic levels (table 4.14). Fortunately, there is no visual evidence that tailings were washed beyond this impoundment and into the creek.

Table 4.14 Soil sampling results (mg/kg) for the Red Pine mine and mill.

Sample Location	As	Cd	Cu	Pb	Zn
Tailings from lowermost impoundment (RRPD10M)	30.9[1]	5.04[1]	407[1,2]	33.2[1]	43.6

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3)
(2) Exceeds phytotoxic levels (table 1.3)

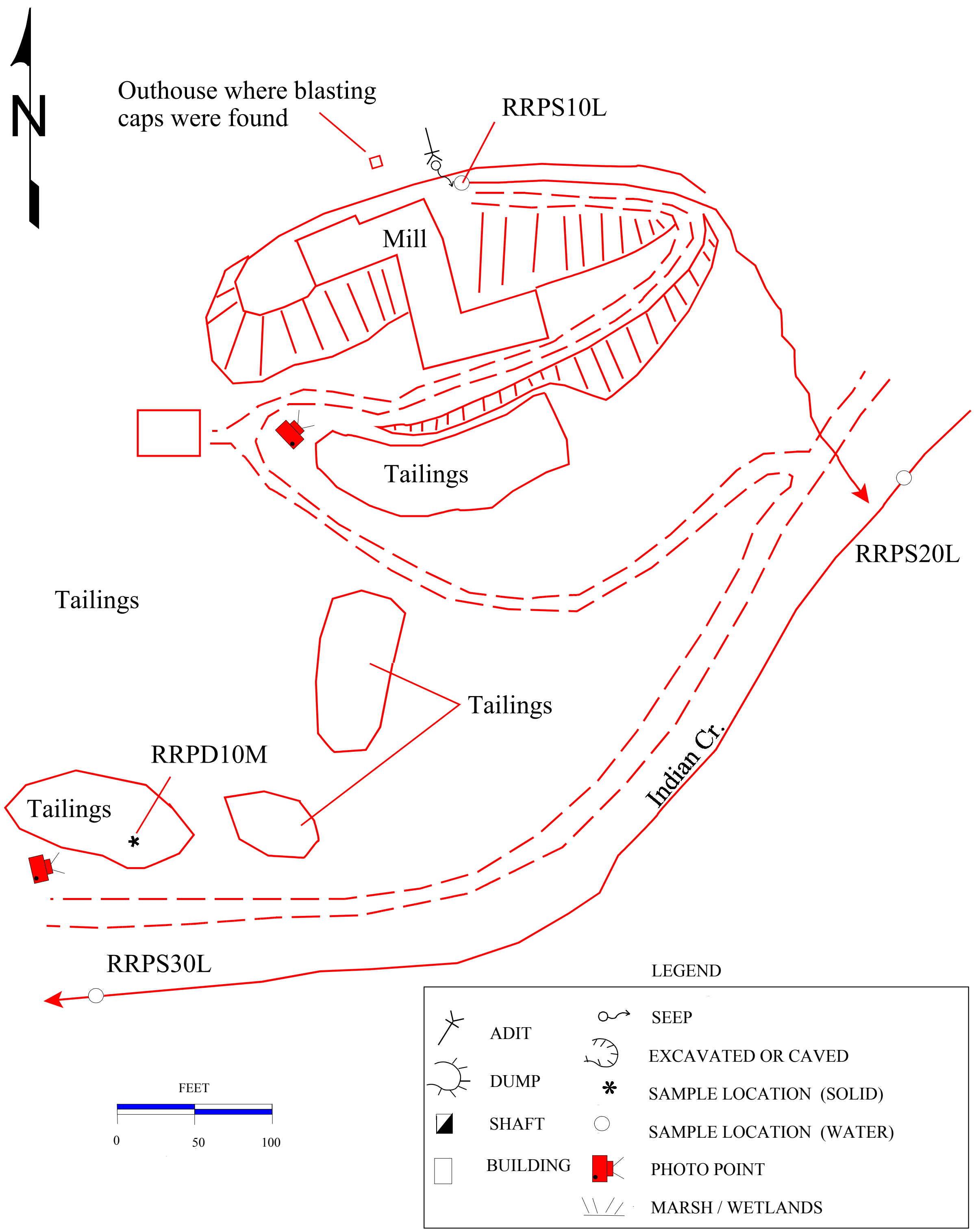

Figure 4.33 Site map of the Red Pine mine and mill, August 1997.

Figure 4.34 The Red Pine mine and mill are located on a southeast-facing mountain slope above Indian Creek near Sheridan.

Figure 4.35 Soil sample RRPD10M was collected from a breached impoundment that contains some muddy tailings.

4.15.3.3 Water

The water quality of the adit discharge and Indian Creek upstream and downstream of the site was good. No standards were exceeded.

4.15.3.4 Vegetation

The tailings impoundments and waste-rock dumps near the mill are barren to moderately vegetated. The lowermost tailings impoundment is well vegetated with grass except for a barren muddy area that covers about a hundred square feet.

4.15.3.5 Summary of Environmental Conditions

The tailings and discharge at the site do not appear to adversely impact the water quality of Indian Creek. The wet tailings in the lowermost impoundment contain an elevated concentration of copper that may impact ground-water quality in a localized area.

4.15.4 Structures

A relatively new mill building in good condition is located at the site. Inside the building, much of the milling equipment still remains. A cabin near the mill is also in fairly good condition.

4.15.5 Safety

Three or four blasting caps were observed in the outhouse uphill of the mill. The Sheridan District office was notified of this hazard.

Inside the mill building, there are several 55-gallon drums. At least one of the drums still contains some fluid, probably a light oil or hydraulic fluid. Although the mill building is posted with no trespassing signs, it is open and there are numerous high places from which to fall. Finally, the gate to the adit has been vandalized so that entry into the mine workings is possible.

4.16 RICHMOND GROUP, URBANE MINE, AND BISMUTH PROSPECT

4.16.1 Site Location and Access

The Richmond Group (T3S R5W Sec. 22 AACA), Urbane mine (T3S R5W Sec. 22 AACB), and Bismuth prospect (T3S R5W Sec. 22 ABDD) are on BNF-administered land along a tributary to Goodrich Gulch. Access to the sites is via a rough road that turns north off the Goodrich Gulch road.

4.16.2 Site History - Geologic Features

The Richmond Group consists of numerous adits, trenches, and dumps. Mining activities disturbed many acres, but most of the workings are on a dry, south-facing hillside. Host rock is Cambrian Flathead sandstone and Woolsey shale. The ore consists of quartz veins with iron-oxide veinlets and native gold. Iron-oxide staining is the only evidence of mineralization on the dumps.

The Urbane is located a short distance down the drainage from the Richmond. Workings at the site include two adits and accompanying dumps. Host rock is Precambrian gneiss. Gold and silver ore were produced from a brecciated, iron-oxide gangue at this mine.

The Bismuth prospect consists of a caved adit and a mid-sized dump. Host rock is Precambrian gneiss. A surface assay sample included gold, silver, copper, lead, zinc, and iron. Mineralizaton on the dump includes limonite staining and trace amounts of chalcopyrite and pyrite in quartz veins.

4.16.3 Environmental Condition

At each site, waste rock is present in the flood plain of the small tributary to Goodrich Gulch (figures 4.36, 4.37, and 4.38). The waste is not highly mineralized, and is not eroding appreciably.

4.16.3.1 Site Features - Sample Locations

Water-quality samples were collected upstream (JRIS10H) and downstream (JRIS20H) of the three sites on August 29, 1996. The flow rate of the creek at the upstream location was 7 gpm; at the downstream location, the rate was 9 gpm.

Composite soil sample JRID10L was collected from the streamside dumps at the Bismuth and Urbane. No sample was collected at the Richmond because the dump material was very coarse.

Figures 4.39 and 4.40 are photographs of the Bismuth and Urbane sites, respectively.

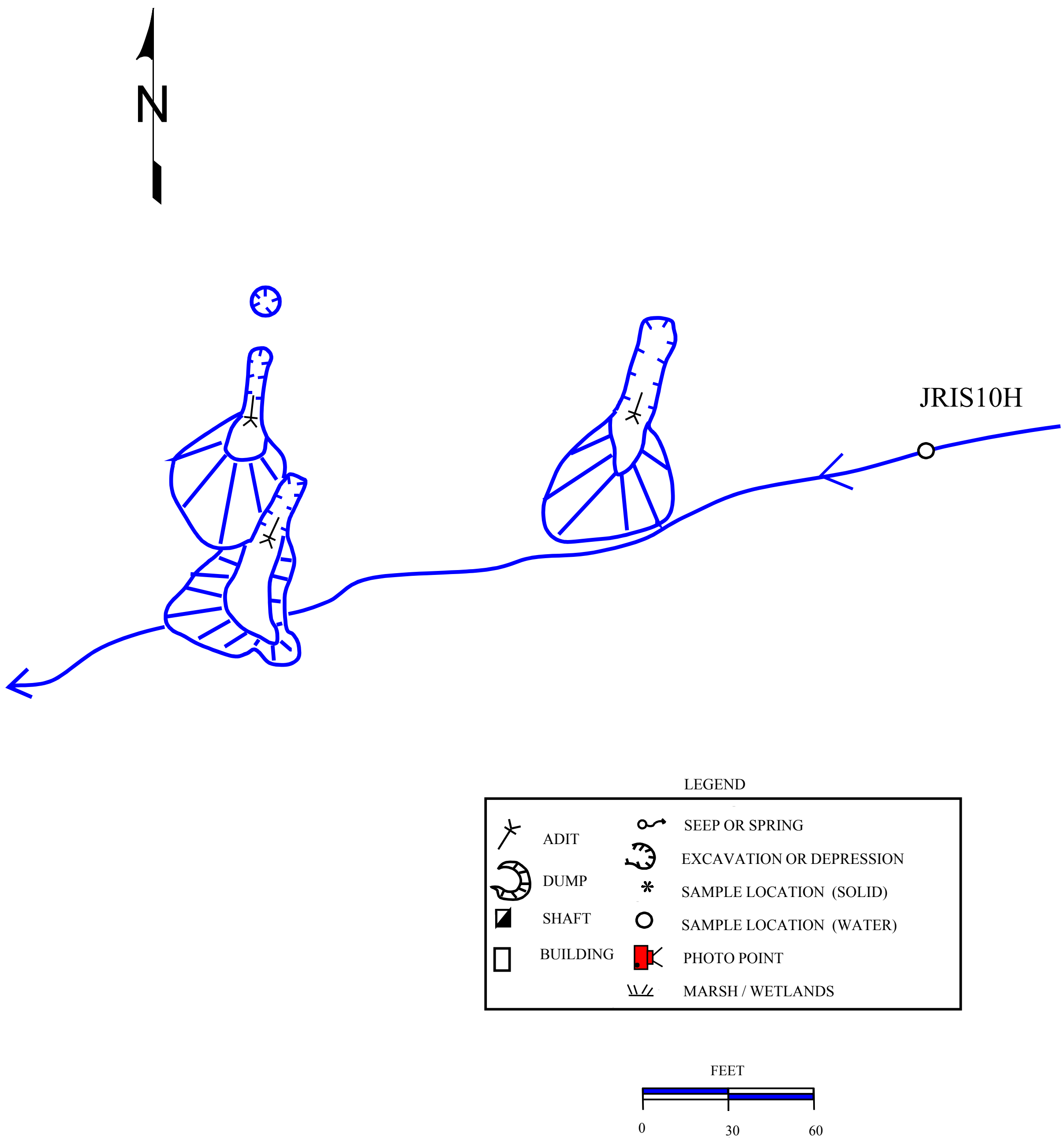

Figure 4.36 Site map of the Richmond Group mine, August 1996.

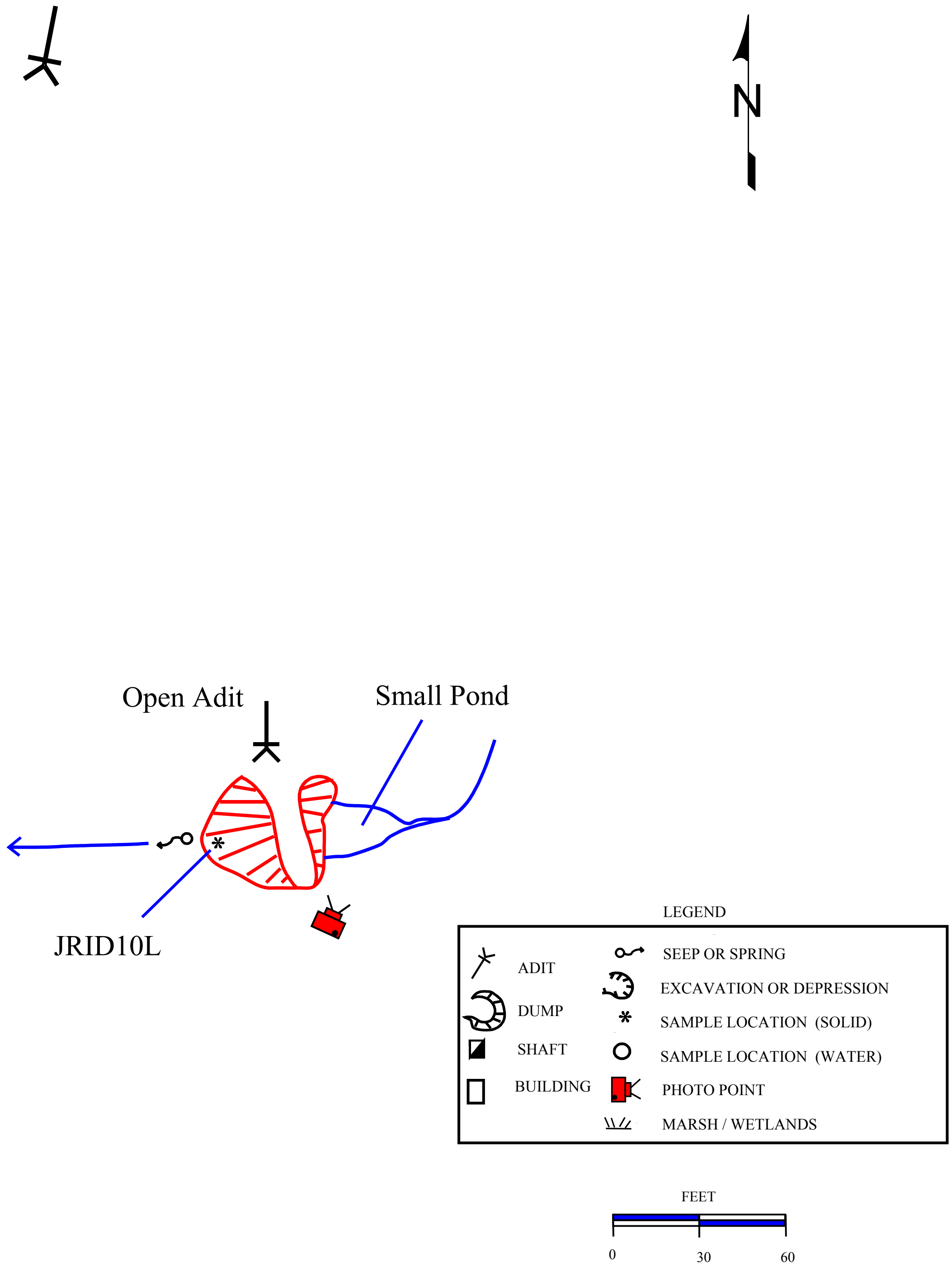

Figure 4.37 Site map of the Urbane mine, August 1996.

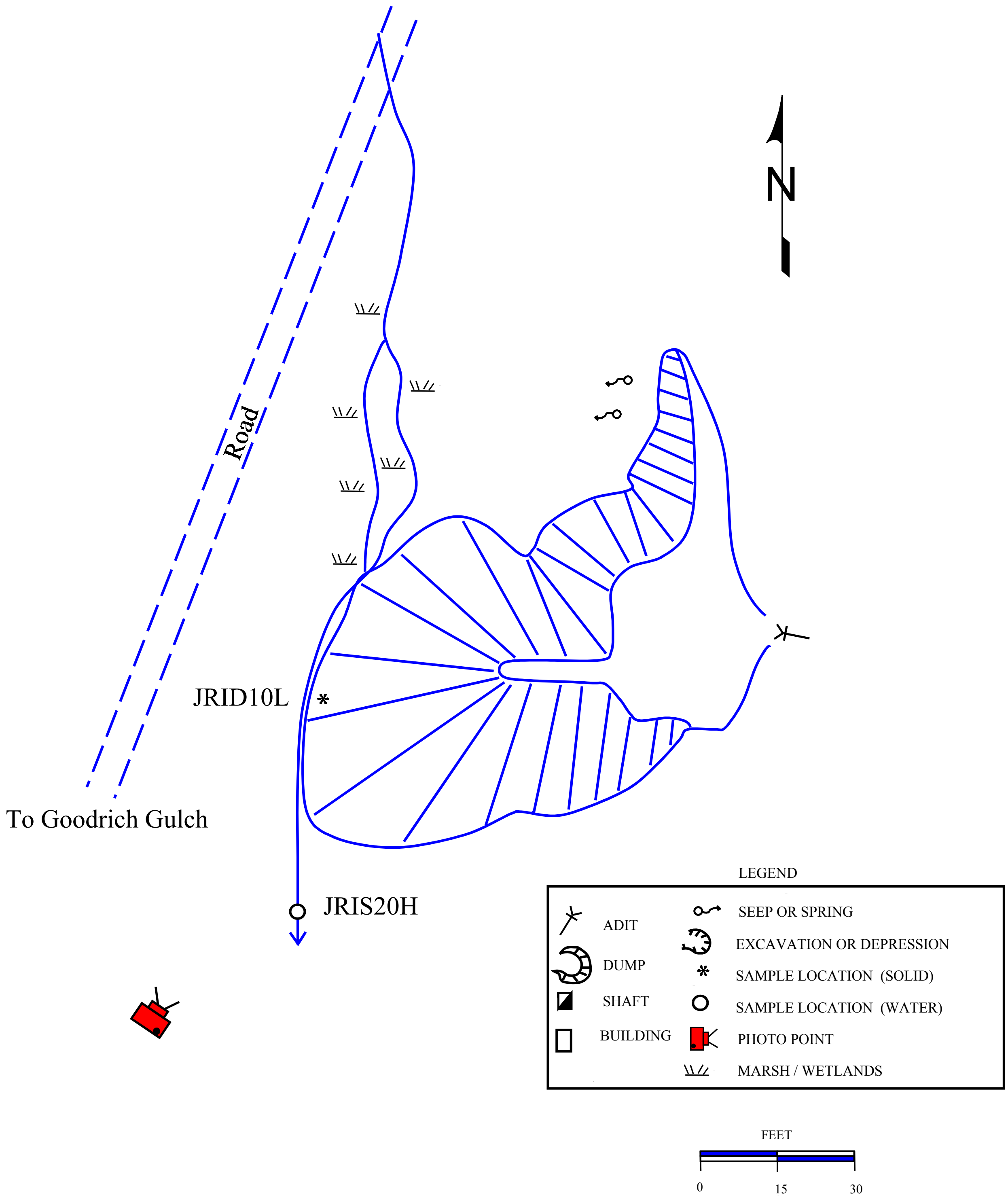

Figure 4.38 Site map of the Bismuth mine, August 1996.

Figure 4.39 At the Bismuth prospect, a small tributary to Goodrich Gulch flows past a mid-sized waste-rock dump.

Figure 4.40 Water collects in a small pond behind a waste-rock dump at the Urbane mine.

4.16.3.2 Soil

The soil composite from the Urbane and Bismuth streamside dumps contained concentrations of arsenic, cadmium, copper, lead, and zinc above one or more Clark Fork Superfund background levels (table 4.15). However, none of the metals occurred at concentrations above phytotoxic levels.

Table 4.15 Soil sampling results (mg/kg) for the Urbane mine and Bismuth prospect.

Sample Location	**As**	**Cd**	**Cu**	**Pb**	**Zn**
Composite sample from streamside dumps at Urbane mine and Bismuth prospect (JRID10L)	12.0[1]	2.5[1]	22[1]	76.0[1]	383[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3)
(2) Exceeds phytotoxic levels (table 1.3)

4.16.3.3 Water

Water quality upstream and downstream of the sites was good. No standards were exceeded.

4.16.3.4 Vegetation

The waste-rock dumps at all three sites are moderately vegetated with grasses and brush.

4.16.3.5 Summary of Environmental Conditions

The streamside wastes at these sites currently are stable and do not significantly impact soil or water quality on BNF-administered land. However, a major runoff or precipitation event could cause erosion of the dumps because they are close to an active stream.

4.16.4 Structures

No structures were observed at the sites.

4.16.5 Safety

At the Urbane mine, there is an open adit that is a safety concern. The adits at the other sites have collapsed.

4.17 SCHMIDT PROSPECT

4.17.1 Site Location and Access

The Schmidt prospect (T3S R5W Sec. 24 ABBD) is on a patented claim at the head of Goodrich Gulch, just west of the Old Baldy Mountain summit. The site is accessed by following a Forest Service road east of Twin Bridges and then hiking 2.5-miles along a foot trail.

4.17.2 Site History - Geologic Features

Workings at the site consist of multiple caved adits and accompanying dumps. Surface disturbances are spread over about an acre. Host rock is Precambrian gneiss; gangue mineralogy is quartz. Winchell (1914) reported oxidized ore rich in gold near the surface. The dumps today are heavily stained with iron-oxides and contained abundant sulfides (mostly pyrite and chalcopyrite).

4.17.3 Environmental Condition

The site's lowermost waste-rock dump is in contact with the watercourse in Goodrich Gulch. The dump is composed of fine to cobble-sized material that contains some sulfides.

4.17.3.1 Site Features - Sample Locations

Water-quality samples were collected several hundred yards upstream (JSMS10L) and downstream (JSMS20L) of the site on August 29, 1996. The flow rate of the creek was estimated to be 0.2 cfs at both sample locations. Site features and sample locations are shown on figure 4.41; figures 4.42 and 4.43 are photographs of the site.

4.17.3.2 Soil

No soil samples were collected from the streamside dump because it is on private land. Also, no waste material was observed on the BNF-administered land downstream of the mine.

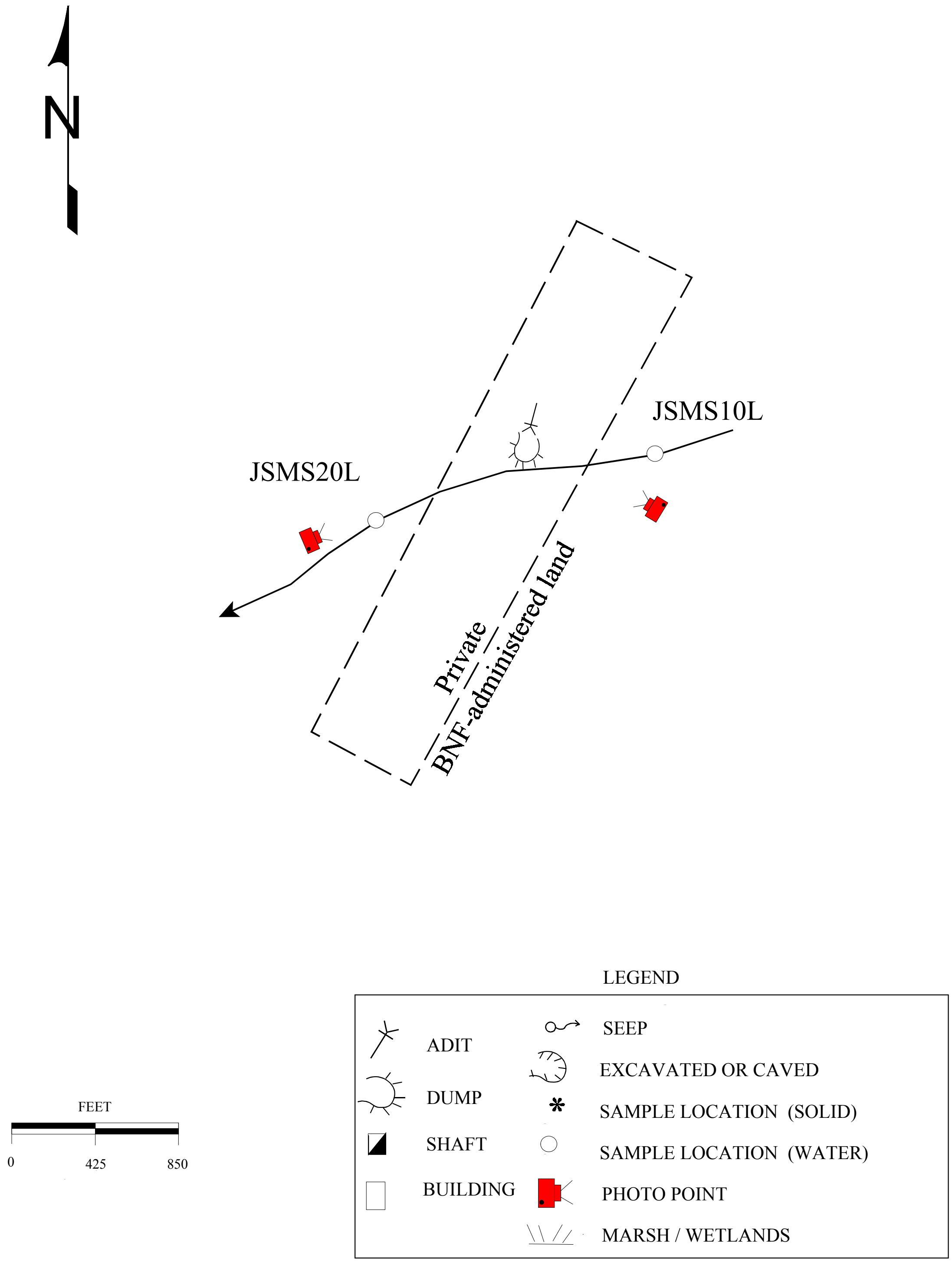

Figure 4.41 Site map of the Schmidt North prospect, August 1996.

Figure 4.42 The Schmidt prospect's lowermost waste-rock dump is in contact with the watercourse in Goodrich Gulch.

Figure 4.43 Sample JSMS20L was collected downstream of the mine to determine if streamside waste rock had impacted water quality.

4.17.3.3 Water

Downstream of the site, the concentration of mercury was found to be 0.11 :g/l, which exceeds the chronic aquatic life standard of 0.012 :g/l (table 4.16).

Table 4.16 Water-quality exceedences at the Schmidt prospect.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Goodrich Gulch watercourse - upstream of mine (JSMS10L)																			
Goodrich Gulch watercourse - downstream of mine (JSMS20L)										C									

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

Note: The analytical results are listed in appendix V

4.17.3.4 Vegetation

Although most of the streamside dump is barren, the portion bordering Goodrich Gulch has naturally revegetated. No impacts to vegetation were observed downstream of the site.

4.17.3.5 Summary of Environmental Conditions

During spring runoff and heavy precipitation events, erosion of the prospect's streamside dump may contribute to metal loading in the Goodrich Gulch watercourse. However, under low flow conditions which prevail most of the year, the dump appears stable and probably does not significantly impact soil or water quality on BNF-administered land.

Because mercury was detected at low concentrations downstream of the site, further sampling should be conducted to verify and characterize its occurrence. Mercury could be associated with the ore body, or it may have been used to recover gold at the site.

4.17.4 Structures

A collapsed cabin is located on private land at the site. No structures were observed on adjoining BNF-administered land.

4.17.5 Safety

No hazards were noted at the site.

4.18 SMUGGLER MINE

4.18.1 Site Location and Access

The Smuggler mine (T4S R4W Sec. 13 DCCB) is located on BNF-administered land about 1.5 miles west of the Mill Creek Campground. A ghost town associated with the mine is visible from the main road that parallels Mill Creek.

4.18.2 Site History - Geologic Features

Winters *et al.* (1994) stated that a N75°W 70°SW fault zone hosts ore zones up to 10 feet thick. Rock fragments on the dump suggest that calc-silicate gneiss with abundant calcite hosts the deposit and that it may be associated with a feldspar-hornblende-rich igneous intrusion.

Select samples assayed up to 1.6 oz/ton gold, 0.76 oz/ton silver, 0.01% copper, 0.99% lead, and 0.054% zinc. According to Winters *et al.* (1994), there is a high potential for significant resources at the site.

Development included 2,450 feet of underground workings and a 100-ton amalgamation and gravity mill (Trauerman and Waldron 1940). Tailings are confined to a dry meadow.

4.18.3 Environmental Condition

This site consists of a caved adit (A-1, figure 4.44) that discharges water. The discharge flows across some waste rock before it sinks into the ground. The adit is about 500 feet from Mill Creek.

4.18.3.1 Site Features - Sample Locations

The site was visited and sampled on August 21, 1996 and September 10, 1996. A sample of the adit discharge (JSMS10L) was collected about 40 feet from the portal. The discharge was flowing at about 6 gpm. Site features and the sample location are shown on figure 4.44; figures 4.45 and 4.46 are photographs of the site.

4.18.3.2 Soil

No soil samples were collected at the site.

4.18.3.3 Water

The water quality of the adit discharge was good; no standards were exceeded.

4.18.3.4 Vegetation

The waste rock is sparsely to well vegetated. Along the course of the adit discharge, vegetation is dense.

4.18.3.5 Summary of Environmental Condition

At the Smuggler mine, the adit discharge is of good quality and waste rock is not being actively eroded. The site is not adversely impacting BNF-administered land.

4.18.4 Structures

There are three mine buildings on site; two are in bad shape and one was in good condition (B-1, figure 4.44). The nearby ghost town consists of six cabins that are in good condition.

4.18.5 Safety

There is some minor garbage on site, but no safety hazards were identified.

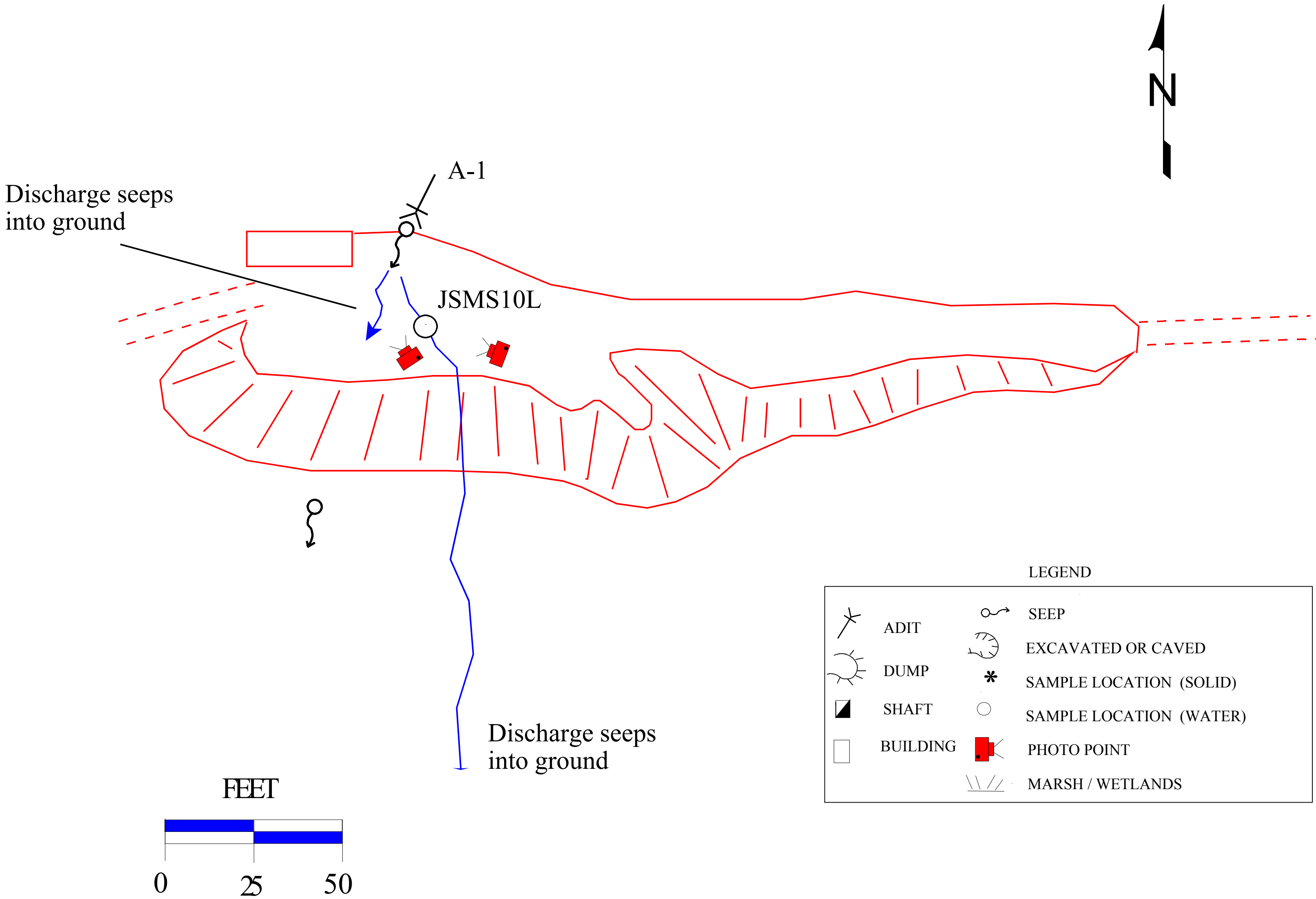

Figure 4.44 Site map for the Smuggler mine, September 1996. The adit discharge sinks into the ground about 200 to 300 feet from Mill Creek.

Figure 4.45 The collapsed adit portal at the Smuggler mine is located near a mine building that is in good condition.

Figure 4.46 Sample JSMS10L was collected about 40 ft from the portal. The path of the discharge was well vegetated.

4.19 UNCLE SAM MINE

4.19.1 Site Location and Access

The Uncle Sam mine is located on the Middle Fork of Mill Creek (T4S R3W Sec. 17 AABB). The site is on BNF-administered land and is accessible by road; however, a gate restricts access to motorized vehicles.

4.19.2 Site History - Geologic Features

The Uncle Sam mine must have been one of the major operations of the Sheridan district. A N35˚E 30˚NW quartz-pyrite-sphalerite-galena-chalcopyrite vein up to 2 feet thick (Winters *et al.* 1994) in biotite schist was mined. Mineralization also appears to be disseminated in the host rocks, which include biotite schist with siderite and sericite alteration products and feldspar-hornblende porphyry related to the Tobacco Root batholith.

The best select samples taken by Winters *et al.* (1994) contained 1.15 oz/ton gold, 5.5 oz/ton silver, 1.3% copper, 1.3% lead, and 1.5% zinc.

Workings consist of three open adits (one with a locked gate) and five caved adits (noted by Winters *et al.* 1994). More than 1,800 feet of underground workings are present (Trauerman and Waldron 1940).

4.19.3 Environmental Condition

The site's lowest adit (A-1, figure 4.47) has a 3 gpm discharge that flows over some waste rock before sinking into the ground about 200 ft from the Middle Fork of Mill Creek. The course of the discharge is stained with iron-oxyhydroxide precipitates. The uppermost adit (A-2) discharges a small amount of water into the creek through a PVC pipe.

The presence of salts, sulfides, and staining indicate the waste-rock dumps at the site are highly mineralized. Also, the waste rock generally is devoid of vegetation. One dump is in contact with the Middle Fork of Mill Creek and is being actively eroded.

4.19.3.1 Site Features - Sample Locations

The site was visited and sampled on August 22, 1996 and September 23, 1996. Water-quality sample JUSS01H was collected from the A-1 adit discharge. The discharge from the A-2 adit was not sampled because not enough water was flowing at the time of the site visit.

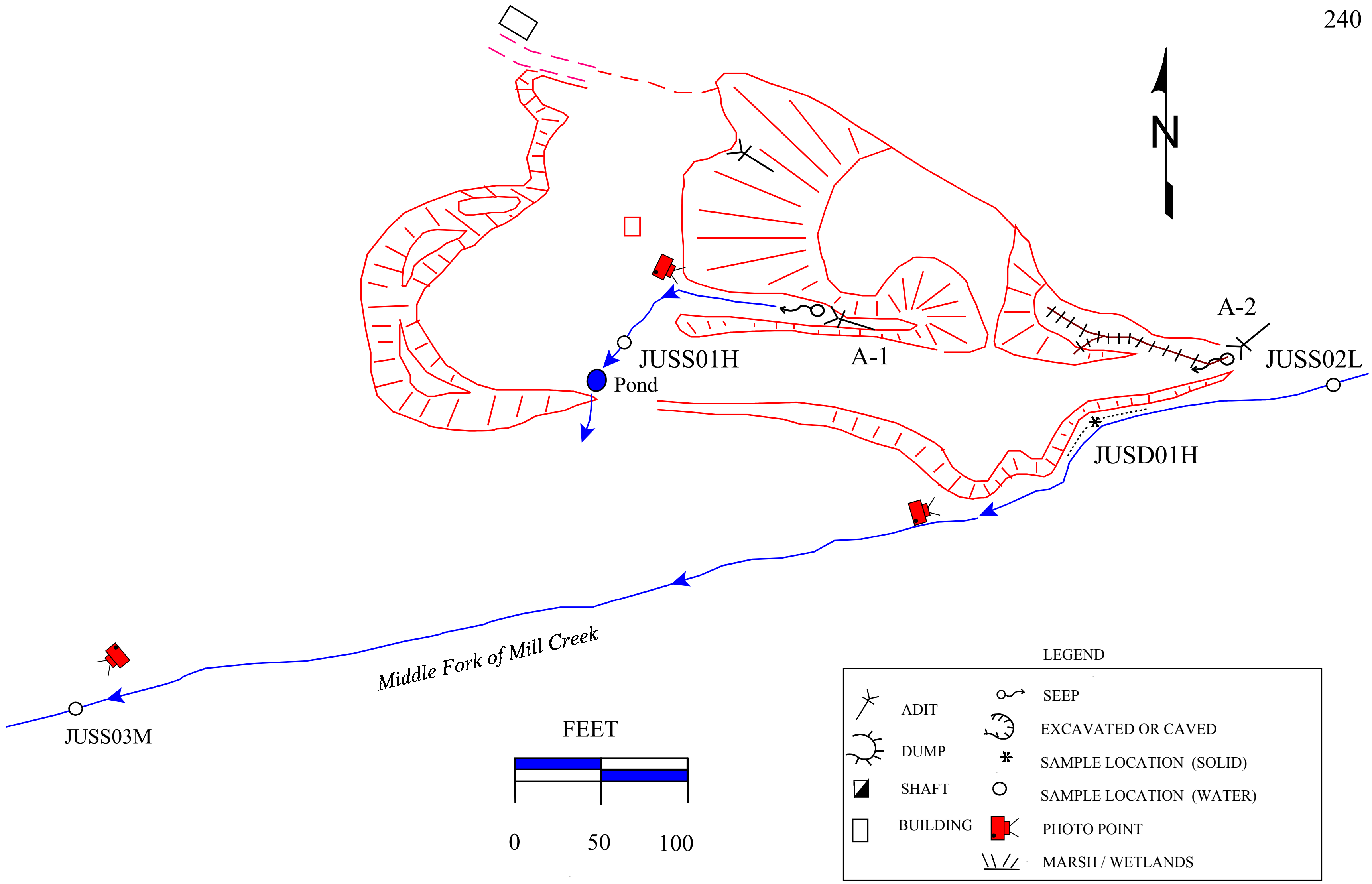

Figure 4.47 Site map of the Uncle Sam mine, September 1996. Waste rock is in contact with the Middle Fork of Mill Creek.

The Middle Fork of Mill Creek was sampled upstream (JUSS02L) and downstream (JUSS03M) of the mine site to determine impacts to the creek from the adit discharges and the erosion of waste rock. The flow rate at the upstream location was 112 gpm; at the downstream location, the rate was 90 gpm.

Finally, a composite soil sample was collected of the waste rock where it is in contact with the creek (JUSD01H).

Site features and the sample location are shown on figure 4.47; figures 4.48 and 4.49 are photographs of the site

4.19.3.2 Soil

The concentration of arsenic in the soil sampled from the streamside waste dump was above Clark Fork Superfund background and phytotoxic levels (table 4.17). Cadmium, copper, lead, and zinc were above one or more the Clark Fork Superfund background levels but did not exceed phytotoxic concentrations.

Table 4.17 Soil sampling results (mg/kg) for the Uncle Sam mine.

Sample Location	As	Cd	Cu	Pb	Zn
Streamside waste rock (JUSD01H)	158[1,2]	61[1]	80[1]	126[1]	148[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3)
(2) Exceeds phytotoxic levels (table 1.3)

4.19.3.3 Water

The sample from the adit discharge (table 4.18, JUSS01H) exceeded the acute aquatic life standard for zinc and the chronic aquatic life standards for zinc and cadmium. The secondary MCL for manganese also was exceeded.

The metal concentrations in the upstream and downstream samples from the Middle Fork of Mill Creek were low and exceeded no standards. The field pHs, about 8.55 at both locations, were slightly above the upper secondary MCL limit of 8.5; however, the pHs measured in the laboratory were within the acceptable range.

Figure 4.48 The lowermost adit at the Uncle Sam mine is open and has an iron-stained discharge.

Figure 4.49 A mineralized waste-rock dump is being actively eroded by the Middle Fork of Mill Creek.

Table 4.18 Water-quality exceedences at the Uncle Sam mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Middle Fk Mill Cr - upstream of site (JUSS02L)																			S*
Adit A-1 discharge (JUSS01H)				C					S				A,C						
Middle Fk Mill Cr - downstream of site (JUSS03M)																			S*

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic
- * Laboratory pH was within the acceptable range of 6.5-8.5

Note: The analytical results are listed in appendix V

4.19.3.4 Vegetation

The waste-rock dumps at the site are devoid of vegetation.

4.19.3.5 Summary of Environmental Condition

The discharge from the A-1 adit contains elevated concentrations of several metals. Ground water in the vicinity of the discharge is probably impacted, but because the discharge is relatively small, its impact on the Middle Fork of Mill Creek appears negligible. The streamside waste rock poses a more serious environmental problem. During high flow events, it is likely that material eroded from the dump increases the total and dissolved metal load in the creek.

4.19.4 Structures

There is a cabin adjacent to the road that leads to the mine site. The cabin is being maintained and is in good condition. There is also a building on site that is related to the mine operations. This structure is also in good condition.

4.19.5 Safety

The lower adit is open and thus provides easy access to the mine workings. The upper adit has a gate that restricts access. Several of the waste rock dumps on site have steep slopes and footing is loose.

4.20 UNNAMED 03S05W26DBAC MINE

4.20.1 Site Location and Access

The Unnamed 03S05W26DBAC mine (T3S R5W Sec. 26 DBAC) is located on BNF-administered land east of the town of Twin Bridges. The site is within the Wet Georgia Gulch drainage, a tributary to the Jefferson River. The site can be accessed by road, but during wet weather, caution must be used because clay makes the road surface extremely slick.

4.20.2 Site History - Geologic Features

Workings at the site consist of a caved adit with a medium-sized dump. The surface disturbance covers less than a tenth of an acre. Host rock is Precambrian gneiss and white quartz is the gangue. The dump is stained with iron oxides and has trace amounts of sphalerite(?) and malachite.

4.20.3 Environmental Condition

A small clear discharge flows from the collapsed adit that is located on a steep slope several hundred feet above Wet Georgia Gulch (figure 4.50). The discharge sinks into the ground less than 20 feet from the portal.

4.20.3.1 Site Features - Sample Locations

A water-quality sample (RUNS10H) was collected from the adit discharge on August 28, 1996. The flow rate of the discharge was less than 0.1 gpm. Site features and the sample location are shown on figure 4.50; figures 4.51 and 4.52 are photographs of the site.

4.20.3.2 Soil

Soils at the site did not appear to be impacted by metal contamination, and erosion was minor; therefore, no soil samples were collected.

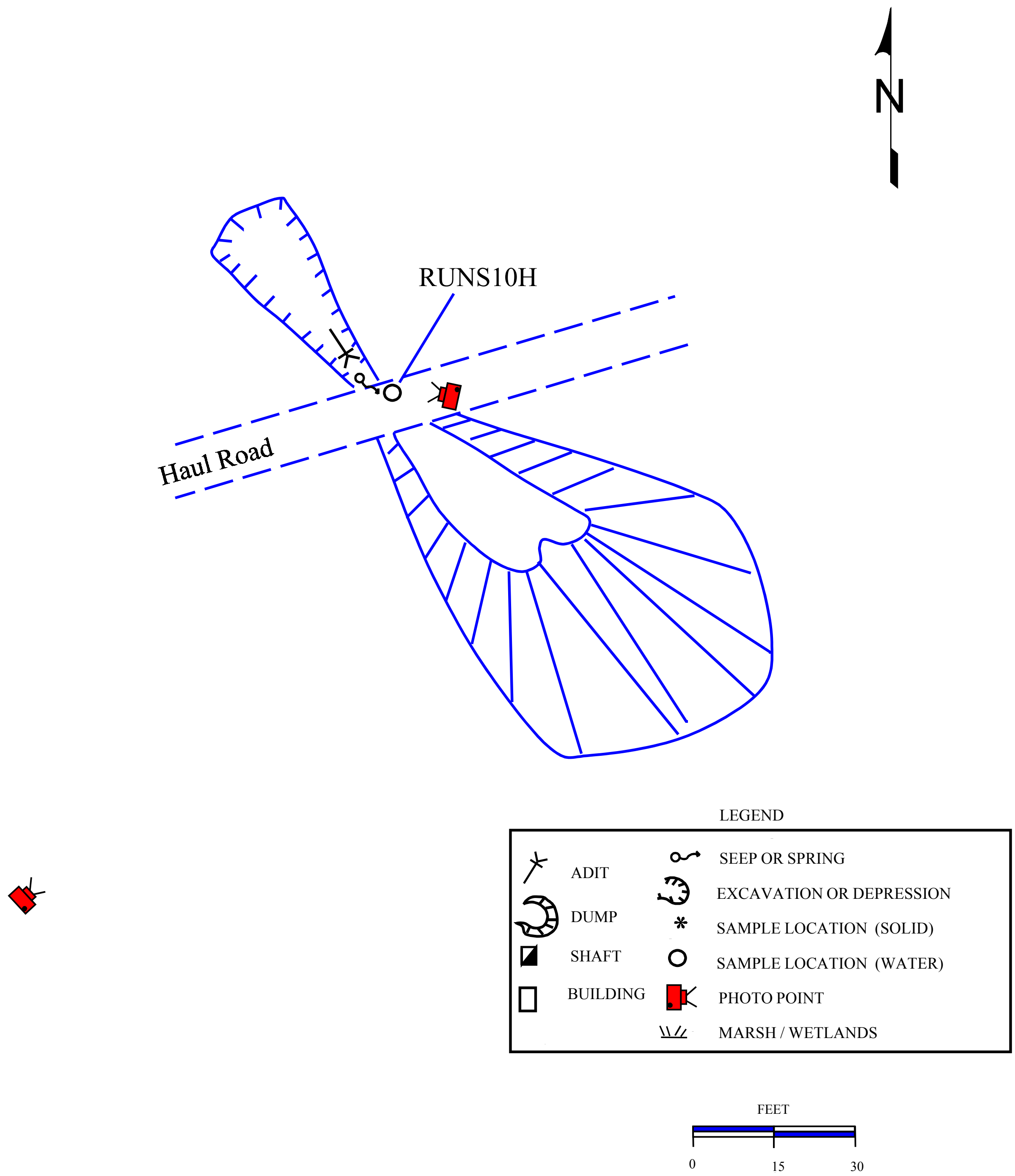

Figure 4.50 Site map of the Unnamed 03S05W26DBAC mine, August 1996.

Figure 4.51 The Unnamed 03S05W26DBAC mine is located on a steep slope above Wet Georgia Gulch.

Figure 4.52 Sample RUNS10H was collected from the adit discharge at the site.

4.20.3.3 Water

The water quality of the adit discharge was good; none of the target analytes occurred at concentrations above their standards.

4.20.3.4 Vegetation

The site's waste-rock dump is moderately vegetated with grasses and brush. Vegetation close to the adit discharge appeared healthy.

4.20.3.5 Summary of Environmental Conditions

This site poses little, if any, environmental concern. The water quality of the small adit discharge appears to be good, and the nearby waste-rock dump is stable and naturally revegetating.

4.20.4 Structures

No structures were observed at the site.

4.20.5 Safety

No safety problems were observed at the site.

5.0 ENVIRONMENTAL IMPACT SUMMARY

A total of 387 mine and/or mill sites were identified that are on or near the southern portion of the Beaverhead-Deerlodge National Forest. Of these sites, 253 were visited by the MBMG to investigate for possible environmental problems. Forty-four sites were found to have potential environmental impacts on BNF-administered land, and water and soil samples were collected to assess the extent of the impacts; a list of these sites is presented in table 5.1. If a water-quality standard was exceeded at a site, it is noted in the table. Seventeen of the sites had no water-quality problems, and therefore the exceedence columns are blank. Sites where six or more parameters exceeded standards include the Elkhorn mine and mill, the Frisbee mine, the Martin mine, and the Park mine. Sites where three to five parameters exceeded standards include the Clara, Uncle Sam, Unnamed Belt Shale, and Wellman Group/New York Claim mines. The remaining 19 sites only had one or two parameters that exceeded standards.

More than half of the 44 sites listed in table 5.1 had potential mine-waste erosion problems. These sites are identified in the table with an asterisk (*). The Elkhorn mine and mill, Leiter mill tailings, Martin mine, Queen of the Hill tailings, and Trapper mine and mill have streamside wastes with high concentrations of arsenic, copper, lead, and/or zinc and are obviously impacting BNF-administered lands. Wastes at the Bismuth, Carney, Clara, Ibex , Richmond, Urbane, and Unnamed Trout Creek sites are at risk of eroding but were found to contain relatively low metal concentrations.

Table 5.1 List of investigated sites with potential environmental problems and summary of water-quality exceedences.

Site Drainage Basin	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Bobsled and OCJ Claims* Big Hole																			
Brownes Lake Tungsten* Big Hole										C		C							
Branham Basin JMR																			S[1]
Calvert (Red Button)* Big Hole										C									
Capitol Beaverhead-Red Rock	S																		
Carney* Big Hole	S,C																		
Clara* Big Hole	S,C						S,A		S										S
Copper Queen Beaverhead-Red Rock							S,A		S										
Cousin Jack JMR																			
Diadem Group (Arnold) Big Hole							S		S										
Elkhorn mine and mill* Big Hole	S,A C			P,A C		S,A C	S,A	P,C	S				A,C						S
Elkhorn -Upper Camp Big Hole						S			S										
Elm Orlu Big Hole																			

Table 5.1 List of investigated sites with potential environmental problems and summary of water-quality exceedences (continued).

Site Drainage Basin	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Farlin Gulch Adit* Big Hole																			
French Creek* Beaverhead-Red Rock																			
Frisbee* JMR	S,C			C		A,C		P,C	S				A,C						S
Greenwood Concentrator* Big Hole																			
Ibex* Big Hole																			S
Independence Gulch Claim No. 1* JMR										C									
Indian Queen Mine and Smelter Big Hole																			
Jahnke Big Hole												C							
Lakeshore* JMR																			S[1]
Leiter Mill Tailings* JMR																			
Lone Wolf* JMR																			
Lucky Strike* Beaverhead-Red Rock																			
Martin* Big Hole						C	S,A	C	S			A,C							S[1]

Table 5.1 List of investigated sites with potential environmental problems and summary of water-quality exceedences (continued).

Site Drainage Basin	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Missouri-McKee/ Snowslide* JMR																			S[1]
Park Big Hole						A,C	S	C	S			C	A,C						S
Pedro (Pot Rustler) and Pedro Middle JMR																			
Presidential-Demos Group JMR	S,C																		S
Queen of the Hills Mine Big Hole																			S[1]
Queen of the Hills Tailings* Big Hole				C															S
Red Pine* JMR																			
Richmond Group*, Urbane*, and Bismuth Prospect* JMR																			
Schmidt Prospect* JMR										C									
Smuggler JMR																			
Trapper Mine and Mill* Big Hole																			
Uncle Sam* JMR				C					S				A,C						S[1]

Table 5.1 List of investigated sites with potential environmental problems and summary of water-quality exceedences (continued).

Site Drainage Basin	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Unnamed 03S05W26DBAC JMR																			
Unnamed Belt Shale Beaverhead-Red Rock	S,AC						S		S										
Unnamed Trout Creek* Beaverhead-Red Rock												C							
Wellman Group/New York Claim Beaverhead-Red Rock	S,C					A,C			S				A,C						

Exceedence codes:

- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic
- S[1] - pH measure in laboratory was within acceptable secondary MCL range of 6.5-8.5.

Note: The analytical results are listed in appendix V.

JMR: Jefferson, Madison, and Ruby river drainages

6.0 REFERENCES

Benham, J.R. 1981. Mineral resources of the West Pioneer RARE II Area No. 1-006, BeaverheadCounty, Montana: U.S. Bureau of Mines MLA Open File Report 4-81, 38 pp.

Bump, K. 1998. National Forest Service Administrator. Dillon, Montana. Personal communication with Robert Wintergerst and Richard Marvin. March 1998.

Burger, H.R. 1967. Bedrock geology of the Sheridan district, Madison County, Montana. Montana Bureau of Mines and Geology Memoir 41. 22 pp.

Cather, E.E., and Linne, J.M. 1983. Mineral resource investigation of the Middle Mountain-Tobacco Root Rare II area, Madison County, Montana. U.S. Bureau of Mines Open-File Report MLA 95-83. 26 pp.

Close, T. J. 1994. Mineral resources of the East Pioneer study area, Beaverhead County, Montana. U.S. Bureau of Land Management unpublished report.

DeBoer, T.A. 1991. Geology and mineralization of the Lentung tungsten skarn deposit near Brownes Lake, Pioneer Mountains, Montana. M.S.thesis, Western Washington University. 200 pp. Map and cross section scale 1" = 200'.

Department of Natural Resources and Conservation (Montana) 1981. Water Storage in the Big Hole – A Recommendation. Water Resources Division, Helena, Montana. 46 pp.

Department of Natural Resources and Conservation (Montana) 1995. Measuring Devices on the Big Hole River–Draft Report. Water Resources Division, Water Measurement Program, Helena, Montana. 36 pp.

Elliott, J. E., Loen, J. S., Wise, K. K., and Blaskowski, M. J. 1992. Maps showing locations of mines and prospects in the Butte 1° x 2° quadrangle, western Montana. U.S. Geological Survey Miscellaneous Investigations Map I-2050-C.

Evans, H. J. 1946. Report on the mining properties of Boston Mines Company, Beaverhead County, Montana. Internal report to Marvin E. Walker, MBMG files, Rm. 213, Main Hall, Butte, MT. 25 pp.

Eyde, T.H. 1958. The Potosi tungsten district, Madison County, Montana. Montana Bureau of Mines and Geology Information Circular 21. 51 pp.

Eyde, T.H. 1957. The Potosi tungsten district Madison County, Montana: M.S. thesis, Montana.

Fearing, F. C., and Winchell, A. N. 1922. Private study on the Hecla mines, Bryant mining district. Montana Bureau of Mines and Geology files, room 213, Main Hall, Butte.

Fluorescent Mining Corporation 1944. Unpublished U.S. Geological Survey report that discusses Star Claims/Fluorescent Claims. Montana Bureau of Mines and Geology files, room 213, Main Hall, Butte.

Geach, R. D. 1972. Mines and mineral deposits (except fuels), Beaverhead County, Montana. Montana Bureau of Mines and Geology Bulletin 85. 194 pp.

Gilbert, F. C. 1935. Directory of Montana mining properties. Montana Bureau of Mines and Geology Memoir 15. 99 pp.

Goudarzi, H. 1941. Geology and ore deposits of the Quartz Hill area, Beaverhead County, Montana. M.S. thesis, Montana School of Mines, Butte. 53 pp.

Harrington, N. 1993. Personal communication. Montana Department of Health and Environmental Sciences, Helena, Montana 59620.

Hem, J. D. 1985. Study and interpretation of the chemical characteristics of natural waters. U.S. Geological Survey Water-Supply Paper 2254, 3rd Edition. 263 pp. with plates.

Karlstrom, T. N. V. 1948. Geology and ore deposits of the Hecla mining district, Beaverhead County, Montana. Montana Bureau of Mines and Geology Memoir 25. 87 pp.

Kinley, T. M. 1987. The occurrence and timing of gold mineralization at the Red Pine mine, western Tobacco Root Mountains, southwestern Montana. M. S. thesis, Montana State University, Bozeman. 129 pp.

Lambeth, R. H., and Mayerle, R. T. 1983. Mineral investigation of the Italian Peak RARE II area (No. 1-1945), Beaverhead County, Montana, and Italian Peak Middle RARE II area (No. m-4945), Clark and Lemhi counties, Idaho. U.S. Bureau of Mines. Mineral Land Assessment Open-File Report 53-83. 26 pp.

Lawson, D. C. 1976. Directory of mining enterprises, with a list of coal mines and a section on the mineral industry of Montana in 1975. Montana Bureau of Mines and Geology Bulletin 100. 63 pp.

Lawson, D. C. 1980. Directory of mining enterprises for 1979. Montana Bureau of Mines and Geology Bulletin 111. 52 pp.

Lindsay, W. L. 1979. Chemical Equilibria in Soils. John Wiley & Sons, New York. 449pp.

Lipton, D. A., 1988, Mineral resources of the West Big Hole study area, Beaverhead County, Montana: U.S. Bureau of Mines MLA 16-88, 158 p.

Loen, J. S., and Pearson, R. C. 1984. Mines and prospects of the Dillon 1˚ x 2˚ quadrangle, Idaho and Montana. U.S. Geological Survey Open-File Report 84-377. 93 pp.

Loen, J. S., and Pearson, R. C. 1989. Map showing locations of mines and prospects in the Dillon 1º x 2º quadrangle, Idaho and Montana. U.S. Geological Survey Miscellaneous Investigations Series Map I-1803-C. 85 pp. Scale 1:250,000.

Lorain, S. H. 1937. Gold lode mining in the Tobacco Root Mountains, Madison County, Montana. U.S. Bureau of Mines and Geology Information Circular 6972. 74 pp.

Lowell, W. R. 1965. Geologic map of the Bannack-Grayling area, Beaverhead County, Montana. U.S. Geological Survey Miscellaneous Geologic Investigations Map I-433. 6 pp. 1 sheet. Scale 1: 31,680.

Lyden, C. J. 1948. The gold placers of Montana. Montana Bureau of Mines and Geology Memoir 26, Reprint 6. 151 pp.

McClernan, H. G. 1977. Metallogenesis of mineral deposits in Cambrian carbonate rocks, southwestern Montana. Ph.D. dissertation, University of Idaho, Moscow. 122 pp.

McClernan, H. G. 1982. Lead-zinc-silver deposits in carbonate host rocks in Montana: Mississippi Valley-type(?). Montana Bureau of Mines and Geology Open-file report 104. 10 pp.

Metesh, J.J. 1992. Quality Assurance Project Plan for Mine Site Preliminary Assessments - Deerlodge National Forest. Montana Bureau of Mines Open-File Report. May 1992.

M'Gonigle, J. W. and Hait, M. H. Jr. 1997. Geologic map of the Jeff Davis Peak quadrangle and the eastern part of the Everson Creek quadrangle, Beaverhead County, southwest Montana. U.S. Geological Survey Geologic Investigations Map I-2604.

Miller, T. 1996. Big Hole Water Treatment Facility, Superintendent of Plants. Telephone conversation with Richard Marvin.

MINOBRAS 1975. Montana Industrial minerals. 66 pp.

Montana Standard 1997. Newspaper article on May 27. Butte.

Mottana, A., Rodolfo, C., and Liborio, G. 1978. Simon and Schuster's guide to rocks and minerals. Simon and Schuster. New York. 607 pp.

Myers, W. B. 1952. Geology and mineral deposits of the northwest quarter of Willis quadrangle and adjacent Brownes Lake area, Beaverhead County, Montana–A preliminary report. U.S. Geological Survey Open-File Report 147. 46 pp.

National Oceanic and Atmospheric Administration 1991. Climatological data from Montana. vol. 90, no. 12.

Northern Testing Laboratories 1982. Report of geotechnical investigation (to Abandoned Mine Reclamation Bureau, Department of State Lands), hard rock mine dump and mill pond project, western Montana, Volumes I and II. 26 pp. and 13 pp. With appendices (trace element analyses test results, cross sections, logs of exploration holes), Billings, Montana.

O'Neill, J. M. 1983. Geologic map of the Middle Mountain-Tobacco Root Roadless Area, Madison County, Montana. U.S. Geological Survey Miscellaneous Field Studies Map MF-1590-A. Scale 1:50,000.

O'Neill, J. M., Cather, E., and Linne, J. M. 1983. Mineral resource potential map of the Middle Mountain-Tobacco Root roadless area, Madison County, Montana: U.S. Geological Survey Miscellaneous Field Studies Map MF-1590-C.

Pardee, J. T., and Schrader, F. C. 1933. Metalliferous deposits of the greater Helena mining region, Montana. U.S. Geological Survey Bulletin 842. 318 pp.

Pattee, E. C. 1960. Tungsten resources of Montana: deposits of the Mount Torrey batholith, Beaverhead County. U.S. Department of the Interior Bureau of Mines Report of Investigations 5552. 40 pp.

Pearson, R. C., and Zen. E. A. 1985. Geologic map of the eastern Pioneer Mountains, Beaverhead County, Montana. U.S. Geological Survey miscellaneous map MF-1806-A. Scale 1:50,000.

Perry, E. S. 1948. Talc, graphite, vermiculite and asbestos in Montana. Montana Bureau of Mines and Geology Memoir 27. 44 pp.

Pioneer Technical Services, Inc. (with assistance by: Thomas, Dean and Hoskins, Inc.) 1995. Abandoned hardrock mine priority sites, summary report (for Montana Department of State Lands Abandoned Mines and Reclamation Bureau). 598 pp.

Popoff, C. C., and Service, A. L. 1965. An evaluation of the western phosphate industry and its resources, Part 2. Montana. U.S. Bureau of Mines Report of Investigations 6611. 146 pp.

Reid, R. R. 1957. Bedrock geology of the north end of the Tobacco Root Mountains, Madison County, Montana. Montana Bureau of Mines and Geology Memoir 36. 25 pp.

Reyner, M. L., and Trauerman, C. J. 1950. Directory of Montana mining properties, 1949. Montana Bureau of Mines and Geology Memoir 31. 125 pp.

Ruppel, E. T., O'Neill, J. M., and Lopez, D. A. 1983. Geologic map of the Dillon 1˚ x 2˚ degree quadrangle, Idaho and Montana. U.S. Geological Survey Miscellaneous Investigations Series Map I-1803-H. Scale 1:250,000.

Sahinen, U.M. 1935. Mining districts of Montana. M.S. thesis, Montana School of Mines, Butte, Montana. 109 pp.

Sassman, O. 1941. Metal mining in historic Beaverhead County. M.A. thesis, Montana State University, Bozeman. 310 pp.

Schmidt, C. J., and Garihan, J. M. 1986. Middle Proterozoic and Laramide tectonic activity along the southern margin of the Belt basin. Montana Bureau of Mines and Geology Special Publication 94. p. 217-236.

Schutz, J. L. 1986. Geology of precious metal mineralization in the Baldy Mountain district, Beaverhead County, Montana. M.S. thesis, Colorado State University, Fort Collins. 190 pp. 3 maps.

Shenon, P. J. 1927. Gold at Bannack, Montana. Engineering and Mining Journal 123(8):326.

Shields, R. R., White, M. K., Ladd, P. B., and Chambers, C. L. 1997. Water resources of Montana, water year 1996. U.S. Geological Survey Water-Data Report MT-96-1. 458 pp.

Soil Conservation Service 1977. Average annual precipitation–Montana, based on 1941-1970 base period. U.S. Department of Agriculture. 13 pp.

Stumm W., and Morgan J. J. 1981. Aquatic Chemistry: an Introduction Emphasizing Chemical Equilibria in Natural Waters. John Wiley & Sons, New York. 780 pp.

Swanson, R.W. 1970. Mineral resources in Permian rocks of southwest Montana. U.S. Geological Survey Professional Paper 313-E. p. 661-771. plates 26-29.

Tansley, W., Schafer, P. A., and Hart, L. H. 1933. A geological reconnaissance of the Tobacco Root Mountains, Madison County, Montana. Montana Bureau of Mines and Geology Memoir 9. 57 pp.

Trauerman, C. J., and Waldron, C. R. 1940. Directory of Montana mining properties. Montana Bureau of Mines and Geology Memoir 20. 34 pp.

Trexler, B. D. Jr., Ralston, D. A., Reece, D. A., and Williams, R. E. 1975. Sources and causes of acid mine drainage. Idaho Bureau of Mines and Geology Pamphlet 165. 129 pp.

Truckle, D. M. 1988. Geology of the Calvert Hill area, Beaverhead County, Montana. M.S. thesis, Montana College of Mineral Science and Technology, Butte. 94 pp. 2 plates.

Vitaliano, C. J., and Cordua, W. S. 1979. Geologic map of southern Tobacco Root Mountains, Madison County, Montana. Geological Society of America Map and Chart Series MC-31. Scale 1:62,500.

Walker, D. D. 1963. Tungsten resources of western Montana, miscellaneous deposits. U.S. Bureau of Mines Report of Investigations 6334. 60 pp.

Wallace (Idaho) Miner (The) 1981. Commodity section, June 4.

Winchell, A. N. 1914. Mining districts of the Dillon quadrangle, Montana, and adjacent areas. U.S. Geological Survey Bulletin 574. 191 pp.

Winters, R., Graham, D., Hillman, T., Hughes, C., and Johnson, R. 1994. Mineral resource appraisal of the Beaverhead National Forest, Montana. U.S. Bureau of Mines MLA 18-94. 84 pp. 9 appendices.

Wisdom Ranger District Files 1997. U.S. Forest Service, Wisdom, Montana.

Wood, J. M., Kennedy, F. S., and Rosen, C. G. 1968. Synthesis of methyl-mercury components by extracts of a methanogenic bacterium: Nature 220:173-174.

Zen E. A. No date. Map showing Granite & Tiger mine location. Montana Bureau of Mines and Geology files, room 213, Main Hall, Butte.

APPENDIX I
USFS-MBMG 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 and 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 all 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.

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-$^1/4$ miles ___$^1/4$-$^1/2$ miles ___$^1/2$ -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-$^1/4$ miles ___$^1/4$-$^1/2$ miles ___$^1/2$ -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
LIST OF SITES IN THE SOUTHERN BEAVERHEAD-DEERLODGE NATIONAL FOREST

ID	Site Name	Drainage*	1:24k Quadrangle
BE000852	ADAMS PEAK CLAIMS	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000156	AJAX MINE	BIGHOLE	HOMER YOUNGS PEAK
BE000594	AMADEN	BIGHOLE	TORREY MOUNTAIN
BE004320	ANDERSON DEPOSIT - ASBESTOS	BEAVERHEAD	DEER CANYON
BE000282	ARGENTA (GLADSTONE) MINE	BEAVERHEAD	ERMONT
MA006884	ARGENTA ADIT 1	JMR	OLD BALDY MOUNTAIN
BE000808	CLAIMS	BIGHOLE	ODELL LAKE
BE000947	AURORA MINE	BIGHOLE	VIPOND PARK
BE008345	BARBOUR (BARBER ?) GULCH ADITS	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000035	BEAVERHEAD (LUCKY STRIKE)	BEAVERHEAD	LEMHI PASS
MA003285	BEDFORD	JMR	RAMSHORN MOUNTAIN
MA003135	BELLE	JMR	POTOSI PEAK
MA003785	SWEAT	JMR	PONY
BE000528	BESTOS & VIDAH CLAIMS	BEAVERHEAD	DEER CANYON
MA003793	BEULRH / BEULAH	JMR	POTOSI PEAK
MA004152	BIG CHIEF MINE	JMR	
BE004215	BIG FOUR MINE	BIGHOLE	MOUNT TAHEPIA
MA007100	BIG TOM MINE	JMR	
MA007250	BINS MINE/ BINS MINES	JMR	RAMSHORN MOUNTAIN
BE000624	BIRCH CREEK IRON	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000664	BIRCH CREEK LIMESTONE	BIGHOLE	TWIN ADAMS MOUNTAIN
BE008319	BIRCH CREEK PLACER	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000604	BIRCH CREEK-CAVE GULCH AREA	BEAVERHEAD	ARGENTA
MA006809	BISMARK-NUGGET ADITS	JMR	OLD BALDY MOUNTAIN
MA006785	BISMUTH PROSPECT	JMR	OLD BALDY MOUNTAIN
BE000796	BLACK BEAR	BIG HOLE	STEWART MOUNTAIN
BE000846	BLACKMORE / PEAR LAKE	BIGHOLE	TORREY MOUNTAIN
BE008306	BLUE BELL MINE / BLUE BELT	BIGHOLE	VIPOND PARK
BE004275	BLUE EYED ANNIE MINE	BEAVERHEAD	ELKHORN HOT SPRINGS
BE000581	BOBSLED & O.C.J. CLAIMS	BIGHOLE	MAURICE MOUNTAIN
BE008307	BONANZA	BIGHOLE	VIPOND PARK
BE004295	BONAPART PROSPECT	BIGHOLE	MOUNT TAHEPIA
BE000766	BOSTON AND MONTANA COMPANY	BIGHOLE	ELKHORN HOT SPRINGS
BE004010	BOZEADAR PROPERTY	BIGHOLE	TORREY MOUNTAIN
MA008404	BRANHAM BASIN MINE	JMR	POTOSI PEAK
BE000642	/IVANHOE	BIGHOLE	STORM PEAK
BE000592	BROWNES LAKE-LOST CREEK AREA	BIGHOLE	STORM PEAK
BE000906	BRYANT MINING DISTRICT (HECLA)	BIGHOLE	MOUNT TAHEPIA
MA003780	BUFFALO CREEK PLACER	JMR	CIRQUE LAKE
BE003910	BUFFALO GROUP	BEAVERHEAD	DEER CANYON
MA006803	BULLIDICK PROSPECT	JMR	OLD BALDY MOUNTAIN
MA008083	BUNGALOW	JMR	POTOSI PEAK
BE000162	BURGIEROS A / G-W MINE	BIGHOLE	VIPOND PARK
BE008203	BUSTER CLAIMS	BIGHOLE	TORREY MOUNTAIN
BE000168	BUSTER MINE	BIGHOLE	TORREY MOUNTAIN
BE000652	CABIN CREEK AREA	BEAVERHEAD	ISLAND BUTTE
BE000636	CALVERT (RED BUTTON CLAIM)	BIGHOLE	FOOLHEN MOUNTAIN
MA000247	CALVERTS CLAIMS	JMR	CIRQUE LAKE
BE000072	CANNIVAN GULCH	BIGHOLE	VIPOND PARK
BE000486	CAPITOL MINE	BEAVERHEAD	ARGENTA
BE008346	CARNEY MINE	BIGHOLE	JACKSON HILL
MA006836	CAROLINA MINE	JMR	OLD BALDY MOUNTAIN
BE000550	CATTLE GULCH SYNCLINE	BIGHOLE	CATTLE GULCH
BE004525	CAVE CREEK	BEAVERHEAD	ARGENTA
BE000816	CAVE NITRATE	BEAVERHEAD	CABOOSE CANYON
BE000989	CHURCHILL MINE	BIGHOLE	DEWEY

ID	Site Name	Drainage*	1:24k Quadrangle
BE000875	EAST AURORA MINE	BIGHOLE	VIPOND PARK
BE000898	EAST END OF LIMA DISTRICT	BEAVERHEAD	LIMA PEAKS
BE000606	ECHO LODE	BEAVERHEAD	POLARIS
MA006833	ELENORA	JMR	OLD BALDY MOUNTAIN
MA008071	ELKHORN	JMR	PONY
BE008334	ELKHORN - UPPER CAMP	BIGHOLE	ELKHORN HOT SPRINGS
BE000564	ELKHORN HOT SPRINGS	BEAVERHEAD	ELKHORN HOT SPRINGS
BE008333	ELKHORN MILL	BIGHOLE	ELKHORN HOT SPRINGS
BE000582	ELKHORN MINE / OLD ELKHORN MINE	BIGHOLE	ELKHORN HOT SPRINGS
MA006863	ELLA MINE	JMR	OLD BALDY MOUNTAIN
BE000611	ELM ORLU	BIGHOLE	MOUNT TAHEPIA
MA006821	EMPIRE STATE	JMR	OLD BALDY MOUNTAIN
BE004465	FAIRVIEW	BIGHOLE	TWIN ADAMS MOUNTAIN
MA006956	FAIRVIEW MINE	JMR	OLD BALDY MOUNTAIN
BE008322	FARLIN GULCH ADIT	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000670	FITZWATER CLAIMS	BIGHOLE	TORREY MOUNTAIN
SB006364	FLEECER MOUNTAIN AREA	BIGHOLE	DEWEY
BE008321	FLORENCE AND LILLY	BIGHOLE	TWIN ADAMS MOUNTAIN
BE003880	FLUORESCENT AND STAR CLAIMS	BIGHOLE	STORM PEAK
BE000270	FLUORITE NO. 1	BEAVERHEAD	ERMONT
BE000822	FOOL HEN PROSPECT / FOOLHEN	BIGHOLE	FOOLHEN MOUNTAIN
BE004610	FOREST QUEEN	BIGHOLE	MOUNT TAHEPIA
BE004615	FRACTION MINE	BIGHOLE	MOUNT TAHEPIA
BE000186	FRANKLIN MINE	BIGHOLE	MOUNT TAHEPIA
BE000784	FRANKLIN NO. 1	BIGHOLE	STEWART MOUNTAIN
BE000197	FRENCH & WATSON GULCHES PLACER	BEAVERHEAD	ERMONT
DL004924	FRENCH CREEK PLACER	BIGHOLE	LINCOLN GULCH
MA003140	FRISBEE / FRISBIE	JMR	RAMSHORN MOUNTAIN
BE008041	GALLAGHER GULCH PROSPECTS	BEAVERHEAD	GALLAGHER GULCH
BE008331	GARNET ADIT	BIGHOLE	STORM PEAK
MA005560	GARRISON MINE	JMR	CIRQUE LAKE
BE004250	GLADSTONE	BEAVERHEAD	ERMONT
BE000768	GLOW WORM PROSPECT; GREENHORN CLAIM	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000149	GOB MINE	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000887	GOLD COIN MINE	BIGHOLE	VIPOND PARK
BE000150	GOLD NUGGET	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000760	GOLDEN DAWN MINE	BEAVERHEAD	ERMONT
BE000288	GOLDEN ERA MINE	BEAVERHEAD	ERMONT
BE000294	GOLDFINCH MINE	BEAVERHEAD	ERMONT
MA003535	GOODRICH GULCH PLACER	JMR	OLD BALDY MOUNTAIN
BE008320	GRANITE	BIGHOLE	TWIN ADAMS MOUNTAIN
BE004035	GRANITE AND TIGER MINES	BIGHOLE	MOUNT TAHEPIA
MA003100	GRAY EAGLE	JMR	NOBLE PEAK
BE000893	GRAY JOCKEY MINE / GREY JOCKEY	BIGHOLE	VIPOND PARK
BE000899	GREAT WESTERN MINE	BIGHOLE	VIPOND PARK
MA004082	GREEN JACKET	JMR	POTOSI PEAK
BE000546	GREENSTONE MINE	BIGHOLE	TWIN ADAMS MOUNTAIN
BE008327	GREENWOOD CONCENTRATOR	BIGHOLE	MOUNT TAHEPIA
MA004187	GRIGG GROUP / GRIGG MOLYBDENUM	JMR	POTOSI PEAK
BE000593	GUY MINE	BEAVERHEAD	ELKHORN HOT SPRINGS
BE000144	HAGGERTY PROPERTY/KOPPER KOIN	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000826	HARKNESS	BEAVERHEAD	EIGHTEENMILE PEAK
BE000754	HARKNESS NORTH	BEAVERHEAD	EIGHTEENMILE PEAK
BE004020	HARRISON / DORA	BIGHOLE	WISE RIVER
BE000252	HAZEL PROSPECT	BEAVERHEAD	POLARIS
BE004025	HECLA MINE	BIGHOLE	MOUNT TAHEPIA

BE000965	CLARA MINE (MONTY CLINTON)	BIGHOLE	WISDOM
MA004512	CLARK'S WARM SPRINGS / POTOSI	JMR	POTOSI PEAK
BE004545	CLEOPATRA MINE	BIGHOLE	MOUNT TAHEPIA
BE000180	CLEVE-AVON GROUP	BIGHOLE	MOUNT TAHEPIA
BE000790	COEUR D'ALENE	BIGHOLE	STEWART MOUNTAIN
BE000660	COMET MINE; COMET GROUP	BEAVERHEAD	ELKHORN HOT SPRINGS
BE004550	COOLIDGE TOWNSITE	BIGHOLE	ELKHORN HOT SPRINGS
MA006857	COP PROSPECT	JMR	OLD BALDY MOUNTAIN
BE000864	COPPER CONTACT CLAIM	BIGHOLE	TWIN ADAMS MOUNTAIN
MA008337	COPPER MOUNTAIN SOUTHEAST	JMR	COPPER MOUNTAIN
BE008335	COPPER QUEEN	BEAVERHEAD	ELKHORN HOT SPRINGS
BE000600	COPPER QUEEN MINE	BIGHOLE	GOLDSTONE PASS
MA006842	CORNCRACKER MINE	JMR	OLD BALDY MOUNTAIN
MA003070	CORNELIA	JMR	NOBLE PEAK
MA003145	COUSIN JACK	JMR	POTOSI PEAK
MA003748	COUSIN JENNIE	JMR	POTOSI PEAK
BE000526	CROOKED RUN CREEK	BEAVERHEAD	LIMA PEAKS
BE000827	CROSS MINE	BEAVERHEAD	ERMONT
MA004087	CROWN POINT CLAIM	JMR	POTOSI PEAK
MA006890	CRYSTAL LAKE	JMR	OLD BALDY MOUNTAIN
BE004195	DAISY VEIN MINE	BIGHOLE	VIPOND PARK
MA003575	DAIZY NO. 1 / DAISY NO. 1	JMR	
BE004575	DARK HORSE / DARKHORSE MINE	BIGHOLE	GOLDSTONE PASS
MA003305	DEMOCRAT	JMR	OLD BALDY MOUNTAIN
MA004092	ROGER,	JMR	POTOSI PEAK
MA008405	DEMOS GROUP MILL	JMR	POTOSI PEAK
BE000682	DEWEY	BIGHOLE	DEWEY
BE000120	DIADEM GROUP (ARNOLD) MINE	BIGHOLE	STEWART MOUNTAIN
BE004530	DISCOVERY MINE	BEAVERHEAD	ERMONT
BE004435	DOODLE BUG	BEAVERHEAD	JEFF DAVIS PEAK
MA003540	DRY GEORGIA GULCH	JMR	OLD BALDY MOUNTAIN
BE000694	DRY HOLLOW GULCH PROSPECT	BIGHOLE	CATTLE GULCH
MA004137	DULEA MINE	JMR	RAMSHORN MOUNTAIN
BE004580	DUTCHMAN MINING CO. MINE	BEAVERHEAD	ERMONT
BE004440	HENRY MINE	BEAVERHEAD	ERMONT
MA007226	HIGH RIDGE (AREA)	JMR	OLD BALDY MOUNTAIN
MA005592	HOGBACK MOUNTAIN PHOSPHATE	JMR	SPUR MOUNTAIN
BE004410	IBEX MINE / BEAR PAW / UP-2	BIGHOLE	ODELL LAKE
MA008040	INDEPENDENCE GULCH CLAIM NO. 1	JMR	OLD BALDY MOUNTAIN
BE000802	INDIAN GIRL	BIGHOLE	SHAW MOUNTAIN
BE000828	INDIAN QUEEN MINE	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000774	INTERNATIONAL PROSPECT	BIGHOLE	TORREY MOUNTAIN
BE004050	JACK KNIGHT PROSPECT	BEAVERHEAD	TORREY MOUNTAIN
BE004460	JACK MINE	BEAVERHEAD	ERMONT
BE000504	JAHNKE MINE / STRAIGHT TIP GROUP	BIGHOLE	GOLDSTONE PASS
BE000935	JOE MAURICE MINE	BIGHOLE	MAURICE MOUNTAIN
MA000379	JOHNNY GULCH MINE	JMR	BUCKS NEST
MA003090	JONQUIL / TONQUIL	JMR	NOBLE PEAK
BE000834	JUMBO GROUP (BURCH, U.S. TREASURER,	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000468	JUMPER NO 1	BIGHOLE	ISAAC MEADOWS
BE000755	KATE CREEK GRAPHITE DEPOSITS	BEAVERHEAD	DEER CANYON
BE000730	KELLEY GULCH	BEAVERHEAD	ERMONT
BE004205	KEOKUK MINE, KEOKIRK	BIGHOLE	MOUNT TAHEPIA
MA004102	KEYSTONE CLAIM	JMR	POTOSI PEAK
BE000911	KEYSTONE MINE	BIGHOLE	WISE RIVER
BE008382	KEYSTONE UPPER WORKINGS	BIG HOLE	WISE RIVER
MA005608	KIDD MINE	JMR	RAMSHORN MOUNTAIN
BE004200	KNOBY MINE	BIGHOLE	VIPOND PARK
MA006770	KRUEGER NORTH ADIT	JMR	OLD BALDY MOUNTAIN
BE000910	LA MARCHE CREEK	BIGHOLE	MELROSE
MA006905	LAKESHORE MINE AND MILL	JMR	NOBLE PEAK
BE000772	LAST CHANCE	BIGHOLE	STEWART MOUNTAIN
BE000820	LAST CHANCE	BEAVERHEAD	EIGHTEENMILE PEAK
BE000762	LAST CHANCE GROUP, SHADY TREE	BEAVERHEAD	LEMHI PASS
BE000540	LAST CHANCE NO. 3	BEAVERHEAD	EIGHTEENMILE PEAK
BE000258	LEGAL TENDER MINE	BEAVERHEAD	ERMONT
MA008362	LEGGAT	JMR	NOBLE PEAK
MA008245	LEITER/LEITERVILLE MILL TAILINGS	JMR	NOBLE PEAK

ID	Site Name	Drainage*	1:24k Quadrangle
BE004085	LEN CLAIMS	BIGHOLE	STORM PEAK
BE000052	LENTUNG (PROSPECT) DEPOSIT	BIGHOLE	STORM PEAK
BE000510	LIMA GYPSUM MINE	BEAVERHEAD	LIMA PEAKS
BE004495	LIME KILN GULCH QUARRY	BIGHOLE	DEWEY
BE000089	LIMESTONE OCCURRENCE	BIGHOLE	CATTLE GULCH
BE004370	LION MOUNTAIN GROUP	BIGHOLE	MOUNT TAHEPIA
BE008328	LION MOUNTAIN TUNNEL	BIGHOLE	MOUNT TAHEPIA
MA003315	LITTLE GOLDIE	JMR	OLD BALDY MOUNTAIN
BE000058	LITTLE MOOSE HORN	BIGHOLE	ISAAC MEADOWS
BE003835	LITTLE SHEEP CREEK	BEAVERHEAD	GALLAGHER GULCH
BE000904	LITTLE SHEEP CREEK AREA	BEAVERHEAD	GALLAGHER GULCH
BE000514	LITTLE WATER CANYON	BEAVERHEAD	DIXON MOUNTAIN
BE008204	LM CLAIMS	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000917	LOG CABIN LODE	BIGHOLE	VIPOND PARK
BE000923	LONE PINE MINE (QUARTZ HILL)	BIGHOLE	VIPOND PARK
MA006866	LONE STAR PROSPECT	JMR	OLD BALDY MOUNTAIN
MA003790	LONE WOLF AND CATARACT	JMR	PONY
BE000498	LOST CREEK MINE - "B" ADIT	BIGHOLE	TWIN ADAMS MOUNTAIN
BE008340	LOST CREEK MINE - "H" ADIT	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000598	SYNCLINE	BIGHOLE	TWIN ADAMS MOUNTAIN
MA006839	LOTTIE MINE	JMR	OLD BALDY MOUNTAIN
BE004070	QUEEN PROPERTY	BIGHOLE	TWIN ADAMS MOUNTAIN
BE008384	RANGER	BIG HOLE	HOMER YOUNGS PEAK
MA005768	RANGER MINE	JMR	OLD BALDY MOUNTAIN
BE000948	RANGER MINE	BEAVERHEAD	POLARIS
MA006818	RED BELL	JMR	OLD BALDY MOUNTAIN
MA004467	RED PINE MINE	JMR	NOBLE PEAK
BE000712	RED ROCK BASIN	BEAVERHEAD	DELL
MA007187	RICHMOND GROUP	JMR	OLD BALDY MOUNTAIN
BE008338	ROADSIDE ADITS, SEC. 15	BEAVERHEAD	ELKHORN HOT SPRINGS
BE000858	ROCKY HUEEP (PROSPECT)	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000342	ROSEMONT MINE	BEAVERHEAD	ARGENTA
BE000155	S.S.& R. MINE	BEAVERHEAD	TEPEE MOUNTAIN
BE000570	SAGINAW MINE	BIGHOLE	SELWAY MOUNTAIN
BE000036	SANTA MARIA RAINBOW GROUP	BIGHOLE	TWIN ADAMS MOUNTAIN
BE008330	SAPPINGTON CREEK SHAFT	BIGHOLE	MOUNT TAHEPIA
MA006815	SCHMIDT PROSPECTS NORTH	JMR	OLD BALDY MOUNTAIN
BE008300	SEC 27 UNNAMED MINE	BIGHOLE	BIG HOLE PASS
MA008085	SECTION 13 MILLSITE	JMR	RAMSHORN MOUNTAIN
MA008086	SECTION 14 MILLSITE	JMR	RAMSHORN MOUNTAIN
BE008342	SECTION 14 MINES	BIGHOLE	ELKHORN HOT SPRINGS
BE000508	SHEEP CREEK	BEAVERHEAD	DELL

BE004420	LOWER CLEVE TUNNEL	BIGHOLE	MOUNT TAHEPIA
BE000084	PULL..	BIGHOLE	JACKSON HILL
MA007142	LUCKY SILVER	JMR	OLD BALDY MOUNTAIN
BE000066	LUCKY STRIKE MINE	BEAVERHEAD	JEFF DAVIS PEAK
BE004005	LUCKY STRIKE MINE	BEAVERHEAD	ARGENTA
BE000714	LUKE SI QUARRY	BIG HOLE	CATTLE GULCH
BE004185	MAGNET MINE - MAGNA MINE	BEAVERHEAD	ELKHORN HOT SPRINGS
BE000012	MAIDEN CREEK COPPER MINE	BEAVERHEAD	DEADMAN PASS
MA006854	MAINSTREET	JMR	OLD BALDY MOUNTAIN
BE003915	MAMMOTH ADIT	BIGHOLE	STORM PEAK
MA000979	MANGANESE OCCURRENCE	JMR	SPUR MOUNTAIN
BE000971	MARTIN MINE	BIGHOLE	STEWART MOUNTAIN
BE003920	PAYDAY	BEAVERHEAD	ARGENTA
BE000977	MAYNARD MINE / SHADY REST	BIGHOLE	STEWART MOUNTAIN
BE000646	MCBRIDE CREEK	BEAVERHEAD	DEER CANYON
BE000090	DEADWOOD	BEAVERHEAD	DELL
BE000599	MCCONNELL (WELLMAN) GROUP	BEAVERHEAD	ELKHORN HOT SPRINGS
BE000330	MCDONALD	BEAVERHEAD	ERMONT
BE003940	MINNIE GAFFNEY MINE	BIGHOLE	MOUNT TAHEPIA
MA007166	MINES	JMR	RAMSHORN MOUNTAIN
BE008205	MOLYTUNG CLAIMS	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000515	MONAGHAN PROSPECT	BIGHOLE	TORREY MOUNTAIN
MA000529	MONITOR	JMR	
BE000894	MONTANA LODE	BIGHOLE	ISAAC MEADOWS
MA003065	MONTANA MINE	JMR	NOBLE PEAK
MA004097	MONTE CRISCO / MONTE CHRISTO	JMR	
BE000929	MONTE CRISTO MINE	BIGHOLE	VIPOND PARK
BE000888	MOOSEHORN MINE / MOOSE HORN	BIGHOLE	ISAAC MEADOWS
MA008264	MOUNT JACKSON MINE	JMR	NOBLE PEAK
MA003788	MOUNTAIN MEADOW	JMR	PONY
MA004067	MOUNTAIN ROSE CLAIM	JMR	POTOSI PEAK
SB006416	GROUP	BIGHOLE	DEWEY
BE000966	MT. TORY, MOUNT TORREY ?	BIGHOLE	TORREY MOUNTAIN
MA003320	NETTIE	JMR	OLD BALDY MOUNTAIN
BE000378	NEW ARIADNE MINE	BIGHOLE	MOUNT TAHEPIA
BE003905	ATLANTUS)	BIGHOLE	MOUNT TAHEPIA
MA003695	NEW DEAL	JMR	POTOSI PEAK
MA006791	NEW YORK PROSPECT	JMR	OLD BALDY MOUNTAIN
MA003595	NOBLE LOWER ADIT	JMR	NOBLE PEAK
BE008021	NORTH HAZEL PROSPECTS	BEAVERHEAD	POLARIS
BE000815	STAR	BIGHOLE	DICKIE HILLS
MA003128	OCCIDENTAL SOUTH	JMR	NOBLE PEAK
BE003960	ATLANTUS	BIGHOLE	MOUNT TAHEPIA
BE003965	ORO FINO MINE	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000605	ORO GRANDE & ECLIPSE	BEAVERHEAD	ELKHORN HOT SPRINGS
MA007055	OXIDENTAL / OCCIDENTAL	JMR	NOBLE PEAK
BE008043	PARADISE CLAIM	BEAVERHEAD	ERMONT
BE000587	PARK MINE	BIGHOLE	ELKHORN HOT SPRINGS
BE003975	PARK MINE	BEAVERHEAD	ERMONT
SB006572	PATSY ANN MINE	BIGHOLE	DICKIE PEAK
BE008042	PAY DAY GROUP	BEAVERHEAD	ARGENTA
MA002993	PEDRO	JMR	COPPER MOUNTAIN
MA002998	PEDRO MIDDLE	JMR	COPPER MOUNTAIN
BE003985	PETE AMPO MINE	BIGHOLE	CATTLE GULCH
BE000881	PETTINGILL MINE / PETTINGALE	BIGHOLE	VIPOND PARK
BE000750	PHYLLIS CLAIM	BIGHOLE	TWIN ADAMS MOUNTAIN
BE003990	PINE TREE MINE	BEAVERHEAD	ERMONT
BE000474	PIONEER MINE	BIGHOLE	GOLDSTONE PASS

BE008069	SHEEP CREEK MINE / HUMBOLT MOUNTAIN	BIGHOLE	TORREY MOUNTAIN
BE000941	SHEEP MOUNTAIN PROSPECTS	BIGHOLE	VIPOND PARK
BE000798	SHEEP MOUNTAIN TUNGSTEN PROSPECT	BIGHOLE	VIPOND PARK
BE000778	SHELLEY	BIGHOLE	STEWART MOUNTAIN
MA003095	SHERIDAN	JMR	NOBLE PEAK
BE003825	SILVER KING MINE	BIGHOLE	MOUNT TAHEPIA
BE000348	SILVER RULE MINE	BEAVERHEAD	ERMONT
MA000607	SLIDEROCK MOUNTAIN	JMR	SPUR MOUNTAIN
MA003468	SLIDEROCK MOUNTAIN PHOSPHATE	JMR	SPUR MOUNTAIN
MA007031	SMUGGLER MINE	JMR	COPPER MOUNTAIN
MA008365	SNOWSTORM	JMR	NOBLE PEAK
BE008350	SOURDOUGH CAVE	BEAVERHEAD	DEER CANYON
SB008272	SOUTH FORK PARKER CREEK MINE	BIGHOLE	DEWEY
BE000718	SOUTH GREENSTONE GULCH	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000354	SPANISH MINE	BEAVERHEAD	ERMONT
MA005464	SPUHLER GULCH OCCURENCE	JMR	NOBLE PEAK
BE000810	STANFIELD TUNGSTEN PROSPECT	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000767	STAR & STAR EXTENSION / MOONLIGHT	BIGHOLE	DICKIE HILLS
BE000360	STARLIGHT	BEAVERHEAD	ERMONT
MA004072	STASNOS	JMR	POTOSI PEAK
BE003895	STINSON MINE	BEAVERHEAD	ERMONT
BE000839	STORM AND SIMPSON MINES	BEAVERHEAD	ELKHORN HOT SPRINGS
BE000366	STORM KING	BEAVERHEAD	ERMONT
BE008341	SUGARLOAF MOUNTAIN ADIT	BIGHOLE	STORM PEAK
MA003942	SUNBEAM	JMR	NOBLE PEAK
MA003173	SUNBEAM EXTENSION	JMR	NOBLE PEAK
MA006848	SUNFLOWER 1	JMR	OLD BALDY MOUNTAIN
MA005692	SUNLIGHT MINE	JMR	
MA003168	SUNNYSIDE	JMR	NOBLE PEAK
MA008278	SUNRISE	JMR	NOBLE PEAK
BE008392	SWEENEY GULCH PROSPECTS	BEAVERHEAD	GRAPHITE MOUNTAIN
BE000821	SWEENEY MINE; BONANZA II; S.S. & R	BEAVERHEAD	TEPEE MOUNTAIN
BE000497	SYLVIA MINE	BEAVERHEAD	ERMONT
BE000048	TELSTAR GROUP	BEAVERHEAD	ELKHORN HOT SPRINGS
BE000054	TENDER GROUP	BEAVERHEAD	ERMONT
MA003867	TEXAS LODE MINE	JMR	OLD BALDY MOUNTAIN
BE000918	THE FAITHFUL MINE / OLD FAITHFUL	BIGHOLE	VIPOND PARK
BE004540	TIGER GROUP	BEAVERHEAD	ELKHORN HOT SPRINGS
BE000953	TITANUS MINE	BIGHOLE	VIPOND PARK
MA003310	TOPEKA	JMR	OLD BALDY MOUNTAIN
BE004130	TRAIL CREEK PLACERS	BIGHOLE	BIG HOLE BATTLEFIELD
BE000502	TRAPPER CREEK SYNCLINE	BIGHOLE	CATTLE GULCH
BE008325	TRAPPER MILL SITE	BIGHOLE	MOUNT TAHEPIA
BE000617	TRAPPER MINE	BIGHOLE	MOUNT TAHEPIA
BE000414	TRAPPER NO 1	BEAVERHEAD	LEMHI PASS
BE008326	TRUE BLUE	BIGHOLE	MOUNT TAHEPIA
BE004140	TRUE FISSURE MINE	BIGHOLE	MOUNT TAHEPIA
BE000556	TRUSTY LAKE SYNCLINE	BIGHOLE	CATTLE GULCH
BE000959	TUXEDO MINE	BIGHOLE	VIPOND PARK
BE008308	TWIN FIR	BIGHOLE	VIPOND PARK
MA003493	UNCLE SAM	JMR	RAMSHORN MOUNTAIN
SB008347	UNKNOWN - PINE DALE MINE	BIGHOLE	DICKIE PEAK
MA008084	UNKNOWN PROSPECTS	JMR	POTOSI PEAK
BE008349	UNKNOWN STONE	BEAVERHEAD	DELL
BE008339	UNNAMED - T4S, R12W,SEC 15, DAAC	BEAVERHEAD	ELKHORN HOT SPRINGS
MA008039	UNNAMED 03S05W26DBAC MINE	JMR	OLD BALDY MOUNTAIN
MA008363	UNNAMED ADIT - SECTION 12	JMR	RAMSHORN MOUNTAIN
BE004405	UNNAMED COPPER MOLYBDENUM	BEAVERHEAD	TORREY MOUNTAIN

BE008273	ARCADIA	BIGHOLE	BIG HOLE PASS
MA008070	PONY MINE	JMR	PONY
MA004032	GROUP	JMR	POTOSI PEAK
BE008353	PROSPECTS - T14S, R11W, SEC 02	BEAVERHEAD	GRAPHITE MOUNTAIN
BE008332	LAKE	BIGHOLE	STORM PEAK
BE008329	MINE	BIGHOLE	MOUNT TAHEPIA
BE008314	QUARTZ HILL MILL	BIGHOLE	VIPOND PARK
BE000544	QUARTZ HILL SYNCLINE	BIGHOLE	CATTLE GULCH
BE000924	QUEEN OF THE HILLS	BIGHOLE	VIPOND PARK
BE008318	QUEEN OF THE HILLS MILL TAILINGS	BIGHOLE	VIPOND PARK
ID	**Site Name**	**Drainage***	**1:24k Quadrangle**
MA008265	UNNAMED SEC 19	JMR	RAMSHORN MOUNTAIN
MA008266	UNNAMED SEC 24	JMR	RAMSHORN MOUNTAIN
MA008364	UNNAMED SECTION 30	JMR	RAMSHORN MOUNTAIN
BE000053	UNNAMED TUNGSTEN	BIGHOLE	STORM PEAK
BE000071	UNNAMED TUNGSTEN	BEAVERHEAD	POLARIS
BE000005	GARNET	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000077	TUNGSTEN,MOLYBDENUM,GARNET	BIGHOLE	TWIN ADAMS MOUNTAIN
BE000377	TUNGSTEN,MOLYBDENUM,GARNET	BIGHOLE	TWIN ADAMS MOUNTAIN
BE003805	UNNAMED URANIUM OCCURRENCE	BEAVERHEAD	TORREY MOUNTAIN
BE000700	UPPER CANYON CREEK	BIGHOLE	CATTLE GULCH
BE004145	UPPER CLEVE MINE	BIGHOLE	MOUNT TAHEPIA
BE000724	UPPER FRENCH CREEK	BIGHOLE	TORREY MOUNTAIN
MA003075	UPPER LEITER	JMR	NOBLE PEAK
MA008267	UPPER LEITER	JMR	NOBLE PEAK
MA006812	URBANE	JMR	OLD BALDY MOUNTAIN
BE000870	VIRGINIA CLAIM	BEAVERHEAD	ERMONT
BE000060	VIRGINIA GULCH MINE	BEAVERHEAD	ERMONT
BE004565	WAPITA MINE	BEAVERHEAD	ERMONT
MA003872	WASHINGTON CREEK MINE	JMR	RAMSHORN MOUNTAIN
BE004620	WATSON GULCH MINE	BEAVERHEAD	ERMONT
BE008344	WELLMAN MINE - NEW YORK CLAIM	BEAVERHEAD	ELKHORN HOT SPRINGS
MA008268	WEST BUNGALOW	JMR	POTOSI PEAK
BE000706	WEST LIMB MINE	BIGHOLE	CATTLE GULCH
BE008315	WEST LONE PINE	BIGHOLE	VIPOND PARK
MA003573	WHITE ANGEL QUARRY	JMR	OLD BALDY MOUNTAIN
BE000773	WHITE CAP CLAIM	BIGHOLE	FOOLHEN MOUNTAIN
BE008207	WHITE ELEPHANT	BIGHOLE	MOUNT TAHEPIA
MA004142	WHITE SWAN PROPERTY	JMR	RAMSHORN MOUNTAIN
MA003775	WIGWAM NORTH FORK PLACER	JMR	CIRQUE LAKE
MA004077	WILLIAM FLY	JMR	POTOSI PEAK
MA003073	WILLOW CREEK MINE	JMR	HOME PARK RANCH
MA003525	WISCONSIN CREEK PLACER	JMR	OLD BALDY MOUNTAIN
BE000786	WISE RIVER PLACER	BIGHOLE	MAURICE MOUNTAIN
BE008380	WISE RIVER UNNAMED MINE	BIG HOLE	WISE RIVER
BE008381	WISE RIVER UNNAMED MINE	BIG HOLE	WISE RIVER
BE008383	WISE RIVER UNNAMED MINE	BIG HOLE	WISE RIVER
BE000396	YELLOW BAND GROUP	BEAVERHEAD	ERMONT
BE008044	YELLOWSTONE LODE (CABIN)	BEAVERHEAD	POLARIS
MA004482	YELLOWSTONE MINE	JMR	BUCKS NEST

*BEAVERHEAD: Beaverhead-Red Rock drainage, Chapter 2
BIG HOLE: Big Hole River drainage, Chapter 3
JMR: Jefferson, Madison, and Ruby drainages, Chapter 4

BE008301	UNNAMED GOLD	BIG HOLE	FOX GULCH
BE000269	UNNAMED GRAPHITE	BEAVERHEAD	MEDICINE LODGE PEAK
BE004390	UNNAMED GRAPHITE	BEAVERHEAD	DEER CANYON
BE000449	UNNAMED GYPSUM	BEAVERHEAD	DELL
BE004335	UNNAMED GYPSUM	BEAVERHEAD	DELL
MA002983	UNNAMED MINE	JMR	COPPER MOUNTAIN
MA002988	UNNAMED MINE	JMR	COPPER MOUNTAIN
MA003143	UNNAMED MINE	JMR	OLD BALDY MOUNTAIN
MA003148	UNNAMED MINE	JMR	OLD BALDY MOUNTAIN
BE000101	UNNAMED MOLYBDENUM,TUNGSTEN,GARNET	BIGHOLE	STORM PEAK
ID	**Site Name**	**Drainage***	**1:24k Quadrangle**

APPENDIX III
DESCRIPTIONS OF ADDITIONAL MINE AND MILL SITES IN THE SOUTHERN BEAVERHEAD-DEERLODGE NATIONAL FOREST

Beaverhead-Red Rock River Drainages

Agnes Lode BE000138
Location: T6S R12W Sec. 14 BABB

Pattee (1960) described exploration here as consisting of a few bulldozer trenches. Geach (1972) quoted Pattee almost verbatim. The field visit in 1995 revealed this to be true also. No major excavations were noted. In fact, it was difficult to discern where this occurrence was. One open adit was noted to the east and across the valley from the Little Hawk that may actually be the Agnes. This site was entirely on BNF-administered land.

Echo Lode BE000606
Location: T6S R12W Sec. 11 DCAD

This patented claim was surrounded by BNF-administered land and had three totally collapsed adits. The lower one was collapsed in two places for 50 feet leaving a kind of tunnel that may be in danger of further collapse. There was one upper working, an unfenced 15-foot glory hole, that led down to a shaft - a minor hazard. Access to this area was remote; the area was dry and windy.

There were abundant secondary copper minerals with other skarn minerals especially on the lower dump. There was no record of production for this lode.

Hazel Prospect/North Hazel Prospect BE000252/BE008021
Location: T6S R12W Sec. 11 ACBD

DSL-AMRB has secured the one open adit remaining here with a locked culvert and grate. The rest of the workings consisted of open cuts/dozer trenches as might be expected in a tungsten prospect.

There were two distinct areas of exploration: a north area and a south area. The contact between the Mississippian Madison limestone and Cretaceous granodiorite striking northwest was well exposed in the open cut to the south. Good specimens of scheelite can still be found to the north with lesser amounts of secondary copper minerals and molybdenite(?). Pattee (1960) states the tactite found here was exposed for an average length of 215 ft by an average width of 105 ft by 3 to 33 ft in depth. Geach (1972) repeats Pattee's findings, adding that this property consists of 11 unpatented claims. It is located on BNF-administered land.

Little Hawk/Little Hawk Mill BE000756/BE008020
Location: T6S R12W Sec. 15 AACB

The Little Hawk consisted of a large ridge-top open cut with one or two minor underground exploration tunnels. There was an open inclined shaft to the southeast. Below the ridge, there was a gravity mill in poor condition and a tailings impoundment in good condition. No runoff was observed, and the only possible erosion would be from wind on the dry, unconsolidated, silt- to sand-sized tailings. The area was reasonably revegetated with sagebrush and grasses. Analyses of the tailings by the MBMG staff (1996) and Pioneer Technical Services (1995) indicate this site is not an environmental problem.

An assay from a composite sample of the Little Hawk tailings (PGLH-1) contained 0.006 opt Au, 0.02 opt Ag, 0.05% Cu, 0.001% Pb, and 0.003% Zn. The disturbances are primarily on BLM-administered land but may extend slightly onto BNF-administered land.

Ranger Mine BE000948
Location: T6S R12W Sec. 9

The Ranger mine, as listed in MILS, had an accuracy of +/- 10 kilometers and no other sources of information. There was a Ranger mine listed in Sassman (1941) near Swede Creek, Jackson, Montana (p. 280) that was possibly the correct location. The site was screened out.

Big Hole River Drainage

Adams Peak/Twin Adams Mountain claims BE000852
Location: T4S R10W Sec. 23 DBAC

Quote from Pattee (1960) ..." The claims are on the south slope of the west peak of Twin Adams Mountain and are adjacent to the Lost Creek mine. The east boundary of the Mount Torrey batholith extends southward through the property. The igneous mass intrudes Amsden limestone and Quadrant quartzite. Debris from two trenches contains a small amount of disseminated scheelite in tactite but none was exposed in place. A grab sample from a trench at the north end of the claims assayed a trace of WO_3. Assays of two other samples from the same trench and one sample from a second trench showed no tungsten." Winter *et al.* (1994) reported one shallow adit, pits and two bulldozer trenches. The USBM also took three samples yielding assays of trace, 0.15%, and 0.43% tungsten.

Ajax BE000156
Location: T6S R17W Sec. 7 DDAA

Several short adits investigate a 5-foot-thick iron- and copper-stained quartz vein that fills a N45˚E 45˚SE fault zone with Belt quartzite on both sides. Along strike, this structure becomes an actinolite-chlorite-quartz-malachite breccia zone. Avalanches have obliterated all buildings once present, but apparently the site contained a mill. No tailings are present. Production totals are 1,643 tons of ore that yielded 979 ounces of gold, 7,621 ounces of silver, 299 pounds of copper, and 140,239 pounds of lead (Lipton 1988). Ore also contains up to 0.55% molybdenum and 0.13% tungsten (Lipton 1988). The site is on private land.

Amadon Group BE000594
Location: T5S R11W Sec. 8 CCCD

This occurrence was referenced in Loen and Pearson (1989) as the Amaden lode. It is referenced as the “Amadon Claim Group” in Myers (1952) and in a Defense Minerals Exploration Administration Docket No. DMEA-1138 on file with the USGS in Reston, Virginia. Loen and Pearson (1989) refer to this as a copper/molybdenum stockwork or porphyry in quartz monzonite (Kqm). They also categorize it as a mine or prospect that has no record of production or the production is unknown. Winters *et al.* (1994) state that there was one caved adit here and a 30-ft long, partially sloughed, open cut. The location was taken from this report.

The Amadon group was not visited because it was unlikely that it would significantly impact BNF-administered land.

Aurora and East Aurora BE000947/BE000875
Location: T1S R11W Sec. 25 ACDA

Two short caved shafts explore a vein in Cambrian Hasmark dolomite. The vein is vertical, strikes east, is 5-6 feet wide, and contains tetrahedrite, pyrite, and malachite (Winters *et al.* 1994). Production has been 633 tons of ore, from which 4 ounces of gold, 13,746 ounces of silver, and 1914 pounds of copper were recovered (Geach 1972).

Big Four Mine BE004215
Location: T3S R11W Sec. 2 ADDD

This was a fraction claim between the Avon and the Franklin, according to Karlstrom (1948). Karlstrom (1948) further states that it was initially claimed by Thompson and Hopkins but was later absorbed as a part of the West Avon claim. The map in plate 6 in Karlstrom (1948) shows the approximate location of the Big Four to the east of the Franklin mine.

The area was visited, and no environmental problems located. Some rusting junk associated with either the Franklin or the Big Four remains, and the Franklin has an open incline. Geach (1972) shows production from the Big Four in 1918: 3 tons of ore yielded 84 oz Ag, 218 lbs Cu, and 775 lbs Pb.

Birch Creek BE000664
Location: T5S R10W Sec. 15 CCCA

These unpatented claims are located in secs 14, 15, and 23, T1S, R10W, with the main limestone quarry in section 14. The BLM 1:100,000 map shows this area as BNF-administered land. There was a grated "well" approximately 20 feet deep, that looks like it was designed as a roaster or for some other function. Some of the bolts holding down the grate have been removed. Highwalls were near vertical but were only 20 to 30 feet high with loose rocks. One, iron lime "kiln" remains. Access to the site was good via an improved road.

Birch Creek Iron BE000624
Location: T5S R10W Sec. 21

This site was considered to be a part of the Jumbo Group.

Black Bear BE000796
Location: T3S R13W Sec. 18 DBBC

One adit caved 30 feet from the portal is present. Workings probably amount to less than 100 feet in length. Slickensided quartzite hosts an iron-stained quartz vein. Two samples taken by Benham (1981) contained 12.1 and 16.7 oz/ton silver and 0.11% and 0.45% molybdenum. The site is on BNF-administered land.

Blackmore BE000846
Location: T5S R11W Sec. 5 CBAA

The Blackmore's location was shown in Pattee (1960) and also was located by Winters *et al.* (1994). This publication quotes an unpublished report (Close 1994) that the property consists of two groups of prospects, one with four pits and the other with five pits and trenches. It was described as a N80°E striking, 70° to 86° dipping, 6 to 9-ft wide altered zone in granodiorite containing quartz veins and stringers running 0.209% and 0.742% Mo, with select samples as high as 0.817% Mo. Pattee (1960) found only one small pit with veins less than 5 inches wide with small blebs of molybdenite.

The property was screened out: it was a molybdenum prospect, with only pits for workings and it probably has minimal impact to BNF-administered land.

Blue Bell BE008306
Location: T2S R11W Sec. 8 DCCD

At the Bluebell, there are numerous shallow shafts, pits, and trenches, some containing water, in unaltered limestone. Waste rock is all heavily vegetated. Geach (1972) thought that the mine sought bedding plane veins not exposed at the surface. Although there are no indications of mineralization, Winters *et al.* (1994) managed to select a dump sample that assayed 0.02 oz/ton gold, 14 oz/ton silver, 2.33% copper, 28.5% lead, and 0.10% zinc.

Bonanza BE008307
Location: T1S R11W Sec. 25 ADCD

Workings include a caved adit several hundred feet long and some prospect pits. Mineralization occurs at the contact between the Jefferson and Red Lion Formations and consists of quartz, pyrite, and galena (Winters *et al.* 1994). A select sample contained 0.03 oz/ton gold, 12 oz/ton silver, and 0.3% lead (Winters *et al.* 1994). The site is on private land.

Bonaparte Prospect BE004295
Location: T3S R11W Sec. 11 BBCD

The Bonaparte was discovered by Samuel Ayotte according to Karlstrom (1948). This prospect was part of the Keokuk-Elm Orlu Group (one of six patented claims) according to Geach (1972). Also according to this bulletin, it lies along the contact between the Meagher limestone and a quartz monzonite sill. Two adits (both caved according to Geach) were driven along quartz veins containing pyrite. Geach (1972) lists production from the Bonaparte as 50 tons of ore yielding 181 lbs Cu, 699 oz Ag, and 1 oz Au.

The area was visited but the workings present were not positively identified as the Bonaparte. There were three or more shallow open, steep-sided workings in the general area but no environmental problems.

Brownes Lake - Lost Creek Area BE000592
Location: T3S R10W Sec. 34 DACA

Swanson (1970) lists this occurrence of Phosphoria Formation as a phosphate resource. No mention of any actual workings were noted. See reference for resource estimates.

Bryant (Hecla) Mining District BE000906
Location: T3S R11W Sec. 2 DBAC

This entry is a general description of the Bryant mining district also known as Hecla and includes many mines. The area was named after James A. Bryant (Sassman 1941). Sassman describes the district with a historical perspective, and Karlstrom (1948) describes the geology of the mines in the area. Geach (1972) describes individual mines in the area, primarily referring to Karlstrom (1948). Winchell (1914), Fearing and Winchell (1922), Reyner and Trauerman (1950), and McClernan (1977 and 1982) are additional references for the area.

Burgieros A (G W) BE000162
Location: T1S R11W Sec. 35 CBBA

Workings consist of a caved adit several hundred feet long and an open cut. Dumps are vegetated limestone. Some work was done on the mine in 1975 (Winters *et al.* 1994). Dolomite of the Cambrian Hasmark and Red Lion formations hosts four N25˚-30˚E 45˚-85˚NW quartz-tetrahedrite-chacopyrite-acanthite-galena-sphalerite-azurite-malachite veins. Four samples assayed from 2.6 to 25 oz/ton silver, 0.9 to 1% copper, 1.6 to 4.7% lead, 0.82 to 3.8% zinc, and up to 0.18% arsenic, 0.44% antimony, and 0.02% cadmium (Winters *et al.* 1994).

Buster Mine BE000168
Location: T5S R10W Sec. 19 ACAB

This patented claim lies on the southeast side of a quartzite knob and to the east of the large park at the top of the French Creek-Thief Creek road. No road goes directly to it. The workings are on the lower portion of the patented claim. The workings include a culverted (DSL-AMRB) and locked adit trending N5°E and an inclined shaft that was only about 10 to 15 ft deep, trending N80°W. It was obviously not considered a hazard by the DSL-AMRB when they closed the adit. A totally dilapidated log cabin lies in the Sheep Creek drainage. No environmental or physical hazards were noted here. The dumps consist of limestone (dolomite?), with skeletal quartz/boxwork of quartz stringers and small pieces of limonite. The workings appear associated with small, iron-stained shears in the limestone.

Cannivan Gulch BE000072
Location: T2S R11W Sec. 22 BD

This is a recent molybdenum prospect with some reclaimed drill holes and pads.

Cleopatra Mine BE004545
Location: T3S R11W Sec. 3 ADDA

The Cleopatra was a part of the Lion Mountain Group and was located to the southwest on Lion Mountain. It was claimed in 1877 and consists of two areas: the Upper and Lower Cleopatra. A description was included in Karlstrom (1948).

Although the general area was visited, most of it was private, and no potential environmental impacts to BNF-administered land were noted. Whether or not the workings were presently open was not noted.

Cleve-Avon Group BE000180
Location: T3S R11W Sec. 1 BCAD

This was a group consisting of the Cleve, Avon, and Franklin claims. References for this group include Karlstrom (1948), Winchell (1914), and Geach (1972). Pioneer Technical Services (1995) studied the potential impacts of the Cleve mines (see individual entries for more information).

Copper Contact Claim BE000864
Location: T5S R10W Sec. 14 CBBB

Copper Contact was a patented claim to the east of the Indian Queen mine. One adit was located but was completely collapsed with 10 to 12 in. diameter Douglas fir trees growing on the dump. The dump consists of weathered intrusive and little else. The mine is located near the contact with Mission Canyon limestone (Loen and Pearson 1989, Pattee 1960) and the intrusive. A 4-ft chip sample by Pattee (1960) assayed no tungsten, and there was no record of production. One cabin built with Douglas fir logs was located to the northeast, and it was in bad condition (walls O.K. but the roof was gone).

Daisy Vein BE004195
Location: T1S R11W Sec. 25 ACDD

Two short caved shafts explored a N63˚E-striking quartz-tetrahedrite-barite vein in dolomite (Winters *et al.* 1994). No production has been reported. A grab sample assayed 10.5 oz/ton silver, 0.23% lead, and 0.06% antimony (Winters *et al.* 1994). The property is private.

Dark Horse BE004575
Location: T8S R16W Sec. 5 ACCA

This large operation contains two caved adits, one caved shaft, and two short open adits. Total length of workings was probably several thousand feet. The dumps contain iron-stained quartz vein enclosed in a copper-stained phyllite host that appears to be complexly folded and faulted. Lipton (1988) thought that the veins were concordant with bedding. He also reported production of 294 tons containing 93 ounces of gold, 1,611 ounces of silver, and 85,739 pounds of copper. The site is on private land.

Fairview BE004465
Location: T5S R10W Sec. 1 DBBB

Quote from Winchell's (1914) Mining Districts of the Dillon Quadrangle, Montana ...... "On the Fairview claim on Barber Gulch the monzonite was cut by numerous aplite dikes, and was in contact with quartzite that contains layers of curiously spotted brownish red and gray, apparently by unequal distribution of iron oxide. Other layers close at hand consist of a dense gray quartzite, filled with numerous small rudely ellipsoidal openings that average about 0.5 millimeter in diameter and lie in all positions. Some of them were partly filled by a pale-greenish mineral that weathers brownish. These quartzites are strikingly similar to the Weber quartzite of the Pennsylvanian of Utah, and seem to represent the same horizon. They probably belong to the Quadrant formation."

Fitzwater Claims BE000670
Location: T5S R10W Sec. 18 CABB

The general area of these claims as plotted from MILS was scouted, but no workings were located. There is little concern about environmental problems.

Foolhen Property BE000822
Location: T1N R12W Sec. 19 ADDA

Quote from Walker (1963) USBM RI 6334, p. 7 and 8...... "The Fool Hen prospect, 2 miles southeast of the Calvert mine, was accessible by three miles of pack trail from the Calvert mine. It lies at an altitude of 7,600 feet on the crest of a sharp ridge between Bryant Creek and Alder Creek. Workings consist of a 1,000-foot bulldozer trench with two short side cuts. There has been no production. The geology was similar to that at the Calvert mine. The limestone has been metamorphosed to a medium-grained, gray, dolomitic marble. Banding shows that the strike ranges from N 25°E to N25°W, with an almost vertical dip. The tactite lenses and pods range from 80 feet long by 25 feet wide to streaks a few feet long and a few inches wide. Scheelite grains up to an eighth of an inch in diameter are irregularly disseminated through the tactite. Samples from two small tactite zones, exposed in the northwest part of the bulldozer trench, assayed 0.43 percent WO_3. Four other samples ranged from less than 0.01 to 0.23 percent WO_3."

Truckle (1988) mapped this area and does not note the above mentioned formations or occurrences.

Forest Queen BE004610
Location: T3S R11W Sec. 11 BDBB

The Forest Queen is described in Karlstrom (1948) and Geach (1972). It is believed to be the first claim (1872) in the district and was part of the Keokuk-Elm Orlu Group. Host rock is Cambrian Meagher limestone intruded by Tertiary quartz monzonite and is classified as a replacement deposit by Geach (1972). He also states that there is a stratigraphic control in that the shattered limestone lies beneath a less permeable quartzite. The ore was described as quartz-chalcedony with iron and copper staining with sericitized and pyritic (feeder) quartz veins in a sill.

The area was visited, and no environmental problems were noted. The mine was on patented land. Several small shafts or inclined shafts were found in the general area of the Forest Queen and Bonaparte. They are on private land and have no environmental problems associated with them.

Fraction Mine BE004615
Location: T3S R11W Sec. 11 BCBB

Part of the Keokuk-Elm Orlu Group, this unpatented claim lies between the Elm Orlu to the east and the Keokuk to the west. Several shafts/prospects were begun along a vein or structure running along the ridge here. The shaft was flooded (Geach 1972) and was still flooded in 1996 when visited. There was no discharge or evidence of discharge, and the actual water was inaccessible for sampling because of collapse of the log structure over the opening. A total of six openings are evenly spaced along the ridge, three of which may be considered hazardous. An adit was nearly collapsed, and a 20-foot inclined shaft was open.

Franklin Mine BE000186
Location: T3S R11W Sec. 2 ADDC

The Franklin mine was part of the Cleve-Avon Group and (according to Fearing and Winchell 1922) consists of one S20°W-trending adit/incline following northeast-southwest fractures. The mine was claimed by Frank Giley and Ed Stevens who in turn sold it the Hecla Mining Company (Sassman 1941). It was producing as early as 1877 (Karlstrom 1948) and as late as 1938.

Presently, the inclined shaft is still open and hazardous. Rusting junk and two dilapidated buildings are present. To the east of the inclined shaft are surface expressions of an old tunnel that probably led to the Cleve workings (Karlstrom 1948). The area to the south of the mine towards the Trapper contains an occurrence of mostly barren, sand-sized particles that appear to be tailings, possibly from the True Blue mill.

Garnet Adit BE008331
Location: T3S R10W Sec. 32 DADD

Quote from Pattee (1960) ... "The Fluorescent claims are principally on the north side of Rock Creek. The Garnet adit, one of two on the claims, was on the Rock Creek road, about 1 mile northwest of the Brownes Lake mine."

The largest exposure on the property is a 130-ft long outcrop of mineralized tactite on the Mammoth claim, northeast from the Garnet adit. Scheelite and powellite also occur in small exposures of tactite and limestone near the Garnet adit and on the Star claims to the north.

The U.S. Bureau of Mines did some bulldozer trenching in 1942 on the Garnet claim under the wartime strategic minerals program. In 1944 a small mill was constructed near the Garnet adit, and a few hundred pounds of concentrates were produced.

The contact of the Mount Torrey batholith and Amsden limestone trends northwest-ward across the property. The Amsden and overlying formations trend about N25°W and dip about 25° northeasterly. Outcrops form cliffs a few hundred feet high at the west end of the property.

The Garnet adit is caved near the face. No mineralized tactite is exposed in the adit; however, tactite vein that is 5 ft wide and 6 ft high is exposed in the north side of a bulldozer cut 170 ft north of the portal. The tactite is in weathered marble that is bounded on the west by granodiorite. The broken nature of the rock in the cut indicates that the exposure was in a landslide. A 5-foot chip sample across the thickness assayed 0.304% WO_3.

This study found the adit still partly open and accessible to the north of the Forest Service road. A small structure (that may have been a mill) was found on the opposite side of the road. No environmental hazards were noted.

Glow Worm BE000768
Location: T5S R10W Sec. 2 DBDA

This property was developed as early as 1919 for copper and again in the 1950s for tungsten (Pattee 1960). It was a skarn (tactite) associated with Amsden Formation intruded by a Cretaceous granodiorite (Mount Torrey batholith?). The ore minerals include scheelite, powellite, malachite, magnetite, with gangue of quartz, calcite, and gypsum. Pattee (1960) published a geologic sketch of the property, which was accurate to this day. Most adits were partly open to open; only one was totally caved. Most were timbered and were somewhat accessible. Most of the shafts were also partly intact (15 feet to 30 feet deep) and should be considered hazardous. The area in general was remote and does not get a lot of visitors. No environmental problems were associated with the site. References include Pattee (1960), Loen and Pearson (1989), Geach (1972) and Winters *et al.* (1994). There were three cabins in bad condition associated with this site.

Gob Mine BE000149
Location: T5S R10W Sec. 16

MBMG visited the general location as described by MILS but was unable to locate the site.

Gold Nugget BE000150
Location: T5S R10W Sec. 15 DDBC

This prospect is located on the southwest side of Birch Creek, near one cabin that looks habitable and another two log storage buildings. The site identified as the Gold Nugget by Pattee (1960) was located here, but MBMG was not certain that this was the same mine.

Quote from Pattee (1960) ..."This claim was adjacent to the south side of the Indian Queen mine. The workings consist of an adit and lateral totaling 122 feet in length. At the face of the adit a 7-by-9-by-10-inch inclusion of hornfels contains scheelite, powellite, magnetite, and some chlorite. A grab sample assayed 0.026 percent WO_3 and 0.046 percent Mo."

Granite & Tiger BE004035
Location: T3S R10W Sec. 18 DBDA

The site may be part of or the same as the White Elephant (Karlstrom 1948, map). Workings here include one adit driven westward at the base of the ridge, one or more prospects, two inclined shafts (still open to 30 feet or more), and one shaft, collapsed at five feet but with stulls showing. These workings are located at approximately 100-ft intervals along the ridgetop, following the intrusive/limestone contact (Pearson and Zen 1985, and Zen, no date, unpublished map). Zen called this Madison limestone -- Mission Canyon to the south, Lodgepole to the north and Cretaceous intrusive to the west. None of the workings appear to be greater than 50 to 100 ft deep. The adit was driven from the east to intersect the third shaft to the north at depth. Rock on the dumps consists of a white marble from the contact zone, a porphyritic intrusive, and limestone, probably Mississippian Madison. Abundant skeletal quartz stained with iron oxides is present on the third shaft's dump. No sulfides were noted. Hazards include the inclined (approximately 50˚ to 60˚) shafts, but the site is remote and not highly visible.

Gray Jockey BE000893
Location: T2S R11W Sec. 2 BDBB

Workings consist of a caved shaft, two open adits, an open cut, and a mill with a small volume of dry but unvegetated tailings. The mine was worked as recently as 1980 (Winters *et al.* 1994). In Cambrian Hasmark dolomite, a 10-foot-wide quartz-tetrahedrite-galena vein striking N20˚E 30˚-65˚ NW was mined, and 2,161 tons of ore were extracted that yielded 18 ounces of gold, 22,789 ounces of silver, 18,094 pounds of copper, and 1,634 pounds of lead (Geach 1972).

Great Western BE000899
Location: T1S R11W Sec. 25 DACB

Two open stopes and two open shafts are present; the dumps are covered with vegetation. This is a high-grade replacement deposit at a dolomite-shale contact in Cambrian Hasmark Formation, but it produced no ore (Winters *et al.* 1994). A grab sample contained 0.1% silver, 0.3% copper, 0.96% lead, 0.55% antimony, 0.17% arsenic, and 0.24% zinc (Winters *et al.* 1994). The mine is on private land.

Greenstone Mine BE000546
Location: T5S R10W Sec. 11 DBBD

All adits at this site were fenced with barbed wire or cable-gated. There was one collapsing ore bin on private property.

Haggerty Property BE000144
Location: T5S R10W Sec. 22 ABBA

The Haggerty property may also be known as the Kopper Koin (one of the unpatented claims filed here). The open shafts have been fenced with barbed wire and warning signs have been posted by DSL-AMRB. One of the adits was still open but was not greater than 10 to 20 ft deep. The property spans from the base of the hill on the south side of Birch Creek along the limestone/granodiorite contact up the ridge, at least 1,500 feet. Pattee (1960) has an excellent description of the property and a map with assay results (p. 24-26). It was a tungsten mine, and the host rock was Mount Torrey batholith and Mission Canyon limestone. One cabin at the base of the claim looks habitable; it was furnished and locked.

Hecla Mine BE004025
Location: T3S R11W Sec. 11 ACCC

The Hecla is a patented claim associated with the Silver King patented claim; both are located in the southernmost part of the district just north of Trapper Lake. This entry from MILS may also refer to the Hecla Consolidated Mining Company, but for the MBMG study, the name "Hecla" refers specifically to the patented claim. One shaft described in Fearing and Winchell (1922) (possibly caved in 1922) connected with the adit driven northward from the Silver King claim.

The claim is private and so was not visited in this study. It was determined to have no impact to BNF-administered land.

International Prospect BE000774
Location: T5S R11W Sec. 5 BBBB

This site was screened out because it has no references except a USBM mineral property file. It was listed as a tungsten/molybdenum prospect, and it has no record of production.

Jumbo Group BE000834
Location: T5S R10W Sec. 21 ABAD

This site was primarily on private land; it includes five patented claims: Jumbo, Indian Queen, Indian Chief, U.S. Treasurer, and Burch. The road has been improved recently and has a locked gate across it. A cursory examination revealed only collapsed adits, an old truck, and a bulldozer. The land may have been recently logged.

The property was noted in Geach (1972), Loen and Pearson (1989), and Pattee (1960). Pattee has a geologic map and assays for the claims. The occurrence was a skarn, with Cambrian limestone in contact with the Mount Torrey batholith. Ore minerals include scheelite, powellite, and magnetite. Geach's (1972) ore sample, from an area 10 ft long, contained 0.010 opt Au, 0.30 opt Ag, 0.02% Cu, and 41.0% Fe. Pattee's (1960) sample contained 0.013 to 0.042% WO_3.

Keokuk Mine BE004205
Location: T3S R11W Sec. 10 AADA

The Keokuk mine is located in the southwest portion of the Hecla district and is a patented claim. According to Geach (1972) and Karlstrom (1948), this property consists of two inclined shafts (Karlstrom includes a 700 ft adit driven from the northwest of the shafts). Two walls of the horse whim still stood in 1996; the inclined shaft to the west and down slope was still open. The adit was not located. The land is private, and there are no impacts to BNF-administered land. The mine is hosted by Cambrian Meagher limestone where it is at or near the contact with the Cambrian Park Formation.

Knoby BE004200
Location: T1S R11W Sec. 25 DBAA

Pits and trenches investigate a chalcedony vein with silver sulfides, pyrite, and barite. No production was recorded; two select samples averaged 9.5 oz/ton silver, 0.03% copper, 0.26% lead, 0.09% zinc, and 0.09% antimony (Winters *et al.* 1994).

Last Chance BE000772
Location: T3S R14W Sec. 4 ACBD

An open adit that is probably about 200 feet long explores an ENE-trending, 0.5 foot-wide shear containing quartz, sericite, and hematite in granite (Winters *et al.* 1994). Samples contained very little gold (Winters *et al.* 1994). The site is on BNF-administered land.

Lentung Deposit BE000052
Location: T4S R10W Sec. 3 BDBD

The Lentung deposit is the subject of DeBoer's (1991) MS thesis; this reference is the most complete description of the area to date. The deposit is hosted by the Amsden Formation that has been intruded by the Pioneer batholith. It is considered to be the buried extension of the deposit found at Brownes Lake. Reserves are estimated by DeBoer (1991) as 3.3 million tons of 0.48% WO_3. Exploration has consisted primarily of drilling and construction of drill roads. US Borax explored the property from 1988 to 1989 when it dropped the claims.

Lion Mountain Group BE004370
Location: T3S R11W Sec. 2 BCBD

This is a group name for the large collection of mines at the base and up the face of Lion Mountain. The mines include the Atlantus, Alta, Ariadne, Cleopatra, Condor, Mark Anthony, Oneida, Pride of the West, and True Fissure lodes (Karlstrom 1948). See the individual group names for more details. This is the largest and most important group of mines in the district known for its silver and lead.

Lion Mountain Tunnel BE008328
Location: T3S R11W Sec. 2 BDBC

This tunnel was driven to intersect many of the other workings on Lion Mountain. At the time the MBMG visited the site, the tunnel was still partially open (but not far) and had water in it that appeared to be (at least partially) runoff from the hill above. The discharge was contained in a trench to the east of the tunnel and was all on private land. The tunnel had ice in it, even in August.

Lost Creek Mine "B" Adit BE000498
Location: T4S R10W Sec. 14 DBBD

This mine has been divided into two main areas of workings, although the occurrence and minor workings stretch along the entire ridge from 6,800 to 8,000 feet elevation. Pattee (1960) includes detailed maps of most of the workings. According to Pattee (1960), the area has been explored since 1907 with a concentrated effort in the 1950s when 21,150 tons of 0.18% WO_3 was mined. Ore minerals include scheelite, with powellite and malachite occurring in metamorphosed Amsden intruded by Mount Torrey quartz monzonite. Again according to Pattee (1960), workings near the "B" adit included open pits and raises from the adit itself. Faulting and barren lenses of country rock break up the continuity of the deposit. Some of the open cuts presently have steep highwalls, but they have been fenced by DSL-AMRB.

Lost Creek Mine "H" Adit BE008340
Location: T4S R10W Sec. 23 ABDC

This mine has been divided into two main areas of workings, although the occurrence and minor workings stretch along the entire ridge from 6,800 to 8,000 ft elevation. Pattee (1960) includes detailed maps of most of the workings. According to Pattee (1960), the area has been explored since 1907 with a concentrated effort in the 1950s when 21,150 tons of 0.18% WO_3 was mined. Ore minerals include scheelite, with powellite and malachite occurring in metamorphosed Amsden intruded by Mount Torrey quartz monzonite. Again according to Pattee (1960), workings near the "H" adit include open pits, trenches and one open main adit. Faulting and barren lenses of country rock break up the continuity of the deposit. The adit has a gate on it, but the locks have been broken off the hasps. Until the gate is secured with new locks, the opening is considered hazardous.

Lost Creek-Willow Creek BE000598
Location: T5S R10W Sec. 2 AADD

This phosphate occurrence was defined by Swanson (1970). It was tested by one sample that, for a thickness of 7.5 ft, yielded 20% P_2O_5, and a total of 300 tons in block. The average bed thickness of 65 feet was estimated at 9.0% P_2O_5. The "ore" was considered oolitic to pelletal sedimentary apatite. The deposits are related to chemical sedimentation in Permian Phosphoria Formation.

Lower Cleve Tunnel BE004420
Location: T3S R11W Sec. 1 BCCA

These workings are on patented claims and so were not examined in great detail. Fearing and Winchell (1922) made a detailed mine map of the Cleve-Avon and Franklin mines. Karlstrom (1948) and Geach (1972) also mention the Cleve workings; Karlstrom has plan and vertical section maps.

The Cleve mines have no discharges, and the effects of the eroding waste was studied by Pioneer Technical Services (1995) for DSL-AMRB.

Mammoth Adit BE003915
Location: T3S R10W Sec. 33 CACA

Quote from Pattee (1960) ... "On the Mammoth claim an adit has been driven into a tactite bed for 53 feet into the hillside. The bed was 9 feet thick, strikes N. 25° W. with a dip of 24° to the northeast, and was a few feet above the quartz-monzonite contact. The outcrop extends 130 feet west of the adit, and broken tactite was uncovered 270 feet farther west on the projected strike. It was covered to the east except for two small exposures less than 300 feet away. Two 9-foot chip samples taken 12 feet and 102 feet west of the adit assayed 0.122 and 0.26 percent WO_3, respectively".

The adit was not located during this study but DeBoer (1991) shows it on his general location map as uphill and to the east approximately 1,200 feet from the Garnet adit. It is unknown whether or not the workings are open.

Maynard BE000977
Location: T3S R14W Sec. 2 BCAB

One short caved adit that is about 100 feet long and a small mill building but no tailings are present at the Maynard. Winters *et al.* (1994) reported that a N65˚E 63˚NW quartz vein in chlorotized and kaolinitized granite was mined. Three samples assayed from 0.03 to 0.94 oz/ton gold and from 0.2 to 1.5 oz/ton silver (Geach 1972; Benham 1981).

Minnie Gaffney BE003940
Location: T3S R11W Sec. 11 BDAA

Originally, this mine was explored by an inclined shaft that was caved by the time Karlstrom examined the area in 1948. Karlstrom noted quartz, pyrite, galena, silicified limestone and iron staining on the dump. He postulates that it was a continuation of the leads followed in the Keokuk, Fraction, and Elm Orlu.

The mine is on a patented claim and there were no visible effects on BNF-administered land attributable to the mine. The general area was visited, and no open shafts were noted.

Monaghan Prospect BE000515
Location: T5S R11W Sec. 5 BABD

The Monaghan prospect is described in Geach (1972) and Loen and Pearson (1989) as a vein deposit with the strongest veins striking NE, and molybdenite, pyrite, and chalcopyrite ore minerals. It was categorized as a molybdenum/copper deposit with Geach's (1972) channel sample running 0.08% to 0.12% MoS_2 and 0.02% Cu.

The prospect was not visited because it had no production, was remote, and was primarily a molybdenum prospect. It is believed to have little or no impact on BNF-administered land.

Monte Christo BE000929
Location: T1S R11W Sec. 24 DCAB

Two caved shafts contain from 500 to 1,000 feet of workings on BNF-administered lands. Dumps are vegetated. Mineralization is in a vertical quartz-sphalerite-galena-tetrahedrite vein hosted by Cambrian Hasmark dolomite that and strikes N46˚W (Winters *et al.* 1994). Production figures are 1,131 tons of ore that yielded 5 ounces of gold, 19,872 ounces of silver, 3,626 pounds of copper, and 28,000 pounds of lead (Geach 1972). Like most mines of the area, it was worked in the 1930s and 1940s, as well as early in the century.

Mt. Tory BE000966
Location: T4S R11W Sec. 32 CDAA

This site was screened out because it is not referenced in the literature and is assumed to be a general descriptor of the area. It was listed as a molybdenum prospect and has a USBM mineral property file, but location accuracy is only +/- 1 km.

New Ariadne BE000378
Location: T3S R11W Sec. 2 BCCB

This mine is part of the Lion Mountain Group, examined in detail in Karlstrom (1948), Geach (1972), and Sassman (1941). It was included in the first group of claims from the late 1870s and produced oxidized, siliceous lead-silver ore as late as the late-1940s (Karlstrom 1948). Karlstrom (1948) has a detailed plan and section map of the New Ariadne showing an inclined adit.

The New Ariadne is on patented, private land and so was not examined in detail. No discharges were noted from the area; whether or not the adit is open is not known.

New Atlantus BE003905
Location: T3S R11W Sec. 2 BBDA

This mine is part of the Lion Mountain Group, examined in detail in Karlstrom (1948), Geach (1972) and Sassman (1941). This claim was still active in the early 1900s; it is located on the same horizon but north/northeast of the Old Atlantus in the middle Meagher (Karlstrom 1948).

The New Atlantus is on patented, private land and so was not examined in detail. No discharges were noted from the area; whether or not the adit is open is not known.

North Star Property BE000815
Location: T1N R12W Sec. 9 ADAD

This property consists of two patented claims at the edge of BNF-administered land. Geach (1972) and Gilbert (1935) are the two references. The land was unpatented in 1935 and workings consisted of 1,000 feet of drifts on a flat lying, 18-inch to 2-foot quartz vein (Gilbert 1935). Presently, there are two patented claims from which recorded production ranged from the years of 1931-32 and 1937-41. Approximately 424 tons of ore yielded 164 oz Au, 813 oz Ag, and 141 lbs Cu (Geach 1972). The host rock was described as quartzite (Missoula Group ?) under a shale layer (Geach 1972). The site was screened out because it is on private land.

Old Atlantus BE003960
Location: T3S R11W Sec. 2 BBDB

This mine is part of the Lion Mountain Group, examined in detail in Karlstrom (1948), Geach (1972), and Sassman (1941). It is on the same horizon but south-southwest of the Old Atlantus in the middle Meagher (Karlstrom 1948).

The Old Atlantus is on patented, private land and so was not examined in detail. No discharges were noted from the area; whether or not the adit is open is not known.

Old Faithful BE000918
Location: T2S R11W Sec. 3 DBBB

One open (but fenced) shaft, one caved shaft, and some trenches comprise the workings of the Old Faithful. The target was a quartz-tetrahedrite-galena-chacopyrite vein (Winters *et al.* 1994) that is 200 feet long by 50 feet wide in Hasmark Formation and Belt quartzite (Geach 1972). Production (1937, 1941-43, 1959) has been 268 tons of ore yielding 3 ounces of gold, 1,569 ounces silver, 507 pounds of copper, and 2,800 pounds of copper (Geach 1972).

Oro Fino Mine BE03965
Location: T5S R10W Sec. 22

This site was screened out because the location accuracy was +/- 5 kilometers.

Phyllis Claim BE000750
Location: T5S R10W Sec. 21 ABCD

This unpatented claim is noted in Pattee (1960) as having a common corner with and is directly west of the U.S. Treasurer patented claim, part of the Jumbo Group. Pattee (1960) states that there was a 25 ft adit in tactite near the common corner and two other adits in quartzite near the same location. The ore mineral here appears to be scheelite, and the commodity was tungsten.

Pioneer BE000474
Location: T7S R16W Sec. 17 ACBD

One caved adit that was about 500 feet long was driven in unaltered, feldspar-rich, cross-bedded Belt quartzite. A sample contained no significant metal values (Lipton 1988).

Prospects east of Brownes Lake Tungsten BE008332
Location: T4S R10W Sec. 3 BACA

Two roads lead east of the open pit mine (Ivanhoe); one older with trees revegetating it and the other still passable. Both have prospects along them but no serious safety hazards (some steep slopes) or environmental problems. Two of the prospects are shown on the Storm Peak 7.5-min. quadrangle. The upper two prospects expose a portion of the Amsden Formation fractured by the Lentung fault as mapped by DeBoer (1991), and the lower two (along with the roadcuts) expose Amsden skarn.

Quartz Hill (Lone Pine) Millsite BE008314
Location: T1S R10W Sec. 30 CCBD

This mill operated between 1891 and 1895 (Geach 1972). A large area of tailings is associated with it, but the tailings are vegetated, dry, and appear to be composed of oxidized material only. Ownership is mixed BNF-administered and private land.

Queen Property BE004070
Location: T5S R10W Sec. 14/15

No references are listed in MILS for this site, and no patented claims were found with this name. It may be the same as the Indian Queen. It was listed as being in sections 14 and 15, T5S, R10W.

Rocky Hueep BE000858
Location: T5S R10W Sec. 16

Ownership unknown; unable to locate.

Saginaw BE000570
Location: T7S R15W Sec. 16 ABCC

Workings consist of one caved inclined shaft with an estimated 1,000 feet of workings. The dump contains jasper with malachite, chrysocolla, iron oxide, and pyrite. Host is feldspar-rich Belt quartzite. Total production was 1,236 tons of ore yielding 445 ounces of gold and 206,282 pounds of copper (Lipton 1988). The site is on private land.

Santa Maria Rainbow BE000036
Location: T5S R10W Sec. 21 DCDC

This group of eight unpatented mining claims was active as recently as 1995 and may be currently active. New claim notices had been located by "Cameco" in 1995, and it looked like a sampling grid had been run. At least six adits were located but it was unknown which were the original Santa Maria adits. The workings were reached by walking over the ridge from the open park along Bridge Gulch and following the two track road to the south. Loen and Pearson (1989) also note a Florence and Lilly claim in section 27 to the east of these workings but along the same road.

Most of the adits were caved with three caved but still open to 10 to 15 feet. A lower adit along Bridge Creek has a wooden post door at the portal, and it looks like someone lived in it recently. This adit was open approximately 15 feet and was driven into marble. Following the road through the woods, a second set of workings (the attempts at beginning two adits?) were reached. These may be the Florence and Lilly claims from Loen and Pearson (1989). Proceeding up the road, a small adit was located west of the intermittent stream. It was caved at the portal but was daylighted with a couple of timber sets remaining open as far back as could be seen. The small amount of waste may be considered "streamside" but it was totally oxidized and was not directly in contact with the stream presently. Again traveling west along the road and crossing another small stream, a small cabin with five adits were driven westward into the hill. These adits seem to be seeking the Paleozoic/intrusive contact. Three were partially open, and two were totally collapsed. Again, here, there was a waste-rock pile that the stream cuts near but was not in direct contact. One upper adit (directly above the fourth adit) has a small seep emanating approximately 10 feet in front of the adit, from a small bit of broken rock, and it fills a trench in front of the adit. There was no evidence that it ever reaches the creek.

The site was remote, and the depth to which the adits were open was short. No sulfides were noted, most of the adits were driven along, or positioned to intersect, the Torrey Mountain batholith and sedimentary rock (limestone or quartzite) contact. One of the westernmost adits has a substantial fault breccia and gouge at the portal. This mine was listed as developing in 1975 (Lawson 1976) and as inactive in 1979 (Lawson 1980).

Sheep Creek Mine BE008069
Location: T5S R10W Sec. 19 DBBD

This mine was the shaft symbol located in sec 19, T5S, R10W on the Torrey Mountain 7.5-min. quadrangle. It was difficult to locate, partially because the road shown on the topographic map either does not exist or is overgrown. It is best located by taking a bearing by compass and cutting down the slope (quartzite talus) through the woods. Winters et al. (1994)

stated that this site was part of the larger Buster group of claims. The mine was worked in the 1970s, and 10 tons of ore were mined in 1972. A grab sample assayed 0.25 opt Au, 11.4 opt Ag, 4.4% lead, and 2.6% zinc (Winters et al. 1994).

A log cabin was built over a steeply inclined shaft that was open at least 50 ft. It was driven in dolomite/limestone(?), possibly Hasmark. The rocks strike N20°W and dip 40°SW. Two shallow trenches were dug to the north of the shaft. No environmental or water problems were noted.

Shelley BE000778
Location: T3S R14W Sec. 4 ADAA

Development consists of three prospect pits and a trench, all of which are heavily vegetated. Benham (1981) reported that the target was a one-foot-thick iron-stained shear zone, and a chip sample contained only 0.02 oz/ton gold.

Silver King BE003825
Location: T3S R11W Sec. 11 DBBC

The Silver King is a patented claim associated with the Hecla patented claim; both are located in the southernmost part of the district just north of Trapper Lake. It was patented in 1943 and was open at the time of Karlstrom's report (1948). The dump contains white to yellow limestone with pyrite, sphalerite, galena, and quartz with little or no malachite/azurite.

The claim is private and so was not visited in this study. It was determined to have no impact on BNF-administered land.

South Greenstone BE000718
Location: T5S R10W Sec. 11 DDAC

According to Swanson (1970), phosphate is hosted here by the Retort Member, Permian Phosphoria Formation, in oolitic to sedimentary pelletal apatite. Swanson (1970) states that there is a mineable thickness totaling 67.5 feet with nearly 20% P_2O_5. Samples collected by Popoff and Service (1965) ran 23.4% P_2O_5 (for 2.85 ft) and 18.8% P_2O_5 (for 5.2 ft). Swanson (1970) hypothesized that shearing in the Greenstone area may have ruined the phosphate ore. There were two trenches: one on the north side and one on the south side of the road. The Phosphoria was exposed in each and the ore in the one on the south side of the road was extremely shattered. These workings are shown as prospects on the 7.5-min. quadrangle.

Stanfield Tungsten BE000810
Location: T5S R10W Sec. 22 BDAB

This prospect has recently been claimed as a group known as the "Velvet claims". It was described in Pattee (1960) who also included a site map. Geach (1972) also described the property. The excavations include a fenced shaft at the east end, with a trench to the east of the shaft. Following the road to the west, it passes over more small trenches dug along the intrusive/limestone contact. A 100 ft wide x 15 ft deep, open-pit was dug at the west end of the contact which was for mill tests according to Geach (1972). Geach wrote that a 50- to 100-ton tungsten mill was installed but no mill was noted during this visit.

Minerals here include specular hematite, garnet, epidote, and scheelite. No structures remain standing. The location describes the easternmost shaft, with one trench to the east of the shaft, several small trenches to the west of the shaft and one open pit to the west. No adits were found.

Star and Star Extension BE000767
Location: T1N R12W Sec. 36 DDBA

This mine is mentioned in Geach (1972) as being in the Pioneer Mountains area (not an organized district), although he includes the production from the Star mine in the Vipond district. Access was via Forest Service road 925. The two different lists of production figures in Geach (1972) do not match. Years of operation spanned from 1932-1959; 664 tons of ore yielded 552 oz Au, 780 oz Ag, 579 lbs Cu, 200 lbs Pb, and 400 lbs Zn. This mine is also noted in Winters *et al.* (1994) and Loen and Pearson (1989).

A field visit revealed many small prospects/shallow shafts, one larger shaft (totally caved), and one, partially open, inclined shaft. The workings were generally 25 to 50 ft apart and probably not greater than 25 ft in length. The shallow shafts/prospects were covered by garden fencing, fiberglass panels, and metal shingles. There was some rusting junk remaining, and ore had been “stockpiled” in wash tubs and small drums. The geology of the area was interesting in that many xenoliths of gneiss (Missoula Group ?) are suspended in an intrusive and are exposed in the walls of the cuts. Ruppel et al. (1993) show this area as Precambrian Missoula Group, but it must be very close to the late Cretaceous granodiorite contact.

Star claims/Fluorescent claims BE003880
Location: T3S R10W Sec. 33 CBBD

Loen and Pearson (1989) state that these mines are in skarn and have recorded production. Pattee (1960) states that the Fluorescent claims are on the north side of Rock Creek and are south of the Star claims, but no actual boundaries are shown.

Workings on the properties consist of the Garnet and the Mammoth adits, a trench near the switchback on the Storm Park trail, and several prospect bulldozer trenches that are still evident. The Garnet adit is partially open but has caved for about 50 ft. It is highly visible, lying to the north of the Rock Creek road. A very small crusher or mill(?) lies immediately to the south of the road. No waste is in contact with the stream here.

Pattee (1960) states that production for the area consisted of a few hundred pounds of concentrate from bulldozer cuts in 1942 by the U.S. Bureau of Mines. The Mammoth adit was not located but evidently lies approximately 2,000 feet, N12°E of the Garnet adit.

Sugarloaf Mountain Adit BE008341
Location: T4S R10W Sec. 11 BDBA

This mine is marked with a shaft symbol on the Storm Peak 7.5-min quadrangle. It is actually a caved, east-trending adit (possibly a trench?). There are also several more prospects in the area. The adit appears to have been started in Phosphoria Formation but mostly a gray quartzite (Quadrant?) is on the dump. It appeared that the area was explored for copper because fairly abundant, greenish, copper minerals (azurite/malachite?) were on the dump, along with vuggy rock lined with calcite crystals. The adit was probably less than 30 ft long judging by the small dump. DeBoer (1991) mapped this area at a scale of 1"=200' detailing the outcrops and the prospects.

Titanus BE000953
Location: T1S R11W Sec. 10 ACAA

Two open stopes and a short caved shaft are present. The mine was worked in the 1880s, the late 1930s, and again in the early 1940s (Winters *et al.* 1994). The main body of mineralization is a 10-foot-wide, vertical, east-striking quartz vein that contains barite, pyrite, galena, sphalerite, and tetrahedrite. Production records showed that the vein yielded 45 oz/ton silver (Goudarzi 1941).

Trapper Mine BE000617
Location: T3S R11W Sec. 1 CCAB

Karlstrom (1948) describes the area as being developed by several tunnels (at least 4), two shafts, and an open pit. He states further that the workings reached oxidized and unoxidized ore containing siderite, galena, sphalerite, pyrite, quartz, plus limonite- and copper-stained fragments.

The Trapper "mine" is actually many adits, surface pits, inclines, and prospects. Most workings are caved but there are highwalls and partially open diggings, all of which are on the patented claim. There is a mill associated with the site that is described in chapter 3 of this report. This deposit was one of the first developed in the area. It looked as if there has been some recent small-scale exploration in the area.

True Fissure Mine BE004140
Location: T3S R11W Sec. 2 BCBD

This mine was part of the Lion Mountain Group, and according to Karlstrom (1948) was one of the principal producers in the area. The portal opens 500 ft above the Lion Mountain Tunnel (Karlstrom 1948). It is uphill from the Old and New Atlantus but downhill from the Cleopatra and Ariadne. The mine "worked the upper Meagher" close to its contact with the Park (Karlstrom 1948).

The True Fissure is on patented, private land and so was not examined in detail. No discharges were noted from the area; whether or not the adit is open is unknown.

Tuxedo BE000959
Location: T1S R11W Sec. 34 AABC

Surface disturbances consist of an open shaft less than 100 feet long, a short caved shaft, and limestone waste-rock dumps. A N35˚E vertical quartz-galena vein in Cambrian Hasmark dolomite was mined (Geach 1972). Although Geach (1972) reported that a chip sample contained only 0.020 oz/ton gold, 8 oz/ton silver, 0.90% lead, and 1.2% zinc, Winters *et al.* (1994) took some grab samples that assayed up to 56.6 oz/ton silver.

Twin Fir BE008308
Location: T1S R11W Sec. 25 DCAD

Four caved shafts, some prospect pits, and a few trenches were located along a northwest trend. Length of workings is probably only a few hundred feet. Brecciated and contact metamorphosed dolostone is cut by 6- to 8-inch vertical quartz veins containing barite, tetrahedrite, and silver sulfides (Winters *et al.* 1994). Four samples assayed up to 46 oz/ton silver, 0.37% copper, 1% lead, and 1.6% zinc (Winters *et al.* 1994). The site is on private land.

Unnamed Copper, Molybdenum BE004405
Location: T5S R11W Sec. 8 DBCC

This site was screened out because it has no references, its location was +/- 1 km, and it was listed as a Cu-Mo occurrence.

Unnamed Molybenum, Tungsten, Garnet BE000101
Location: T4S R10W Sec. 11 CAAA

The MILS location of this site plotted in the center of the section, indicating that it is a general location with a precision of +/- 1 km. No references were listed in MILS. The area is generally dry with no problems associated with it. The general vicinity was visited, and no problems found.

Unnamed Tungsten BE000053
Location: T3S R10W Sec. 35 CAAA

The MILS location of this site plotted in the center of the section, indicating that it is a general location with a precision of +/- 1 km. No references are listed in MILS. The area is generally dry with no problems associated with it. The general vicinity was visited, and no problems were found.

Unnamed Tungsten, Molybdenum, Garnet BE000005
Location: T4S R10W Sec. 23 DBBB

The MILS location of this site plotted in the center of the section, indicating that it is a general location with a precision of +/- 1 km. No references were listed in MILS. The area is generally dry with no problems associated with it. The general vicinity was visited, and no problems found.

Unnamed Uranium BE003805
Location: T5S R11W Sec. 21 DBBD

This site was screened out because of its commodity (uranium), its remoteness, its lack of a production history, and its location accuracy (+/- 1 km). The only reference that could be found was the Mineral Resources Beaverhead National Forest - Report of Investigation - Vol 2 of 2.

Unnamed Tungsten, Molybdenum, Garnet BE000077
Location: T5S R10W Sec. 11 DBBB

There were no references listed in the MILS database for this occurrence. Because the location as listed in MILS plots in the center of the section, it was assumed that this was a general description for either an exploration project or unpatented claims with minor development on them. The general area was visited to evaluate the nearby Greenstone mine. Several prospect pits are in the vicinity, but none were identified specifically as this property.

Unnamed Tungsten, Molybdenum, Garnet BE000377
Location: T5S R10W Sec. 2 DBBB

There were no references listed in the MILS database for this occurrence. Because the location as listed in MILS plots in the center of the section, it was assumed that this was a general description for either an exploration project or unpatented claims with minor development on them. The general area was visited to evaluate the nearby Glow Worm and Greenhorn claims. Several exploration roads and drill pads, as well as prospect pits, are in the vicinity, but none were identified specifically as this property.

Upper Cleve Tunnel BE004145
Location: T3S R11W Sec. 1 BCAD

These workings are on patented claims and so were not examined in great detail. Fearing and Winchell (1922) made a detailed mine map of the Cleve-Avon and Franklin mines. Karlstrom (1948) and Geach (1972) also mention the Cleve workings; Karlstrom has plan and vertical section maps. No discharges were noted, and the effects of the eroding waste was studied by Pioneer Technical Services (1995) for DSL-AMRB.

Upper French Creek BE000724
Location: T5S R10W Sec. 19 CABD

References for this phosphate occurrence include Swanson (1970), Popoff and Service (1965) and Minobras (1975). A field visit revealed a 75-foot trench bulldozed into black, Permian Phosphoria and six or more prospect pits in the general area. The ore grade for 5.0 feet was 16.3% P_2O_5 with the ore being oolitic to pelletal apatite as a result of chemical sedimentation (Swanson 1970). Thickness was uncertain because of thrust faulting in the area.

White Cap Mine BE000773
Location: T1N R13W Sec. 12 CACC

Quote from Geach (1972), p. 151..... "The White Cap mine was in the SW¼ sec. 12, T1N, R13W, about 3/4-mile due west of the Calvert open-pit tungsten mine, from which it can be reached by mountain road. The unpatented claim was located in 1956 by George Henderson of Anaconda, Montana. The country rock was buff, sugary dolomite, which was believed to be part of the Hasmark Formation. A prospect pit, 8 feet deep, has been sunk on a 4-foot mineralized zone in the dolomite (Fig.86). The zone has the characteristics of a vein and strikes N. 30 W. and dips 76 NE. The 2 ½-foot hanging wall part of the zone was mineralized by white to gray quartz, blebs of galena, and anglesite, and was copper stained. A chip sample across it assayed 0.08 percent copper, 0.25 percent lead, 0.014 percent WO_3, 0.002 ounce of gold, and 0.06 ounce of silver per ton. The footwall of the zone consists of a boxwork of silica ribs in dolomite. A chip sample of this material assayed 0.05 percent copper, 0.20 percent lead, 0.014 percent WO_3, 0.005 ounce gold, and 0.60 ounce silver per ton. Bulldozer trenches have been dug around the discovery pit but no ore was discerned in any of them. Total recorded production from the property was 10 tons of ore produced in 1960; it yielded 62 ounces of silver."

This study examined the general area via a fairly new logging road leading up from the Calvert mine, that leads to at least four prospect pits in the area. None were positively identified as the White Cap, but most had similar characteristics. Two were merely trenches - dry and shallow; two were probably dug over existing springs and were providing water at a rate of approximately 2 to 3 gpm. They were considered to be of no or minimal impact to the BNF-administered land. Truckle (1988) has no Hasmark Formation in this general area but does have Permian Phosphoria and Pennsylvanian Quadrant formations.

White Elephant BE008207
Location: T3S R10W Sec. 18 DCBB

This mine is referred to as "White Elephant mine and prospects" in Karlstrom (1948). This mine is in the timber adjacent to the Cherry Creek trail in the Pioneer Mountains, immediately to the north of the three cabins on the trail. One of the cabins is in fair condition but with the roof partly ruined. The other two cabins are shells with only three to five rows of logs remaining. The NE-trending adit (the adit symbol on the topographic map) is completely caved from the surface about 50 ft back and then caved at the portal. The dump is fairly substantial with two lobes; the material is primarily a white marble (Mississippian Madison - Mission Canyon ?) with some 2-3 mm wide, limonite, stockwork veins. Other rock on the dump is unaltered, gray limestone (Mississippian Madison (?)) and minor intrusive (Cretaceous porphyry). E-An Zen (no date) and Karlstrom (1948) mapped this area as Madison limestone. No sulfides were noted. The Paleozoic/intrusive contact runs up the ridge - north to northeast.

Other workings were found on the untimbered slopes but these are postulated to be the

Granite and Tiger mines as plotted from MILS; they may be the same as the White Elephant mine and prospects, as plotted in Karlstrom (1948). No environmental problems or physical hazards were noted at the site.

Jefferson-Madison-Ruby River Drainages

Belle MA003135
Location: T4S R3W Sec. 9 CBAD

Quartz-iron oxide fragments on the dump apparently came from a gold-rich,12-inch-wide, N30/E 40/-60/NW vein concordant with the foliation of the surrounding gneiss (Tansley *et al.* 1933). Three open adits and four caved adits extend along the vein for 1,000 feet (Winters *et al.* 1994). Gilbert (1935) reported a combined length of 2,000 feet.

Beulrh MA003793
Location: T4S R3W Sec. 8 ABCD

Rocks on the dump include fragments of quartz-pyrite-dolomite vein and both igneous and gneissic host rocks. All are iron and manganese stained. Select samples taken by Winters *et al.* (1994) assayed up to 0.49 oz/ton gold, 3.2 oz/ton silver, and 0.08% zinc. The dump size indicates about 500 feet of underground workings exist. U.S. Bureau of Mines records show it as a past producer. The caved portal discharges a small amount of water which evaporates or seeps into the ground before it reaches BNF-administered lands. Trees have partially revegetated the dump.

Jonquil MA003090
Location: T3S R4W Sec. 32 DADC

Mineralization appears to be controlled by a N40/E-striking, near vertical structure that extends to the Noble mine to the north and the Fairview mine to the south. The vein contains quartz, pyrite, minor galena, minor chalcopyrite, and calcite. Tansley *et al.* (1933) reported high gold content associated with pyrite. Burger (1967) mapped a quartz monzonite stock nearby that intrudes the Archean marble host.

Workings consist of six caved adits and one short caved shaft, with a combined length of 2,500 feet (Trauerman and Waldren 1940). U.S. Bureau of Mines records (Winters et al. 1994) show "significant production".

Select samples contained up to 0.03 oz/ton gold, 0.44 oz/ton silver, 6.5% copper, and 0.07% zinc.

Montana MA003065
Location: T3S R4W Sec. 17 BDDA

A N37/E-trending structure in quartzofeldspathic gneiss and amphibolite, extends from the Montana mine to the Lakeshore mine. Fragments of quartz-pyrite-calcite vein up to two feet in diameter are present on the dumps. A select sample of this material collected by the MBMG contained 0.1230 oz/ton gold, 11 ppm silver, 293 ppm copper, 1,325 ppm lead, 248 ppm zinc, and 180 ppm arsenic. U.S. Bureau of Mines samples had as much as 1.8 oz/ton gold and 2.6 oz/ton silver (Winters *et al.* 1994).

Workings include six caved adits with a combined length of more than 500 feet. A collapsed stamp mill is also present, but tailings are not. The "stockpile" at the millsite indicates oxidized ore was mined and processed at the Montana mine. The site is on private land.

A clear discharge emerges from the lower adit, but it sinks into the ground before reaching BNF-administered land. The adit appears to be less than a couple hundred feet in length. The associated dump is vegetated and composed of unaltered amphibolite.

Snowstorm MA008365
Location: T4S R3W Sec. 9 DCBB

Northeast-striking quartz veins (Winters *et al.* 1994) concordant to foliation in iron-stained biotite quartzite and quartz-feldspar gneiss were mined at the Snowstorm. The deposit is probably related to nearby small igneous intrusions of the Tobacco Root batholith. Select samples assayed up to 0.69 oz/ton gold, 2.0 oz/ton silver, 0.04% copper, and 0.09% zinc (Winters *et al.* 1994).

Winters *et al.* (1994) found four caved adits and three caved shafts. The longest adit appears to extend only a few hundred feet. Ownership is mixed private and BNF-administered land.

Spuhler Gulch MA005464
Location: T3S R4W Sec. 21 CAAC

This large operation has now been reclaimed, and little information exists in the published literature. Host rock is Archean quartz-biotite gneiss, anthophyllite-garnet gneiss, and calcite-biotite gneiss ("marble"). It appears that vein material was mined from a N46/E-striking, NW dipping structure that contains quartz, abundant pyrite, minor galena, calcite, and siderite. A grab sample of these vein fragments collected by the MBMG contained 1.376 oz/ton gold, 119 ppm silver, 5,970 ppm copper, 3,730 ppm lead, 642 ppm zinc, and 4,090 ppm arsenic.

A mill was present at the site. Like others of the area, it probably treated oxidized ore with a cyanide process. A few tons of tailings are still exposed on dry ground.

Leiter (includes Gray Eagle and Sheridan) MA003100/MA003095
Location: T3S R4W Sec. 29 AAD

Apparently this operation was most active in the late 1890s and was a large producer before 1902 (Tansley *et al.* 1933). Two vein systems were mined, the N70/E-striking, vertical Gray Eagle vein and the more important N25/E-striking, near vertical Sheridan vein. Vein mineralogy is dominated by quartz and pyrite. The Sheridan shear zone extends a mile north to the Spulher mine.

Facilities at the Leiter included an aerial tram, a stamp mill, and a cyanide plant (Winchell, 1914). Workings are all caved, and consist of 31 adits (Winters *et al.* 1994) and many pits. Trauerman and Waldron (1940) reported 4,000 feet of underground development and $1.8 million in production.

Leggat/Fake Uncle Sam MA008362
Location: T4S R3W Sec. 7 ADDA

A quartz-pyrite vein up to one foot wide (Winters *et al.* 1994) is parallel to foliation (N80/W 26/NE) along a layer of biotite-quartz-feldspar schist within a marble bed. The deposit may be associated with intrusive tonalite mapped by Burger (1967) and observed nearby in float. Select samples assayed up to 0.88 oz/ton gold, 0.03 oz/ton silver, and 0.22% zinc (Winters *et al.* 1994). Three caved adits comprise the workings.

Mount Jackson MA008264
Location: T3S R4W Sec. 9 BCDD

Two caved adits with a few hundred feet of associated workings seem to follow iron stained areas subparallel to foliation in gneiss and marble. Some feldspar-hornblende porphyry (diorite?) (O'Neill *et al.* 1983; Smith 1970) appears to be associated with the mineralization. The property is dry.

Noble (Company) MA003595
Location: T3S R4W Sec. 33 BACB

Extensive workings were developed on a long northeast-striking shear zone that extends southwest to the Jonquil and Fairview mines. The zone strikes N30/E and dips 45/NW.

Oxidized vein material contains gold-bearing hematite, cerargyrite, and malachite (Winchell 1914); unoxidized ore contains quartz, pyrite, tetrahedrite, sphalerite, bornite, and chalcopyrite (Burger 1967). Archean quartzofeldspathic gneiss hosts the mineralization, but it seems to be associated with Cretaceous quartz porphyry and lamprophyre intrusive bodies (Loen and Pearson 1989). In fact, Winchell (1914) wrote that the vein was most productive where it cuts these igneous rocks. Select assay samples collected by the MBMG contained up to 0.58 oz/ton gold, 1.5 oz/ton silver, 0.7% copper, 0.76% lead, and 2.2% zinc.

The mine was discovered in 1864 (Winchell 1914) and was a large producer before records were started in 1902. The lower tunnel was 2,700 feet long (Tansley *et al.* 1933), and a lengthy upper drift also exists. All workings are caved and dry. Supposedly a 10-stamp mill existed on the site, but no tailings could be found in 1994. The property is private.

Occidental MA007055
Location: T4S R4W Sec. 1 BBAD

A quartz-sphalerite-chalcopyrite-chalcocite-covellite-pyrrhotite-graphite vein (Burger 1967) is concordant with foliation (N50/W 40/NW) of the host gneiss and marble (Winters *et al.* 1994). Samples assayed by the MBMG contained up to 0.06 oz/ton gold, 7.3 oz/ton silver, 1.0% copper, 66.4% lead, and 3.6% zinc.

Three caved adits are present, and two have stains indicating seasonal discharge, but these workings are on private land. A small stamp mill also is present, but no tailings are visible.

Occidental South MA003128
Location: T4S R4W Sec. 2 CACB

Only minor surface workings are visible, and the waste rock is covered by vegetation.

Sunnyside MA003168
Location: T4S R4W Sec. 10 BCBA

At the Sunnyside, a N45/W 33/NE fault zone in gneiss contains brecciated and silicified gneiss and quartz veins containing malacite, graphite, chalcopyrite, sphalerite, pyrite, and galena (Winters *et al.* 1994). Four caved adits are present, and US Bureau of Mines records show it was a small producer (Winters *et al.* 1994). A millsite and less than 100 tons of dry tailings also are present.

Sunrise MA008278
Location: T3S R4W Sec. 16 ADAA

Several short adits and pits explore an iron-stained breccia zone at the Sunrise prospect. The breccia consists of large gneiss and amphibolite boulders in a matrix of vuggy coarse-grained quartz, calcite, sericite, and iron oxide. The zone is 50 to 100 feet wide, and is exposed along strike for several hundred feet. A chip sample taken across the zone assayed 0.0040 oz/ton gold, 2.8 ppm silver, 148 ppm copper, 1,460 ppm lead, 162 ppm zinc, and 80 ppm arsenic.

APPENDIX IV
SOIL AND WATER
ANALYTICAL RESULTS
SOUTHERN BEAVERHEAD-DEERLODGE NATIONAL FOREST

Beaverhead, Big Hole, Jefferson, Madison, and Ruby River Drainages
Water-Quality Results - Dissolved Concentrations

Mine/ Sample ID	Lab ID	Sample Location	Sample Date	Al (µg/L)	As* (µg/L)	Ba* (µg/L)	Cd* (µg/L)	Cr* (µg/L)	Cu* (µg/L)	Fe (mg/L)	Pb* (µg/L)	Mn (mg/L)	Hg* (µg/L)	Ni* (µg/L)	Ag (µg/L)	Zn* (µg/L)	Cl (mg/L)	F (mg/L)	NO3 as N (mg/L)	SO4 (mg/L)	SiO2 (mg/L)	Field pH (SU)	Field SC (µmhos/cm)	Temp (°C)
BOBSLED & O.C.J. CLAIMS																								
EOCS10L	97Q0370	Elkhorn Creek, downstream of site	02-Oct-96	<30.	<1.	19.9	<2.	<2.	6.1	0.057	2.3	0.023	<.1	<2.	<2.	106.4	<.5	<1.	<.05	12.6	5.7	7.41	74	6.9
EOCS20L	97Q0369	Elkhorn Creek, upstream of site	02-Oct-96	<30.	<1.	13.3	<2.	<2.	5.7	0.059	<2.	0.022	<.1	<2.	<2.	95.2	<.5	<1.	<.05	17	5.7	7.52	74	7.4
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
BRANHAM BASIN MINE																								
JBBS01L	97Q0334	Combined adit discharges	20-Sep-96	1.5	1.6	<10.	0.41	1.8	1.7	0.019	<2.	0.041	<.1	1	<1.	5.4	<.5	<1.	<.05	41.1	6.8	8.48	156	8.2
JBBS02L	97Q0335	Wetlands discharging to Mill Creek, downstream of site	20-Sep-96	<30.	<1.	<10.	<2.	<2.	<2.	<.003	<2.	<.002	<.1	<2.	<1.	5	<.5	<1.	<.05	25.4	6.2	8.79	121	4.5
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	0	0	-	0	-	-	0	0	0	0	-	0	0	1	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
BROWNES LAKE TUNGSTEN/IVANHOE MINE																								
ABLS10L	97Q0266	Unnamed tributary from Agnes Lake, upstream of mine	29-Aug-96	<30.	1	42.6	<2.	<2.	2.5	0.016	<2.	<.002	0.1	<2.	1.9	4.7	0.8	<1.	<.05	3	6.1	8.16	78	17
ABLS20L	97Q0267	Unnamed tributary from Agnes Lake, downstream of mine	29-Aug-96	<30.	<1.	32.3	<2.	<2.	<2.	0.004	<2.	<.002	0.1	<2.	<2.	2	0.9	<1.	<.05	3.1	14	8.29	89	16.1
RBLS10L	97Q0263	Rock Creek, upstream of mine	29-Aug-96	<30.	<1.	10.7	<2.	<2.	<2.	0.037	<2.	<.002	<.1	<2.	<2.	<2.	<.5	<1.	<.05	<2.5	7.8	8.11	41	11.4
RBLS20L	97Q0264	Rock Creek, downstream of mine	29-Aug-96	<30.	<1.	13.7	<2.	<2.	<2.	0.01	<2.	0.005	<.1	<2.	<2.	3.0	<.5	<1.	<.05	<2.5	7.7	7.75	45	11.6
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	2+	0/0	1+	0/0	-	-	-	-	-	-	-	-
BRYANT MINING DISTRICT (HECLA)																								
THES10M	97Q0208	Trapper Creek, downstream of district	15-Aug-96	<30.	<1.	20.3	<2.	3.9	<2.	<.003	<2.	<.002	0.11	2.7	<1.	37.3	<.5	<1.	0.1	<2.5	8.3	9.44	150	11.3
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	0	0	-	0	-	-	0	0	0	0	-	0	0	1	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	1	0/0	0+	0/0	-	-	-	-	-	-	-	-
CALVERT (RED BUTTON) CLAIM																								
CCHS10M	97Q0175	Flooded pit	08-Aug-96	<30.	2.4	22.4	<2.	4	<2.	0.005	<2.	0.003	0.11	2.9	<1.	<2.	0.7	<1.	<.05	6.5	7.1	10.23	155	16
CCHS20H	97Q0176	Adit discharge	08-Aug-96	<30.	<1.	90.3	<2.	8.7	<2.	0.019	<2.	0.01	<.1	6.4	<1.	6.3	1.4	<1.	4.2	15	23.5	7.31	379	6.2
CCHS30H	97Q0178	Calvert Creek, downstream of site	08-Aug-96	<30.	2.2	27	<2.	4.4	<2.	0.016	<2.	0.008	<.1	4.1	<1.	<2.	0.9	<1.	0.141	11.5	20.3	8.96	206	9.7
CCHS40H	97Q0177	Calvert Creek, upstream of Calvert Hill	08-Aug-96	<30.	2	21.3	<2.	4.4	<2.	0.007	<2.	0.003	<.1	4	<1.	<2.	0.7	<1.	<.05	9.4	21.5	8.91	205	7.9
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	0	0	-	0	-	-	0	0	0	0	-	0	0	3	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	1+	0/0	0+	0/0	-	-	-	-	-	-	-	-
CAPITOL MINE																								
BCAS10L	97Q0338	Spring at base of waste-rock dump	25-Sep-96	<30.	1.4	<10.	<2.	2.3	<2.	0.013	2.2	0.003	<.1	<2.	<1.	3	0.7	<1.	<.05	5.1	4.4	6.7	43	3.5
BCAS20L	97Q0339	Spring northeast of cabin	25-Sep-96	52.6	1.8	<10.	<2.	<2.	<2.	0.014	<2.	<.002	<.1	<2.	<1.	11.5	<.5	<1.	0.102	3.1	4.2	6.7	25	4.9
BCAS30L	97Q0340	Cave Gulch, downstream of site	25-Sep-96	63.3	2	<10.	<2.	<2.	<2.	0.033	<2.	<.002	<.1	<2.	<1.	8.7	0.8	<1.	<.05	6.5	4	7.5	51	4.2
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				2	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-

Beaverhead, Big Hole, Jefferson, Madison, and Ruby River Drainages
Water-Quality Results - Dissolved Concentrations

Mine/ Sample ID	Lab ID	Sample Location	Sample Date	Al (µg/L)	As* (µg/L)	Ba* (µg/L)	Cd* (µg/L)	Cr* (µg/L)	Cu* (µg/L)	Fe (mg/L)	Pb* (µg/L)	Mn (mg/L)	Hg* (µg/L)	Ni* (µg/L)	Ag (µg/L)	Zn* (µg/L)	Cl (mg/L)	F (mg/L)	NO3 as N (mg/L)	SO4 (mg/L)	SiO2 (mg/L)	Field pH (SU)	Field SC (µmhos/cm)	Temp (°C)
CARNEY MINE																								
WCAS10L	98Q0138	Woody Creek, upstream of site	11-Aug-97	375.2	1.21	75.5	<2.	<2.	2.2	0.294	<2.	0.022	<.1	<2.	<1.	15.3	6.2		<.05	2.9	29.1	7.35	79	5.8
WCAS20L	98Q0137	Woody Creek, downstream of site	11-Aug-97	453.9	1.3	63	<2.	<2.	<2.	0.246	<2.	0.021	<.1	<2.	<1.	<2.	4.5		<.05	<2.5	27.7	7.32	83	5.7
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				2	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				2	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
CLARA MINE																								
SCLS10M	98Q0139	Steel Creek, upstream of site	11-Aug-97	495	1.3	59.9	<2.	<2.	<2.	1.47	<2.	0.04	<.1	2.1	<1.	4.3	2.29		<.05	17	44.3	6.43	161	4.4
SCLS20H	98Q0136	Adit discharge	11-Aug-97	<30.	1.4	188	<2.	<2.	3.2	0.204	<2.	0.189	<.1	3.4	<1.	24	2.24		<.05	10.6	35.5	6.98	221	13.6
SCLS30M	98Q0135	Steel Creek, downstream of site	11-Aug-97	205.1	3.3	77.7	<2.	<2.	<2.	0.365	<2.	0.186	<.1	3.5	<1.	<2.	4.03		<.05	12.2	50.8	7.58	196	16.1
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				2	-	-	-	-	0	2	-	2	-	-	0	0	0	0	-	0	0	1	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	0/0	1	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				2	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
COPPER QUEEN MINE																								
SCQS10M	97Q0306	Copper Queen Mine * "S Fork" of St Louis	11-Sep-96	<30.	7.8	<10.	<2.	<2.	2.4	4.7	<2.	0.651	<.1	<2.	<1.	11.7	4	<1.	0.9	14.9	21.3	9.06	107	12.3
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	0	1	-	1	-	-	0	0	0	0	-	0	0	1	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	0/0	1	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
COUSIN JACK MINE																								
JCJS10L	97Q0302	Adit discharge	10-Sep-96	<30.	1.3	<10.	<2.	<2.	<2.	<.003	<2.	<.002	<.1	2.3	<1.	7.5	<.5	<1.	2.6	20	12.5	7.79	120	7.4
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
DIADEM GROUP (ARNOLD) MINE																								
BARS10M	97Q0413	Adit discharge	09-Oct-96	<30.	<1.	202.4	<2.	3.6	<2.	0.857	<2.	0.652	<.1	<2.	<2.	18.1	2.3	<1.	<.05	3.6	12.6	7.3	264	6.1
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	0	1	-	1	-	-	0	0	0	0	-	0	0	0	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
ELKHORN - UPPER CAMP MINE																								
EUES10H	97Q0311	Adit discharge	09-Sep-96	<30.	<1.	<10.	<2.	<2.	15.1	<.003	<2.	0.087	<.1	7.8	<1.	27.6	0.9	<1.	<.05	247	19.9	7.29	600	12.9
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	0	0	-	1	-	-	0	0	0	0	-	0	0	0	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	1/1	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
ELKHORN MILL																								
ELES40L	97Q0368	Elkhorn Creek, downstream of site	02-Oct-96	<30.	<1.	<10.	<2.	<2.	12.4	0.047	<2.	0.037	<.1	<2.	<2.	182.6	<.5	<1.	<.05	16.5	4.9	6.53	77	2.4
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	1/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	1/1	-	0/0	-	0+	0/0	0+	1/0	-	-	-	-	-	-	-	-

Beaverhead, Big Hole, Jefferson, Madison, and Ruby River Drainages
Water-Quality Results - Dissolved Concentrations

Mine/ Sample ID	Lab ID	Sample Location	Sample Date	Al (µg/L)	As* (µg/L)	Ba* (µg/L)	Cd* (µg/L)	Cr* (µg/L)	Cu* (µg/L)	Fe (mg/L)	Pb* (µg/L)	Mn (mg/L)	Hg* (µg/L)	Ni* (µg/L)	Ag (µg/L)	Zn* (µg/L)	Cl (mg/L)	F (mg/L)	NO3 as N (mg/L)	SO4 (mg/L)	SiO2 (mg/L)	Field pH (SU)	Field SC (µmhos/cm)	Temp (°C)
ELKHORN (OLD ELK HORN) MINE																								
ELES10L	97Q0310	Southeast adit discharge	10-Sep-96	<30.	<1.	<10.	<2.	<2.	2.1	0.009	<2.	<.002	<.1	<2.	<1.	5	0.8	<1.	<.05	16.2	15.6	8.18	94	4.2
ELES20L	97Q0309	Lower Old Elkhorn mine S of mine on creek	10-Sep-96	<30.	<1.	<10.	<2.	<2.	<2.	<.003	<2.	<.002	<.1	<2.	<1.	3.4	<.5	<1.	0.06	2.7	6.9	7.2	40	5
ELES30H	97Q0307	Adit discharge from Old Elkhorn mine	10-Sep-96	851	4	<10.	21.5	<2.	1115	1.6	66.9	2.9	<.1	4.2	<1.	3812	0.5	<1.	0.06	130	31.6	4.83	289	
ELES40L	97Q0368	Elkhorn Creek, downstream of site	02-Oct-96	<30.	<1.	<10.	<2.	<2.	12.4	0.047	<2.	0.037	<.1	<2.	<2.	182.6	<.5	<1.	<.05	16.5	4.9	6.53	77	2.4
No. Exceeded CWA-Primary				-	0	0	1	0	-	-	1	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				1	-	-	-	-	1	1	-	1	-	-	0	0	0	0	-	0	0	1	-	-
No. Exceeded AQLC-Acute (1)				1	0	-	1/1	0/0	1/1	1	0/0	-	0	0/0	0	2/1	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				1	0	-	1/1	0/0	2/2	-	1/0	-	0+	0/0	0+	2/1	-	-	-	-	-	-	-	-
ELM ORLU MINE																								
TEOS10H	97Q0213	Trapper Creek, upstream of site	22-Aug-96	<30.	1.4	21.2	<2.	7.7	<2.	<.003	<2.	<.002	<.1	4.8	<1.	<2.	<.5	<1.	0.1	4.4	9.2	4.41	264	13.6
TEOS20H	97Q0214	Trapper Creek, downstream of site	22-Aug-96	<30.	1.5	21.2	<2.	7.5	<2.	<.003	<2.	<.002	<.1	4.7	<1.	5.4	<.5	<1.	0.13	4.4	8.7	4.79	265	11.5
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	0	0	-	0	-	-	0	0	0	0	-	0	0	2	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
FARLIN GULCH ADIT																								
FWIS10H	97Q0330	Farlin Gulch, downstream of site	09-Sep-96	<30.	1.1	<10.	<2.	18.9	<2.	<.003	<2.	0.009	<.1	3.8	<1.	3.6	16.1	<1.	0.09	59.7	26.2	7.79	508	7.3
FWIS20H	97Q0331	Farlin Gulch, upstream of site	09-Sep-96	<30.	1		<2.	16.9	<2.	0.007	<2.	0.019	<.1	4.2	<1.	5.4	14.3	<1.	<.05	56.1	25.9	8.4	475	8.1
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
FRISBEE MINE																								
MFRS10L	97Q0269	Lake at Frisbee mine	06-Sep-96	<30.	<1.		<2.	<2.	3.5	0.018	<2.	<.002	<.1	<2.	<1.	17.3	<.5	<1.	<.05	12.9	0.54	7	26	11.3
MFRS20M	97Q0271	Flooded shaft (S2), between lakes	06-Sep-96	157.7	<1.	<10.	2.4	<2.	113.2	0.243	74	0.188	<.1	13	<1.	126.7	<.5	<1.	<.05	56.2	8.6	4.8	123	9.3
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	1	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				1	-	-	-	-	0	0	-	1	-	-	0	0	0	0	-	0	0	1	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	1/1	0	0/0	-	0	0/0	0	1/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				1	0	-	1+/1	0/0	1/1	-	1/0	-	0+	0/0	0+	1/1	-	-	-	-	-	-	-	-
GREENWOOD CONCENTRATOR																								
TGCS10M	97Q0215	Trapper Creek, upstream of site	22-Aug-96	<30.	<1.	16.9	<2.	4.9	<2.	<.003	<2.	<.002	<.1	3.2	<1.	<2.	<.5	<1.	0.1	2.7	8.4	9.85	175	7.8
TGCS20M	97Q0216	Trapper Creek, downstream of site	22-Aug-96	<30.	<1.	23	<2.	5	<2.	<.003	<2.	<.002	<.1	3.3	<1.	3.7	<.5	<1.	0.2	2.7	9.1	8.54	176	8.6
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	0	0	-	0	-	-	0	0	0	0	-	0	0	2	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
IBEX MINE																								
LIBS10L	98Q0126	Adit discharge	31-Jul-97	<30.	<1.	45.4	<2.	<2.	3.4	0.013	<2.	0.004	<.1	<2.	<1.	37.4	<.5		<.05	<2.5	9.5	6.48	20	2.6
LIBS20L	98Q0125	Lacy Creek Tributary, upstream of site	31-Jul-97	36	<1.	46	<2.	<2.	<2.	<.003	<2.	<.002	<.1	<2.	<1.	16.8	<.5		<.05	<2.5	8.8	6.52	16	9.1
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	0	0	-	0	-	-	0	0	0	0	-	0	0	1	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-

Beaverhead, Big Hole, Jefferson, Madison, and Ruby River Drainages
Water-Quality Results - Dissolved Concentrations

Mine/ Sample ID	Lab ID	Sample Location	Sample Date	Al (µg/L)	As* (µg/L)	Ba* (µg/L)	Cd* (µg/L)	Cr* (µg/L)	Cu* (µg/L)	Fe (mg/L)	Pb* (µg/L)	Mn (mg/L)	Hg* (µg/L)	Ni* (µg/L)	Ag (µg/L)	Zn* (µg/L)	Cl (mg/L)	F (mg/L)	NO3 as N (mg/L)	SO4 (mg/L)	SiO2 (mg/L)	Field pH (SU)	Field SC (µmhos/cm)	Temp (°C)
INDEPENDENCE GULCH CLAIM NO. 1																								
RINS10L	97Q0250	Adit discharge	27-Aug-96	<30.	<1.	21.7	<2.	<2.	<2.	<.003	<2.	<.002	0.11	<2.	<2.	21.5	<.5	<1.	0.14	8.2	5.1	8	53	3.7
RINS20L	97Q0254	Independence Gulch, downstream of site	27-Aug-96	<30.	<1.	22.5	<2.	<2.	<2.	0.035	<2.	0.008	<.1	<2.	<2.	12.1	<.5	<1.	<.05	14.4	4.2	7	118	13.1
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	1+	0/0	0+	0/0	-	-	-	-	-	-	-	-
INDIAN QUEEN MINE																								
BIQS10L	96Q0680	Birch Creek, downstream of site	02-May-96	<30.	<1.	24.7	<2.	<2.	<2.	0.053	<2.	<.007	<.1	2.4	<1.	<2.	1.039	<1.	0.115	10.5	12.8	7.3		
BIQS20L	96Q0682	Birch Creek, upstream of site	02-May-96	<30.	<1.	18.8	<2.	<2.	<2.	0.057	<2.	<.007	<.1	2.4	<1.	<2.	1	<1.	0.098	10.4	12.9	7.6		
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
JAHNKE MINE																								
BJAS10L	97Q0323	Adit discharge	10-Sep-96	<30.	<1.	80	<2.	<2.	<2.	<.003	<2.	<.002	<.1	<2.	1.8	18	<.5	<1.	0.22	<2.5	3.3	8.5	43	6.8
BJAS20L	97Q0319	Jahnke Creek, upstream	10-Sep-96	<30.	<1.	77	<2.	<2.	<2.	0.015	<2.	<.002	<.1	<2.	1.8	15.1	<.5	<1.	<.05	<2.5	2.6	7.9	17	14.2
BJAS30L	97Q0317	Jahnke Creek, downstream	10-Sep-96	<30.	<1.	85	<2.	<2.	<2.	0.007	<2.	<.002	<.1	<2.	1.8	14.4	<.5	<1.	<.05	<2.5	3.1	7.8	27	13.7
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	3	0/0	-	-	-	-	-	-	-	-
LAKESHORE MINE AND MILL																								
RLSS10L	97Q0255	Crystal Lake, south shore	27-Aug-96	<30.	1.2	17.1	<2.	<2.	2.2	0.01	<2.	0.003	<.1	<2.	<2.	2.6	<.5	<1.	<.05	13.5	3.9	9	90	17
WLSS10L	97Q0430	Crystal Lake, west shore	07-Oct-96	Cyanide only: <0.005 mg/l																		8.3	95	8.3
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	0	0	-	0	-	-	0	0	0	0	-	0	0	1	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
LEITER MILL TAILINGS																								
RLTS10L	97Q0258	Wisconsin Creek, upstream of site	28-Aug-96	<30.	<2.	10.1	<2.	<2.	<2.	<.003	<2.	<.002	<.1	<2.	<2.	6.3	<.5	<1.	0.1	8.7	6.5	7	78	7.8
RLTS20L	97Q0256	Wisconsin Creek, downstream of site	28-Aug-96	<30.	<1.	15.5	<2.	<2.	<2.	<0.003	<2.	<0.002	<0.1	<2.	<2.	9.2	<.5	<1.	0.1	8.1	7.3	7.7	94	8.4
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
LONE WOLF MINE																								
MLWS01L	97Q0358	Adit discharge	24-Sep-96	<30.	<1.	<10.	<2.	4.6	<2.	<.003	<2.	<.002	<.1	<2.	<1.	5.5	<.5	<1.	0.326	6.1	10.7	8.32	169	9
MLWS02L	97Q0362	Tributary to Cataract Creek, upstream of site	24-Sep-96	<30.	<1.	<2.	<2.	4.8	2.6	<.006	<2.	<.002	<.1	<2.	<1.	9.8	<.5	<1.	0.4	5.1	5.8	8.26	175	7
MLWS03L	97Q0361	Seep southeast of site	24-Sep-96	<30.	<1.	<2.	<2.	4.3	<2.	<.006	<2.	<.002	<.1	<2.	<1.	8.8	<.5	<1.	0.4	5.1	6.2	8.11	161	7
MLWS04L	97Q0364	Tributary to Cataract Creek, downstream of site	24-Sep-96	<30.	<1.	45.1	<2.	3.4	<2.	0.015	<2.	<.002	<.1	<2.	<1.	12	<.5	<1.	0.15	5.8	6.4	8.15	126	9.3
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	2	0/0	0+	0/0	-	-	-	-	-	-	-	-

Beaverhead, Big Hole, Jefferson, Madison, and Ruby River Drainages
Water-Quality Results - Dissolved Concentrations

Mine/ Sample ID	Lab ID	Sample Location	Sample Date	Al (µg/L)	As* (µg/L)	Ba* (µg/L)	Cd* (µg/L)	Cr* (µg/L)	Cu* (µg/L)	Fe (mg/L)	Pb* (µg/L)	Mn (mg/L)	Hg* (µg/L)	Ni* (µg/L)	Ag (µg/L)	Zn* (µg/L)	Cl (mg/L)	F (mg/L)	NO3 as N (mg/L)	SO4 (mg/L)	SiO2 (mg/L)	Field pH (SU)	Field SC (µmhos/cm)	Temp (°C)
LUCKY STRIKE MINE																								
BLSS10L		Jeff Davis Cr, upstream of site	11-Jun-98	-	<1.	40.8	<2.	<2.	<2.	-	<2.	-		<2.	<1.	<3.	-	-	-	-	-	-	-	-
BLSS20L		Adit discharge	11-Jun-98	31.1	<1.	26.8	<2.	2.0	<2.	0.04	<2.	<.001		<2.	<1.	3.6	1.48	0.129	0.099	11.6	10.7	-	-	-
BLSS30L		Jeff Davis Cr, downstream of site	11-Jun-98	-	<1.	41.1	<2.	<2.	<2.	-	<2.	-		<2.	<1.	<3.	-	-	-	-	-	-	-	-
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0	0/0	-	-	-	-	-	-	-	-
MARTIN MINE																								
BMTS10L	97Q0321	E Fk Warm Springs Cr, upstream of site	11-Sep-96	<30.	<1.	40	<2.	<2.	<2.	0.01	<2.	<.002	<.1	<2.	1.8	16.4	<.5	<1.	0.12	<2.5	9.2	6.4	24	7.3
BMTS20L	97Q0315	Adit A01 discharge	11-Sep-96	<30.	2.2	54	<2.	<2.	17.2	0.293	13	0.149	<.1	<2.	4.3	69.3	0.5	<1.	<.05	<2.5	8.5	7.4	59	12.1
BMTS30L	97Q0314	Seep from waste dump WA01	11-Sep-96	<30.	2.8	46	<2.	<2.	4.7	9.2	3.4	0.4	<.1	<2.	2.1	11.2	<.5	<1.	<.05	<2.5	7.5	5.7	73	11.3
BMTS40L	97Q0312	E Fk Warm Springs Cr, downstream of site	11-Sep-96	<30.	<1.	47	<2.	<2.	<2.	0.49	<2.	0.035	<.1	<2.	1.8	18.1	0.5	<1.	<.05	1.3	6.5	6.5	28	9.7
BMTS50L	97Q0316	Adit A04 discharge	11-Sep-96	<30.	<1.	29	<2.	<2.	3.6	0.034	<2.	0.264	<.1	<2.	1.8	4.4	<.5	<1.	5.4	<2.5	8.0	6.4	81	7.8
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	0	2	-	3	-	-	0	0	0	0	-	0	0	3	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	0/0	1	0/0	-	0	0/0	1	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	1/1	-	2/1	-	0+	0/0	5	0/0	-	-	-	-	-	-	-	-
MISSOURI-MCKEE MINE AND MILL																								
MMMS10L	98Q0995	Seep below tailings	19-May-98	<15.	11.4	42.2	<2.	3.2	<2.	0.059	<2.	0.007	<.1	<2.	<1.	17.6	0.5	<.05	<.05	4.7	11.4	6.25	127	4.1
MMMS20L	98Q0993	South Meadow Creek, upstream of site	19-May-98	<15.	<1.	57.2	<2.	<2.	<2.	0.024	<2.	0.004	<.1	<2.	<1.	76.7	0.557	<.05	0.31	2.73	6.0	7.15	30	3.4
MMMS30L	98Q0991	South Meadow Creek, downstream of site	19-May-98	<15.	<1.	35.4	<2.	<2.	<2.	0.022	<2.	<.002	<.1	<2.	<1.	13.4	<.5	<.05	0.09	2.76	6.0	7.13	30	3.7
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	0	0	-	0	-	-	0	0	0	0	-	0	0	1	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
PARADISE CLAIM																								
BTRS10M	97Q0414	Trout Creek, downstream of site	08-Oct-96	<30.	5.8	23.1	<2.	4	<2.	<.003	<2.	<.002	<.1	<2.	<2.	3.7	0.8	<1.	0.153	4.9	3.8	8.4	290	7
BTRS20M	97Q0411	Trout Creek, upstream of site	08-Oct-96	<30.	6.1	18.4	<2.	4.8	<2.	<.003	<2.	<.002	<.1	<2.	1.3	5	0.8	<1.	0.16	4.9	3.7	8.3	289	7.1
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	1+	0/0	-	-	-	-	-	-	-	-
PARK MINE																								
UPMS10L	97Q0305	Adit discharge on unnamed creek	12-Sep-96	<30.	2.1	<10.	<2.	<2.	47.3	0.55	21.9	1	0.24	<2.	1.7	348.6	0.5	<1.	0.5	19.5	22.6	6.4	70	6.8
UPMS20L	97Q0308	Unnamed creek, upstream of site	12-Sep-96	<30.	<1.	<10.	<2.	<2.	<2.	0.143	<2.	0.005	<.1	<2.	<1.	12.7	<.5	<1.	0.07	2.8	17	9.06	107	12.3
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	0	1	-	1	-	-	0	0	0	0	-	0	0	2	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	1/1	0	0/0	-	0	0/0	0	1/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	1/1	-	1/1	-	1+	0/0	1+	2/0	-	-	-	-	-	-	-	-
PAY DAY GROUP																								
BUBS10M	97Q0342	Adit (?) discharge	25-Sep-96	872	8.4	<10.	<2.	6.9	<2.	0.92	<2.	0.285	<.1	<2.	<1.	<2.	2.4	<1.	<.05	15.6	18.1	7.1	188	8.1
BUBS30M	97Q0344	Developed spring downgradient of site	25-Sep-96	<30.	<1.	<10.	<2.	8.8	<2.	0.053	<2.	0.004	<.1	<2.	<1.	8.2	2.9	<1.	<.05	6.8	16.3	6.8	187	9.5
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				1	-	-	-	-	0	1	-	1	-	-	0	0	0	0	-	0	0	0	-	-
No. Exceeded AQLC-Acute (1)				1	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				1	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-

Beaverhead, Big Hole, Jefferson, Madison, and Ruby River Drainages
Water-Quality Results - Dissolved Concentrations

Mine/ Sample ID	Lab ID	Sample Location	Sample Date	Al (µg/L)	As* (µg/L)	Ba* (µg/L)	Cd* (µg/L)	Cr* (µg/L)	Cu* (µg/L)	Fe (mg/L)	Pb* (µg/L)	Mn (mg/L)	Hg* (µg/L)	Ni* (µg/L)	Ag (µg/L)	Zn* (µg/L)	Cl (mg/L)	F (mg/L)	NO3 as N (mg/L)	SO4 (mg/L)	SiO2 (mg/L)	Field pH (SU)	Field SC (µmhos/cm)	Temp (°C)
PEDRO MINE																								
JPES01M	97Q0333	Upper adit, Middle Pedro mine	23-Sep-96	<30.	<1.	<10.	<2.	4.7	<2.	0.007	<2.	0.004	<.1	2.3	<1.	91.1	<.5	<1.	<.05	37.1	4.7	8.42	204	3.2
JPES02M	97Q0332	Lower adit at Pedro mine	23-Sep-96	<1.	<1.	<10.	<2.	9	<2.	<.003	<2.	0.003	<.1	5.7	<1.	4.3	<.5	<1.	0.17	29.2	5	8.25	241	35
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
PRESIDENTIAL (DEMOS) GROUP																								
MPGS01L	97Q0421	Road-cut spring downgradient of adit A-1	08-Oct-96	276.8	<1.	12.4	<2.	<2.	10.4	<.003	<2.	<.002	<.1	<2.	<2.	91.4	<.5	<1.	0.08	25.7	17.4	7.97	76	6.8
MPGS02L	97Q0422	Adit A-2 discharge	08-Oct-96	<30.	<1.	2.8	<2.	3.8	<2.	<.003	<2.	<.002	<.1	4.2	<2.	<2.	<.5	<1.	<.05	106	7.4	7.81	490	8.6
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				1	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				1	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
QUEEN OF THE HILLS MINE																								
BQHS10M	97Q0211	Adit discharge	16-Aug-96	<30.	<1.	98.9	<2.	4.6	<2.	<.003	<2.	<.002	<.1	3.2	<1.	12.6	<.5	<1.	0.1	2.5	9.3	8.6	163	5.8
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	0	0	-	0	-	-	0	0	0	0	-	0	0	1	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
QUEEN OF THE HILLS MILL TAILINGS																								
BQTS10M	97Q0212	Queens Gulch, upstream of tailings	16-Aug-96	<30.	3.1	128.7	<2.	6.9	<2.	<.003	<2.	<.002	<.1	4	<1.	6	0.5	<1.	<.05	3.9	7.2	8.5	246	10.1
BQTS20H	97Q0210	Queens Gulch, downstream of tailings	16-Aug-96	<30.	3.1	107.9	<2.	6.6	<2.	<.003	3.5	<.002	<.1	3.7	<1.	3	0.5	<1.	<.05	4.1	6.5	8.6	260	15.9
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	0	0	-	0	-	-	0	0	0	0	-	0	0	1	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	1/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
RED PINE MINE AND MILL																								
RRPS10L	98Q0283	Adit discharge	29-Aug-97	<30.	<1.	32.9	<2.	<2.	<2.	<.003	<2.	<.002	<.1	<2.	<1.	6.8	<.5		0.08	4.1	10.9	8.03	97	6.1
RRPS20L	98Q0281	Indian Creek, upstream of site	29-Aug-97	<30.	<1.	34.2	<2.	<2.	<2.	<.003	<2.	<.002	<.1	<2.	<1.	8.8	<.5		<.05	7.5	8.0	7.93	91	9.5
RRPS30L	98Q0284	Indian Creek, downstream of site	29-Aug-97	<30.	<1.	34.9	<2.	<2.	<2.	<.003	<2.	<.002	<.1	<2.	<1.	7.6	<.5		<.05	7.3	8.2	8.12	124	10.2
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
RICHMOND GROUP, URBANE MINE, AND BISMUTH PROSPECT																								
JRIS10H	97Q0248	N Fk Goodrich Gulch, upstream of sites	29-Aug-96	<30.	<1.	<10.	<2.	4.4	<2.	<.003	<2.	<.002	<.1	<2.	<2.	11.8	2	<1.	<.05	24.6	11.1	6.6	468	8.1
JRIS20H	97Q0253	N Fk Goodrich Gulch, downstream of sites	29-Aug-96	<30.	<1.	101.3	<2.	4.4	<2.	<.003	<2.	<.002	<.1	<2.	<2.	9	2	<1.	<.05	43.5	11.9	8.1	512	9.9
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-

Beaverhead, Big Hole, Jefferson, Madison, and Ruby River Drainages
Water-Quality Results - Dissolved Concentrations

Mine/ Sample ID	Lab ID	Sample Location	Sample Date	Al (µg/L)	As* (µg/L)	Ba* (µg/L)	Cd* (µg/L)	Cr* (µg/L)	Cu* (µg/L)	Fe (mg/L)	Pb* (µg/L)	Mn (mg/L)	Hg* (µg/L)	Ni* (µg/L)	Ag (µg/L)	Zn* (µg/L)	Cl (mg/L)	F (mg/L)	NO3 as N (mg/L)	SO4 (mg/L)	SiO2 (mg/L)	Field pH (SU)	Field SC (µmhos/cm)	Temp (°C)
SCHMIDT PROSPECTS NORTH																								
JSMS10L	97Q0252	Goodrich Gulch, upstream of site	29-Aug-96	<30.	<1.	36.7	<2.	<2.	<2.	<.003	<2.	<.002	<.1	<2.	<2.	8.6	<.5	<1.	0.2	6.6	5.1	8.2	133	63
JSMS20L	97Q0251	Goodrich Gulch, downstream of sites	29-Aug-96	<30.	<1.	<10.	<2.	2	<2.	<.003	<2.	<.002	0.11	<2.	<2.	10.7	<.5	<1.	0.3	7.2	5.1	7.8	160	7.3
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	1+	0/0	0+	0/0	-	-	-	-	-	-	-	-
SMUGGLER MINE																								
JSMS10L	97Q0303	Adit discharge	10-Sep-96	<30.	<1.	<10.	<2.	4.7	<2.	0.025	2.4	<.002	<.1	3.9	<1.	14.2	0.9	<1.	3.1	11	14	7.92		8.9
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
TRAPPER MILL SITE																								
STMS10H	97Q0206	Sappington Creek, downstream of site	15-Aug-96	<30.	<1.	32.3	<2.	7.6	<2.	<.003	<2.	<.002	<.1	4.4	<1.	<2.	<.5	<1.	<.05	3.1	5.6	8.85	276	14.9
STMS20H	97Q0207	Sappington Creek, upstream of site	15-Aug-96	<30.	<1.	32.7	<2.	7	<2.	0.019	<2.	<.002	<.1	4.2	<1.	<2.	<.5	<1.	<.05	3.2	5.1	8.78	276	15.9
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	0	0	-	0	-	-	0	0	0	0	-	0	0	2	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
UNCLE SAM MINE																								
JUSS01H	97Q0363	Adit discharge	23-Sep-96	<30.	1.2	18.9	3.2	4.3	<2.	<.006	<2.	0.389	<.1	37.6	<1.	266.1	<.5	<1.	<.05	122.1	3.5	8.37	390	3.3
JUSS02L	97Q0359	Mid Fk Mill Creek, upstream of site	23-Sep-96	<30.	<1.	<2.	<2.	2.4	<2.	<.006	<2.	<.002	<.1	<2.	<1.	6.1	<.5	<1.	<.05	6	2.1	8.56	73	2.1
JUSS03M	97Q0365	Mid Fk Mill Creek, downstream of site	23-Sep-96	<30.	<1.	13.3	<2.	2.2	<2.	<.006	<2.	<.002	<.1	<2.	<1.	8.5	<.5	<1.	<.05	6.6	3.1	8.55	178	1.2
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	0	0	-	1	-	-	0	0	0	0	-	0	0	2	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	1/1	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	1+/1	0/0	0/0	-	0/0	-	0+	0/0	0+	1/1	-	-	-	-	-	-	-	-
UNNAMED 03S05W26DBAC MINE																								
RUNS10H	97Q0249	Adit discharge	28-Aug-96	<30.	6.1	<10.	<2.	6	<2.	<.003	<2.	0.043	<.1	2.2	<2.	63.7	1.8	<1.	<.05	38.8	8.8	7.4	516	17.4
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-
WATSON GULCH MINE																								
BFCS10L	97Q0419	Watson Gulch, upstream of site	08-Oct-96	<30.	1.7	39.1	<2.	2.3	<2.	<.003	<2.	<.002	<.1	<2.	<2.	10.2	0.6	<1.	0.05	3.6	6.3	7.9	125	5.8
BFCS20M	97Q0418	Adit discharge	08-Oct-96	<30.	44.6	42.2	<2.	3.6	<2.	<.003	<2.	<.002	<.1	<2.	<2.	5.7	<.5	<1.	<.05	12.9	6.7	7.1	268	7.7
BFCS30L	97Q0416	Watson Gulch, downstream of site	08-Oct-96	<30.	1.5	42.2	<2.	2.1	<2.	<.003	<2.	<.002	<.1	<2.	<2.	6.6	<.5	<1.	<.05	3.7	6.3	8.2	132	7.2
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				0	-	-	-	-	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	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				0	0	-	0+/0	0/0	0/0	-	0/0	-	0+	0/0	0+	0/0	-	-	-	-	-	-	-	-

Beaverhead, Big Hole, Jefferson, Madison, and Ruby River Drainages
Water-Quality Results - Dissolved Concentrations

Mine/ Sample ID	Lab ID	Sample Location	Sample Date	Al (µg/L)	As* (µg/L)	Ba* (µg/L)	Cd* (µg/L)	Cr* (µg/L)	Cu* (µg/L)	Fe (mg/L)	Pb* (µg/L)	Mn (mg/L)	Hg* (µg/L)	Ni* (µg/L)	Ag (µg/L)	Zn* (µg/L)	Cl (mg/L)	F (mg/L)	NO3 as N (mg/L)	SO4 (mg/L)	SiO2 (mg/L)	Field pH (SU)	Field SC (µmhos/cm)	Temp (°C)
WELLMAN MINE - NEW YORK CLAIM																								
WWMS10M	97Q0410	Wellman Creek, downstream of site	08-Oct-96	108.2	<2.	20.1	<2.	2.1	34.3	0.053	<2.	0.052	<.1	<2.	<2.	141.4	1	<1.	<.05	22.1	9.6	7.85	184	6.4
WWMS20M	97Q0408	Wellman Creek, upstream of site	08-Oct-96	<30.	<1.	20.8	<2.	2.2	<2.	0.014	<2.	<.002	<.1	<2.	<2.	8.3	0.8	<1.	<.05	18.9	9.3	8.2	183	7.2
No. Exceeded CWA-Primary				-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary				1	-	-	-	-	0	0	-	1	-	-	0	0	0	0	-	0	0	0	-	-
No. Exceeded AQLC-Acute (1)				0	0	-	0/0	0/0	1/1	0	0/0	-	0	0/0	0	1/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)				1	0	-	0+/0	0/0	1/1	-	0/0	-	0+	0/0	0+	1/0	-	-	-	-	-	-	-	-

* Critical elements. Laboratory data have been qualified according to QAPP.
+ Additional samples may exceed standard because minimum detection limit is greater than chronic aquatic life standard.
(1) Where two values are listed, standard is hardness dependent. Values are calculated on hardness of 100 and 200 mg/L, respectively.

BEAVERHEAD NATIONAL FOREST

Soil Analyses (Qualified Data)
(Concentrations in mg/Kg)

Mine (Database ID)/ Sample ID	Lab ID	Sample Location	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
BRANHAM BASIN MINE (MA003748)																																
JBBD01L	97S0013	Waste-rock dump in contact with adit discharge	1	B		109		N	95.8			0.52	B		56		N	192		N	0.88	B	N	50		N	106		N	67		N
CARNEY MINE (BE008346)																																
WCAD10H	98S0042	Streamside waste-rock dump	2.31	U		27.7		*	304	B		4.62	U		24.9			99.8			0.577	U		72.7	B		8.94	*		59.0		*
CLARA MINE (BE000965)																																
SCLD10H	98S0041	Soil near toe of waste-rock dump	2.55	U		4.99	B	*	142	B		5.11	U		5.11	U		10.2	B		0.638	U		5.11	U		10.6	*		129		*
FRISBEE MINE (MA003140)																																
MFRD10M	97S0011	Waste-rock along shore of unnamed lake	8			82		N	25.8	B		1.2			14		N	177		N	3.2		N	13		N	474		N	113		N
IBEX MINE (BE004410)																																
LIBD10H	98S0040	Soil downhill of waste-rock dump	2.26	U		5.63	B	*	34.3	B		4.53	U		4.53	U		5.25	B		0.566	U		4.53	U		58.1	*		65.4		*
INDEPENDENCE GULCH CLAIM NO. 1 (MA008040)																																
RIND10L	97S0009	Waste-rock dump in wetlands	0.64	B		38		N	171			2.5			44		N	164		N	12.7		N	82		N	41		N	308		N
LEITERVILLE MILL TAILINGS (MA008245)																																
RLTD10M	97S0008	Streamside tailings	14			1100		N	51.8			0.77	B		5		N	197		N	32.9		N	6	B	N	493		N	66		N
LONE WOLF MINE (MA003790)																																
MLWD01M	97S0015	Waste-rock dump in contact with adit discharge	0.49	B		194		N	193			0.7	B		0.42	B	N	1.8	B	N	1.4		N	0.98	B	N	62		N	117		N
LUCKY STRIKE MINE (BE000066)																																
BLSD10L	98S00	Stream sediment downstream of site				3.09			57.9			0.528	U		9.87			10.1	*					3.30	B		14.4	*		22.1		
MARTIN MINE (BE000971)																																
BMTD10M	97S0012	Streamside waste-rock dump	124			104		N	35.3	B		30			3.4		N	551		N	278		N	0.76	B	N	12030		N	1330		N
MISSOURI-MCKEE/SNOW SLIDE MINE AND MILL (MA007166)																																
MMMD10L	98S0152	Tailings along seep channel	21.5	B	N	4192			96.7	B		8.33	U		42.9			258			2.08			13.0	B		6150			394		
PARADISE CLAIM (BE008043)																																
BTRD10M	97S0036	Streamside waste-rock dump	0.65	B		95		N	63.6			0.69	B		2.8		N	10		N	0.65	B	N	6	B	N	46		N	57		N
QUEEN OF THE HILL MILL TAILINGS (BE008318)																																
BQTD10M	97S0007	Streamside tailings	34			210		N	164			14			15		N	2159		N	21.9		N	14		N	15196		N	2583		N
RED PINE MINE AND MILL (MA004467)																																
RRPD10M	98S0055	Tailings in breached impoundment	3.50	B		30.9		*	115	B		5.04	U		12.8	B		407			1.26			27.0			33.200		*	43.6	B	*
RICHMOND GROUP (MA007187), URBANE MINE (MA006812), AND BISMUTH CLAIM (MA006785)																																
JRID10L	97S0010	Composite dump sample from Bismuth and Urbane	0.71	B		12		N	39.4			2.5			23		N	22		N	2.5		N	31		N	76		N	383		N

BEAVERHEAD NATIONAL FOREST

Soil Analyses (Qualified Data)
(Concentrations in mg/Kg)

Mine (Database ID)/ Sample ID	Lab ID	Sample Location	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
UNCLE SAM MINE (MA003493)																																
JUSD01H	97S0014	Streamside waste-rock dump	1.4	B		158		N	66.5			0.54	B		61		N	80		N	1.7		N	50		N	126		N	148		N
WATSON GULCH MINE (BE004620)																																
BFCD10L	97S0035	Streamside waste-rock dump	0.59	B		14		N	108			0.71	B		33		N	143		N	0.65	B	N	45		N	21		N	243		N

Notes:
B - Detected but below method detection limit
U - Analyzed for but below instrument detection limit
N - Spike sample recovery not within control limits
* - Duplicate analysis not within control limits

APPENDIX V
MBMG - USFS
AIM DATABASE TABLES AND FIELDS

Sites Table (Msites.db)
ID number
Name
Alternate name
Mine district
County
Mrds#
Arnli*
Mils*
Latitude
Longitude
Township
Range
Section
Tract
Utm northing
Utm easting
Utm zone
Average elevation
Elevation units
Land owner
1:250kmap
1:100kmap
1:24kmap
Property type
Mine type
Current status
mine method
Map
Scale
First year of production
Last year of production
Process method
Mill process capacity ^
Total waste produced
Total ore produced
Au mined
Ag mined
Cu mined
Pb mined
Zn mined
As mined
Tons mined
Au milled
Ag milled
Cu milled
Pb milled
Zn milled
As milled
Tons milled
Published reserves measured
Published reserves indicated
Published reserves inferred
Depth of workings
Length of workings
Surface area disturbed
Surface map
Surface map agency
Sur map address
Sur map city
Sur map zip
Underground map
Underground map agency
UG map address
UG map city
UG map zip)
Date of update
Who update

Mines Table (Mmlnes.db)
ID
Type of opening
Latitude
Longitude
Utm northing
Utm easting
Size.opening length
Size.opening width
Elevation
Elev units

Mine Openings Table (Fmines.db)
ID
Type of opening
Condition
Ground water
Photo
Photo #s
Ownership
Comments

Forest Table (Forestdb)
ID
Investigator
Date
Photos
Access
Near wetlands
Drainage basin
Waste contact stream
Nearest surface water intake
# of sw intakes within 15 miles
Surface water uses
Nearest well
Well uses
Nearest dwelling
months occupied
houses
Recreational use
Nearest recreation area
Name of area
Hmo adit
Hmo wall
Hmo struct
Hmo chem
Hmo solid
Hmo explosive
Sensitive environments
Pop within 0.25 miles
Pop within 0.5 mNes
Pop within 1 mile
Pop within 2 miles
Pop within 3 miles
Pop within 4 miles

Screening Table (Fscreen.db)
ID
Mill or tailings
Adit discharge
Metals leaching
Water erosion
Residences
Hazmat
Open adit or shaft
Visit
Remarks

Water Sample Table (Fsample.db)
ID
Sample ID
Sampler
PH
Sc25C
Date
TempC
Flow rate
Flow units
Flow method
Sample source
Indicators of contam.
Vegetation
Stain
Salt
Sulfide
Turbid
Location rel. stream
Stream name
Sedimentation
Photo
Photo #s
Remarks

Soils Table (Fsolids.db)
ID
Sample ID
Source
Date
Sampler
Sample type
Length of transect
Soil depth interval
Indicators of contamination
Path
Vegetation
Color
Salt
Photo #s
Photos

Waste Table (Fwaste.db)
ID
Waste type
Wind erosion
Vegetation
Rill
Gully
Seep
Pond
Breach
No indicators of flow
Stability
Floodplain
Distance to stream
Photos
Photo #s

Contamination Table (Fcontam.db)
ID
Type of contamination
Estimated quantity
Container condition
Remarks

Assay Table (Fassay.db)
ID
Sample ID
Material type
Sample method
Comments

Leach Test Table (Leach.db)
ID
Sample ID
Material type
Sample method
Comments