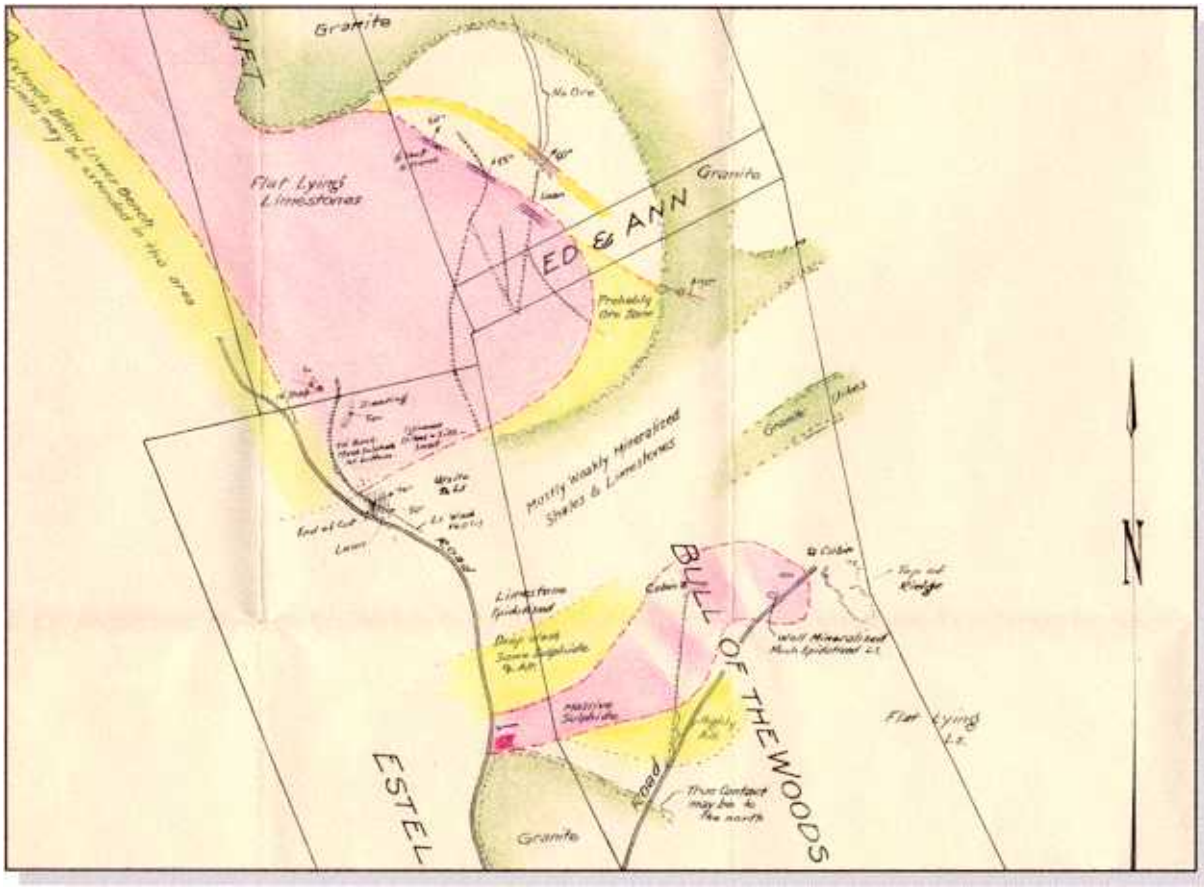
Abandoned-Inactive Mines on Gallatin National Forest-Administered Land



Montana Bureau of Mines and Geology
Abandoned-Inactive Mines Program
Open-File Report MBMG 418

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Prepared for the U.S. Department of Agriculture
Forest Service-Region 1

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Introduction

To fulfill its obligations under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Northern Region of the U.S. 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. Concurrently, the Montana Bureau of Mines and Geology (MBMG) collects and distributes information about the geology, mineral resources, and ground water of Montana. Consequently, the USFS and the MBMG determined that an inventory and preliminary characterization of abandoned and inactive mines in Montana would be beneficial to both agencies and entered into a series of participating agreements to accomplish this work. The first forest inventoried was the Deerlodge National Forest, followed by the Helena National Forest, then the Beaverhead, the Kootenai, and the Lewis and Clark Forests (table 1). Inventory on the Custer National Forest was "in progress" at the same time as that for the Gallatin. The Flathead, Lolo, and Bitterroot National Forests were scheduled to be inventoried last.

Table 1. List of previous inventories and open-file report (OFR) numbers.

National Forest-Volume	Drainage(s)	MBMG OFR #
Deerlodge-Volume I	Basin Creek	321
Deerlodge-Volume II	Cataract Creek	344
Deerlodge-Volume III	Flint Creek and Rock Creek	345
Deerlodge-Volume IV	Upper Clark Fork River	346
Deerlodge-Volume V	Jefferson River	347
Helena-Volume I	Upper Missouri River	352
Helena-Volume II	Blackfoot-Little Blackfoot Rivers	368
Beaverhead	Entire Forest	379
Kootenai	Entire Forest	395
Lewis and Clark	Entire Forest	413
Custer	Entire Forest	421
Bureau of Land Management	Entire State	365

1.1 Project Objectives

In 1992, the USFS and MBMG entered into the first of these agreements to identify and characterize abandoned and inactive mines on or affecting National Forest System lands in

Montana. The objectives of this discovery process, as defined by the USFS, were to

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

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

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

4. Cooperate with other state and federal agencies, and integrate the Northern Region program with their programs.

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

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

1.2 Abandoned and Inactive Mines Defined

For the purposes of this study, 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 various safety, health, and environmental problems that 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; 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 (appendix I-Field Form), the hydrologic environment appears to be affected to the greatest extent. Therefore, this investigation focused most heavily on impacts to surface water and ground water from the mines.

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

1.3.1 Acid-Mine Drainage

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

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 that affect the other five elements.

Most geochemists would add to this list mineral availability, such as calcite, which can neutralize the acidity. These six components occur not only within the mines but can exist within mine dumps and mill-tailings piles making waste material 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 ($[CuFe]_{12}Sb_4S_{13}$), and sphalerite ([Zn,Fe]S) to produce high concentrations of copper, lead, zinc, and other metals. Aluminum can be leached by the dissolution of aluminosilicates common in soils and waste material found in Montana. The dissolution of any given metal is controlled by the solubility of that metal.

1.3.2 Solubilities of Selected Metals

At a pH above 2.2, ferric hydroxide ($Fe[OH]_3$) precipitates to produce a brown-orange stain in surface waters and forms a similarly colored coating on rocks in affected streams. Other metals, such as copper, lead, cadmium, zinc, and aluminum, if present in the source rock, may co-precipitate or adsorb onto the ferric hydroxide (Stumm and Morgan, 1981). Alunite ($KAl_3[SO_4]_2[OH]_6$) and jarosite ($KFe_3[SO_4]_2[OH]_6$) will precipitate at pH less than 4, depending on $SO_4^{=}$ and K^+ activities (Lindsay, 1979). Once the acid conditions are present, the solubility of the metal governs its fate and transport:

Manganese solubility is strongly controlled by the redox state of the water and is limited by several minerals such as pyrolusite and manganite; under reduced conditions, pyrolusite (MnO_2) is dissolved and manganite (MnO[OH]) is precipitated. Manganese is found in mineralized environments as rhodochrosite ($MnCO_3$) and its weathering products.

Aluminum solubility is most often controlled by alunite ($KAl_3[SO_4]_2[OH]_6$) or by gibbsite ($Al[OH]_3$), depending on pH. Aluminum is one of the most common elements in rock-forming minerals such as feldspars, micas, and clays.

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

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

Cadmium solubility data are limited. In soils, cadmium solubility is controlled by the carbonate species octavite ($CdCO_3$) at a soil-pH above 7.5 and by strengite ($Cd_3[PO_4]_2$) at a soil-pH below 6. In soils, octavite is the dominant control on solubility of cadmium. In water, at low partial pressures of H_2S, $CdCO_3$ is easily reduced to CdS.

Copper solubility in natural waters is controlled primarily by the carbonate content; malachite ($Cu_2[OH]_2CO_3$) and azurite ($Cu_3[OH]_2[CO_3]_2$) control solubility when CO_3 is available in sufficient concentrations. In soil, copper complexes readily with soil iron to form cupric ferrite. Other compounds in soil such as sulfate and phosphates also may control copper solubility. Copper is present in many ore minerals, including chalcopyrite ($CuFeS_2$), bornite (Cu_5FeS_4), chalcocite (Cu_2S), and tetrahedrite ($Cu_{12}Sb_4S_{13}$).

Mercury readily vaporizes under atmospheric conditions and thus, is most often found in concentrations well below the 25 µg/L equilibrium concentration. The most stable form of mercury in soil is its elemental form. Mercury is found in low-temperature hydrothermal ores as cinnabar (HgS), in epithermal (hot springs) deposits as native mercury (Hg), and as Hg in human-made deposits where mercury was used in the processing of gold ores.

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

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

1.3.3 The Use of pH and SC to Identify Problems

In other mine evaluation studies similar to this one, pH and specific conductance (SC) have sometimes been used to distinguish "problem" mine sites from those that have no adverse water-related impacts. The general assumption is that low pH (<6.8) and high SC (variable) 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 higher pH values (>7), and its concentration strongly depends on the presence of dissolved iron. Cadmium and lead also may exceed standards in waters having pH values within acceptable limits.

Reliance on SC as an indicator of site conditions also can lead to erroneous conclusions. The SC value of a sample represents 55–75 percent of the total dissolved solids (TDS), depending on the concentration of sulfate. Without knowing the sulfate concentration, an estimate of TDS based

on SC has a 25 percent possible-error range. 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.

Thus, a water sample with a near-neutral pH and a moderate SC could be interpreted to mean that no adverse impacts have occurred when 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 trace elements, and major cations and anions.

1.4 Methodology

1.4.1 Data Sources

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

1) the MILS (mineral industry location system) data base [U.S. Bureau of Mines (USBM)],
2) the MRDS (mineral resource data systems) data base [U.S. Geological Survey (USGS)],
3) published compilations of mines and prospects data,
4) state publications on mineral deposits,
5) USGS publications on the general geology of some quadrangle maps,
6) recent USGS/USBM mineral resource potential studies of proposed wilderness areas, and
7) MBMG mineral property files.

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

1.4.2 Pre-Field Screening

Field crews visited only sites with the potential to release hazardous substances and sites that lacked information to make that determination without a field visit. For problems to exist, a site must have a source of hazardous substances and a method of transport from the site. Most metal mines contain a source for hazardous substances, but the common transport mechanism, water, is not always present. Sites on dry ridgetops were assumed to have no mechanism for water transport and mines described in the literature as small prospects were considered to have inconsequential hazardous-materials sources; thus, neither type was visited.

In addition, the MBMG and the USFS developed screening criteria (table 2) to determine if a site had the potential to release hazardous substances or posed other environmental or safety hazards. The first page of the Field Form (appendix I) contains the screening criteria. If any of the answers were “yes” or unknown, the site was visited. Personal knowledge of a site and published information were used to answer the questions. USFS mineral administrators used these criteria to "screen out" several sites using their knowledge of an area.

Table 2. 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 flood plain or shows signs of water erosion
__	__	5.	Residences, high public-use area, or environmentally sensitive area (as listed in HRS) within 200 feet of disturbance
__	__	6.	Hazardous wastes/materials (chemical containers, explosives, etc.)
__	__	7.	Open adits/shafts, highwalls, or hazardous structures/debris

If the answers to questions 1 through 6 were <u>all</u> "NO" (based on literature, personal knowledge, or site visit), then the site was not investigated further. Question 7 pertained to physical hazards only and was not a criteria for a site visit.

Mine sites that were not visited were retained in the data base along with the data source(s) consulted (appendix II). However, often these sites were viewed from a distance while visiting another site. In this way, the accuracy of the consulted information was often verified.

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

<u>1.4.3 Field Screening</u>

Sites that could not be screened out as described above were visited. All visits were conducted in accordance with a health and safety plan that was developed for each forest. An MBMG geologist usually made the initial field visit and gathered information on environmental

degradation, hazardous mine openings, presence of historical structures, and land ownership. Some site locations were refined using conventional field methods or by Global Positioning System (GPS) data. Each site is located by latitude/longitude and by tract-section-Township-Range as indicated in figure 1.

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

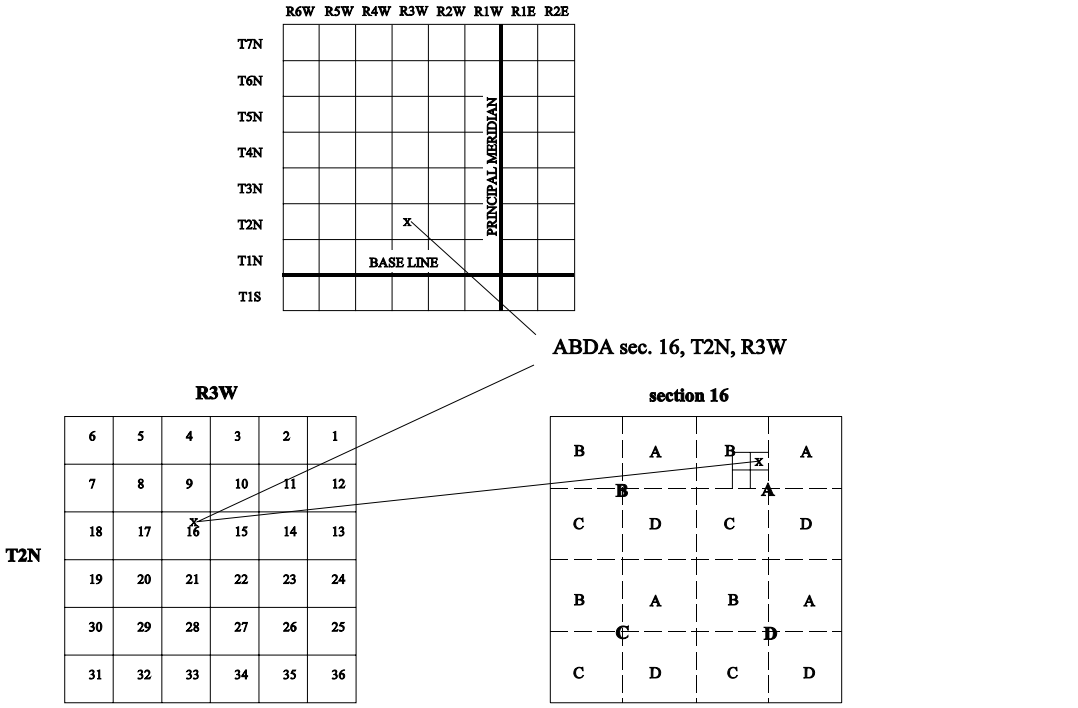


Figure 1. The location of a mine is found as shown using a counterclockwise progression of decreasing quarters of a section of land. The resulting tracts in this case are ABDA.

Sites with potential environmental problems were studied more extensively. The selection of these sites was made during the initial field visit using the previously developed screening criteria (table 2). In other words, if at least one of the first six screening criteria was met, the site was studied further. Sites that were not studied further are included in appendix III.

On public lands, sites with ground-water discharge, flowing surface water, or contaminated soils (as indicated by impacts on vegetation) were mapped by the geologist using a Brunton compass and tape. The maps show locations of the workings, exposed geology, dumps, tailings, surface water, and geologic sample locations.

1.4.3.1 Collection of Geologic Samples

The geologist took the following samples, as appropriate:

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

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

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

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

1.4.4 Field Methods

A MBMG 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

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

The hydrogeologist selected and marked water and/or soil sampling locations based on field parameters (SC, pH, Eh, etc.) and observations (erosion and staining of soils/streambeds), and chose sample locations that would provide the best information on the relative impact of the site to surface water and soils. If possible, surface-water sample locations were chosen that were

upstream, downstream, and at any discharge points associated with the site. Soil sample locations were selected in areas where waste material was obviously impacting natural material. In most cases where applicable, a composite-sample location across a soil/waste mixing area was selected. In addition, all sample sites were located to assess conditions on National Forest System lands; therefore, samples sites were located on National Forest System lands to the extent that ownership boundaries were known.

Because monitoring wells were not installed as part of this investigation, the evaluations of impacts to ground water were based solely upon strategic sampling of surface water and soils. Background water-quality data are 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 Collection of Water and Soil Samples

Sampling crews collected soil and water samples, and took field measurements (stream flow) in accordance with the following:

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

Quality Assurance Project Plan (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.

1.4.4.3 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 sampling and analysis plan (SAP) for each mine site or development area that was then approved by the USFS project manager. Each sample location was plotted on the site map or topographic map and described in the SAP; each sample site was given a unique seven-character identifier based on its location, sample type, interval, and relative concentration of dissolved constituents. The characters of the unique sample identifier were defined as follows:

D DA T U L I C where:

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,

U: S-Surface Water, G-Ground Water

L: Sample location (1-9)

I: Sample interval (default is 0)

C: Sample concentration (High, Medium, Low) determined by the hydrogeologist, based on field parameters.

4.4.4 Existing Data

Data collected in previous investigations were neither qualified nor validated under this project. The quality-assurance managers and project hydrogeologists determined the usability 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 did not exist for a given analysis, the following method was used:

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

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

1.4.6 Standards

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

1.4.6.1 Soil Standards

There are no federal standards for metal concentrations and other constituents in soils; acceptable limits for such are often based on human and/or environmental risk assessments for an area. Because no assessments of this kind have been done, metals concentrations in soils were compared to the limits postulated by the EPA and the Montana Department of Health and Environmental Sciences (MDHES) (now Department of Environmental Quality) for sites within the Clark Fork River basin in Montana. The proposed standard for lead in soils is 1,000 mg/kg to 2,000 mg/kg, and 80 to 100 mg/kg for arsenic in residential areas. The Clark Fork Superfund Background Levels (Harrington- MDHES, written commun., 1993) are listed in table 3.

Table 3. Clark Fork Superfund background levels (mg/kg) for soils.

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)*	500

*A more recent level of 500 mg/kg for lead was provided for state superfund programs (Judy Reese, MDEQ, written commun., 1999). The 1,000 level was an upper limit for lead and not used at CFR sites.

For reference, Reese also provided the following Clark Fork Superfund phytotoxicity levels in table 4.

Table 4. Various levels of toxicity for lead (ARWWS : Anaconda Regional Water and Waste Standards, a part of the Anaconda National Priorities List).

Source		ppm
ARWWS ecological RA	low pH<6.5	94 (Natural Resource Damage #)
ARWWS ecological RA	low pH>6.5	179 (Natural Resource Damage #)
ARWWS ecological RA	high pH<6.5	250
ARWWS ecological RA	high pH>6.5	250
Kabata-Pendias & Pendias (1992)		100-400
CH2MHill (1987)		1,000

1.4.6.2 Water-Quality Standards

The Safe Drinking Water Act (SDWA) directs EPA to develop standards for potable water. Some of these standards are mandatory (primary), and some are desired (secondary). The standards established under the SDWA are often referred to as primary and secondary maximum contaminant levels (MCLs). The maximum contaminant level is defined as " the maximum permissible level of a contaminant in water which is delivered to any user of a public water system" (EPA, 1999). 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 5. In some state investigations, the standards are applied to samples collected as total-recoverable metals. Because total-recoverable-metals concentrations are difficult if not impossible to reproduce, this investigation used dissolved-metals concentrations.

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, soil chemistry are presented in appendix IV.

The data for this project were integrated with existing data and incorporated into a new MBMG abandoned-inactive mines data base.. It is designed to be the most complete compilation available for information on the location, geology, production history, mine workings, references, hydrogeology, and environmental impact of each of Montana's mining properties. The data fields in the current data base are compatible with the MBMG geographic information system (GIS) package.

Table 5. Water-quality standards.

	PRIMARY MCL[1] (mg/L)	SECONDARY MCL[2] (mg/L)	AQUATIC LIFE ACUTE[3,4] (mg/L)	AQUATIC LIFE CHRONIC[3,5] (mg/L)
Aluminum		0.05-0.2	0.75	0.087
Arsenic	0.05[9]		0.34	0.15
Barium	2			
Cadmium	0.005		0.0043[6]	0.0022[6]
Chromium	0.1		1.7[6,7]	0.21[6,7]
Copper	1.3[8]	1.0	0.013[6]	0.009[6]
Iron		0.3		1
Lead	0.015[8]		0.065[6]	0.0025[6]
Manganese		0.05		
Mercury	0.002		0.0014	0.00077
Nickel			0.47[6]	0.52[6]
Silver		0.1	0.0034[6]	
Zinc		5	0.12[6]	0.12[6]
Chloride		250	860	230
Fluoride	4.0	2.0		
Nitrate	10 (as N)			
Sulfate		250		
pH (Standard Units)		6.5-8.5		6.5-9.0

1) 40 CFR 141; revised through 7/1/99.
2) 40 CFR 143; revised through 7/1/99.
3) Priority Pollutants, EPA Region VIII, April 1999.
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.
7) Cr^{+3} species.
8) Action level, EPA Current Drinking Water Standards, National Primary and Secondary Drinking Water Regulations, April, 1999.
9) The Safe Drinking Water Act, as amended in 1996, requires EPA to revise the existing drinking water standard for arsenic. Planned for Spring 2000.

1.5 Gallatin National Forest

Approximately 1.8 million acres are administered by the USFS, Gallatin National Forest (GNF). The area lies east of the Continental Divide in west-central Montana (figure 2) and includes areas both north and south of Interstate 90. The regional office is located in Missoula, Montana, with the Supervisor's office in Bozeman and district offices located in Big Timber, West Yellowstone (Hebgen Lake), Gardiner, Livingston, and Bozeman. The majority of the GNF-administered land

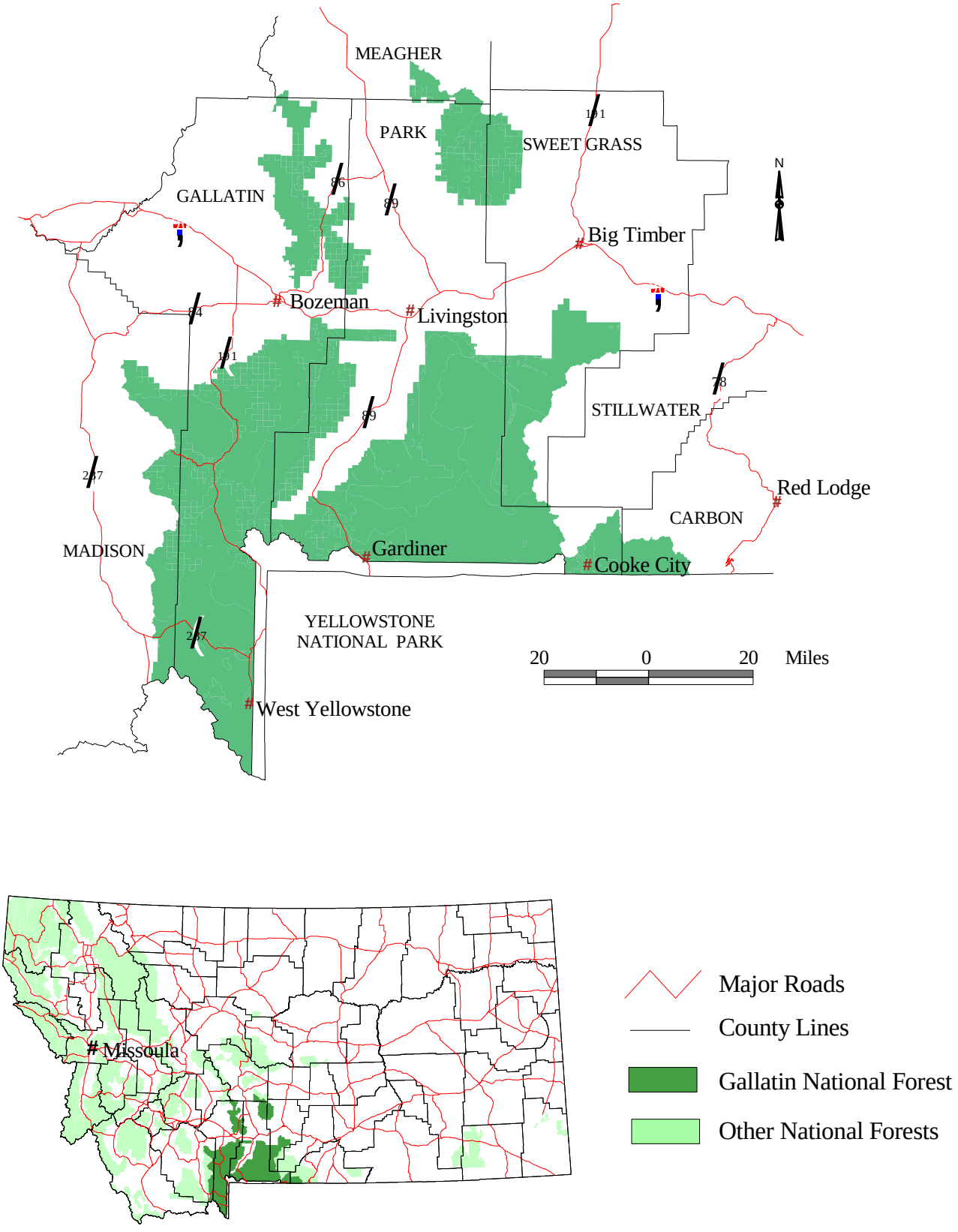


Figure 2. The Gallatin National Forest and associated wilderness areas cover nearly 1.8 million acres in south-central Montana.

is on the Bozeman 1° x 2° quadrangle, and the remainder is on the western half of the Billings 1° x 2° quadrangle and the southeastern portion of the White Sulphur Springs 1° x 2° quadrangle. Gallatin National Forest-administered land lies within parts of Madison, Sweet Grass, Park and Gallatin counties.

The topography is typical of southwestern Montana's Basin and Range province, grading from semiarid grass/sagebrush-vegetated valleys to coniferous forests and alpine peaks above timberline. The Absaroka/Beartooth, Gallatin, Bridger, Crazy, and Madison (including the Spanish Peaks) mountain ranges lie within the Gallatin National Forest boundary. Typical highest mountain elevations of the GNF-administered land range from 10,000 ft to over 11,000 ft. Valley elevations are about 4,482 ft at Big Timber to 4,900 ft at Bozeman to over 5,200 ft at Gardiner.

1.5.1 History of Mining

As with many of the other metal mining areas in the state, the mining districts in the Gallatin National Forest were discovered and most intensely mined from the 1860's to the turn of the 20th Century. By 1870, most of the major mining districts had been discovered. Exploration and mining activity generally focused on precious metals although copper, lead, arsenic, tungsten, chromite, rhodium, cobalt, nickel, zinc, asbestos, sand and gravel, and building stone have also been produced (Hammarstrom and others, 1993; Johnson and others, 1993; Close and others, 1982; Terry and others, 1981; Reed, 1950). The majority of the mining districts are located in the Beartooth Mountains and Absaroka Range.

Mining began with the discovery of placer gold deposits in the 1860's. Many streams were placered but production statistics are generally unavailable since most of the activity was in the 1880's to early 1900's, before records were kept by the U.S. Bureau of Mines. The most significant recorded production came from Emigrant Creek where approximately 35,594 ounces of gold was recovered from 1901 to 1947 (Stotelmeyer and others, 1983). Other important placer deposits were located along Bear Creek in the Jardine-Crevice (Sheepeater) mining district and along the Boulder River.

In the 1870's, mining of lode deposits began in the New World and Jardine-Crevice (Sheepeater) mining districts. The lode-silver lead deposits of the New World mining district were discovered in 1870. Numerous mines were developed in the area including the McLaren, Homestake, and Irma-Republic mines. From 1886 to 1953, the district produced gold, silver, copper, lead, and zinc (Hammarstrom and others, 1993). Plans for development of a new mine by Crown Butte Mines Inc. in the New World district were abandoned in 1998 when the site of the proposed mine was acquired by the U.S. Forest Service. The Jardine-Crevice mining district was the most important gold producing region in the area. Gold bearing quartz veins were discovered in 1870 on Mineral Hill near the present site of the Mineral Hill Mine and historic site of the Jardine

Mine (Johnson and others, 1993). The Mineral Hill Mine, owned by TVX Gold Inc., was an active producer of gold until 1996. Total recorded gold production in the district, through 1996, was approximately 474,441 ounces (R.B. McCulloch, personal commun., 2000; Johnson and others, 1993). Silver, arsenic, and tungsten were also produced in significant quantities. Other smaller lode deposits on the Gallatin National Forest were mined in the Independence, Pass Creek, and Emigrant mining districts.

At present, the most significant mineral deposits in the Gallatin National Forest are those associated with the Stillwater mining district. The district includes private holdings and land within the Gallatin and Custer National Forests. Copper and nickel deposits were discovered in 1883 and chromite deposits were recognized by the 1890's (Page and others, 1985). Most of the exploration, development, and mining during the 20th Century was for chromium; production was strongly influenced by wartime demands. The period of greatest production was from 1953 to 1961, during the Korean War and the U.S. Government stockpiling program, when 900,000 short tons of chromium concentrate was produced from the Mouat Mine near Nye (Page and others, 1985).

The platinum-group metals (PGMs) were recognized in the 1930's, but it was not until the 1960's that exploration programs focused on PGM potential. In the 1970's, Johns-Mansville Corporation geologists discovered and delineated the economic deposits of the PGM (the J-M Reef) and in 1986, the Stillwater Mine began operations (Lawson, 1988). The mine, located on the eastern end of the J-M Reef in the Custer National Forest, currently produces platinum and palladium. Also recovered in the mining process are small amounts of gold, silver, rhodium, copper, nickel and cobalt. A second producing mine, the East Boulder project, is currently in the development phase. It is located on the East Boulder River, near the western end of the J-M Reef, and will be the only large mining operation presently within the Gallatin National Forest boundaries.

In addition to the work on the East Boulder project, smaller scale mining exploration continues in the Gallatin National Forest. In 1999, 21 hard rock mining exploration plans were processed according to the Gallatin National Forest Internet website.

1.5.1.1 Production

The total value (at the time they were mined) of minerals produced from all mines within the Gallatin National Forest boundaries was probably over $10,000,000 with the majority from gold lode mines. These figures do not reflect the cost of mining and milling the metals so the actual profit from these mines would be much less. The estimated values reflect the prices of commodities at the time of production and not current prices. A more current estimate at today's metal prices would total $186,000,000 but again this is a "ballpark" figure (from Johnson and others, 1993).

Table 6. Production from the primary mining districts of the Gallatin National Forest.

Mining district	Gold (oz)	Silver (oz)	Copper (lb)	Lead (lb)	Zinc (lb)	Other commodities
Boulder	10,000	–	–	–	–	
Independence	2,202	1,082	3,805	924		
New World	75,000	500,000	4,000,000	3,000,000	1,200,000	
Emigrant	40,032	3,234	318	954	318	
Stillwater	213	895	1,155	–	–	
Pass Creek	4	48	40	35,508	–	
Jardine-Crevasse	294,190	36,000	–	–	–	Arsenic - 12,616,000 lb Tungsten - 766,122 lb

Production statistics from Johnson and others (1993).

1.5.1.2 Milling

Knowledge 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 mine, produce two materials: 1) a product that is either the commodity or a concentrate that is shipped off site to other facilities for further refinement, and 2) mill waste, which is called tailings.

In the 1800's, 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 commonly removed from free-milling ores at the mill by mercury amalgamation. Cyanidation arrived in the United States 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 2 fundamental processes used for ore concentration: gravity and flotation, and 3 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 Gallatin National Forest Investigation

A total of 212 sites were initially identified in or near the Gallatin National Forest (GNF) by using the USBM MILS data base as a basic reference. Another source of information included the Mineral Resource Appraisal of the Gallatin National Forest by the U.S. Bureau of Mines (MLA19-93, Johnson and others, 1993). Previous to this study, the USBM and the USGS produced several reports on the geology and the mineral resources of the wilderness study areas of the Gallatin National Forest. Reed described much of the earlier mineral exploration activity in Gallatin and Park Counties (Reed, 1950 and 1951). Table 7 summarizes the process by which the final results were achieved in the Gallatin National Forest inventory. Many of the mines in the New World mining district were screened out because they were part of the New World Mining District Response and Reclamation Project and were being studied by other agencies as such. Also, at the time of this study, the area around the TVX Mineral Hill Mine at Jardine was considered active and so was not included in the inventory.

Table 7. Summary of Gallatin National Forest investigation.

Total Number of Abandoned/Inactive Mines Sites that were:	
PART A-Field Form	
Located in the general area from MILS	212
Deleted as a duplicate site	0
Added by MBMG from literature or field visits	246
	458
PART B-Field Form (Screening Criteria)	
Screened out by GNF minerals administrator or by description in literature	312
Unable to locate	10
Visited by MBMG geologist	136
Screened out by geologist	127
PART C-Field Form	
Sampled (Water and/or Soil)	9

These numbers are accurate to the extent that the data base is updated and will change, reflecting current progress in database entry.

An individual discussion of each of the 9 sites referred to the hydrogeologists and sampled by them is included in this report on the Gallatin National Forest. Some sites were on private lands and were sampled collectively at sites located on GNF-administered land. A short description of

the 458 sites inventoried as possibly affecting GNF-administered land are listed in appendix III of this volume.

1.7 Mining Districts and Drainages

The Gallatin National Forest includes at least twelve mining districts as defined by several authors including Sahinen (1935), Reed (1950, 1951), and Johnson and others (1993). These boundaries are subject to interpretation and change, and often the same district is known by various names, as in the case of the Cowles or Haystack district, or the Crevice (Crevasse), Mineral Hill, Sheepeater, Bear Creek or Jardine districts. Some mines are not located in traditional districts, so for the purposes of this study, all the mines studied have been organized by drainage basin, by County and by ranger district. Drainages are a convenient way to separate the National Forest-administered land into manageable areas for discussion of geology and hydrogeology, and perhaps more important, it is an aid to the assessment of cumulative environmental impacts on the drainage.

Gallatin National Forest Drainages

The Gallatin National Forest includes parts of the Yellowstone Headwaters, Upper Yellowstone, Clarks Fork Yellowstone, Madison, Gallatin, and Shields River drainage basins. The majority of the mining activity has been in the Upper Yellowstone and Gallatin basins. The land administered by the Gallatin National Forest includes most of the rugged mountainous terrain in the headwater regions of the Yellowstone, Madison, and Gallatin Rivers.

2.1 Geology

The geology of the Gallatin National Forest (GNF) has been described in numerous reports; only a few of the more recent reports will be mentioned here. A geologic map of the western and northern parts of the GNF was compiled by Wilson and Elliot (1997). Hammarstrom and others (1993) published a map of the Absaroka-Beartooth area as part of a mineral resource-potential study. Detailed geologic mapping and sampling was completed in several wilderness study areas by the U.S. Geological Survey and the U.S. Bureau of Mines. Results were published in reports by Becraft and others (1966), Wedow and others (1975), Simons and others (1979), U.S. Geological Survey and U.S. Bureau of Mines (1983), Close and others (1981), Lambeth and others (1982), and Johnson and others (1993). A brief description of the forest geology summarized from the above reports and maps is presented here.

Geologic units of the Gallatin National Forest vary from Precambrian-age basement rocks to Quaternary alluvium (figure 3). The oldest rocks are Precambrian metamorphic rocks that

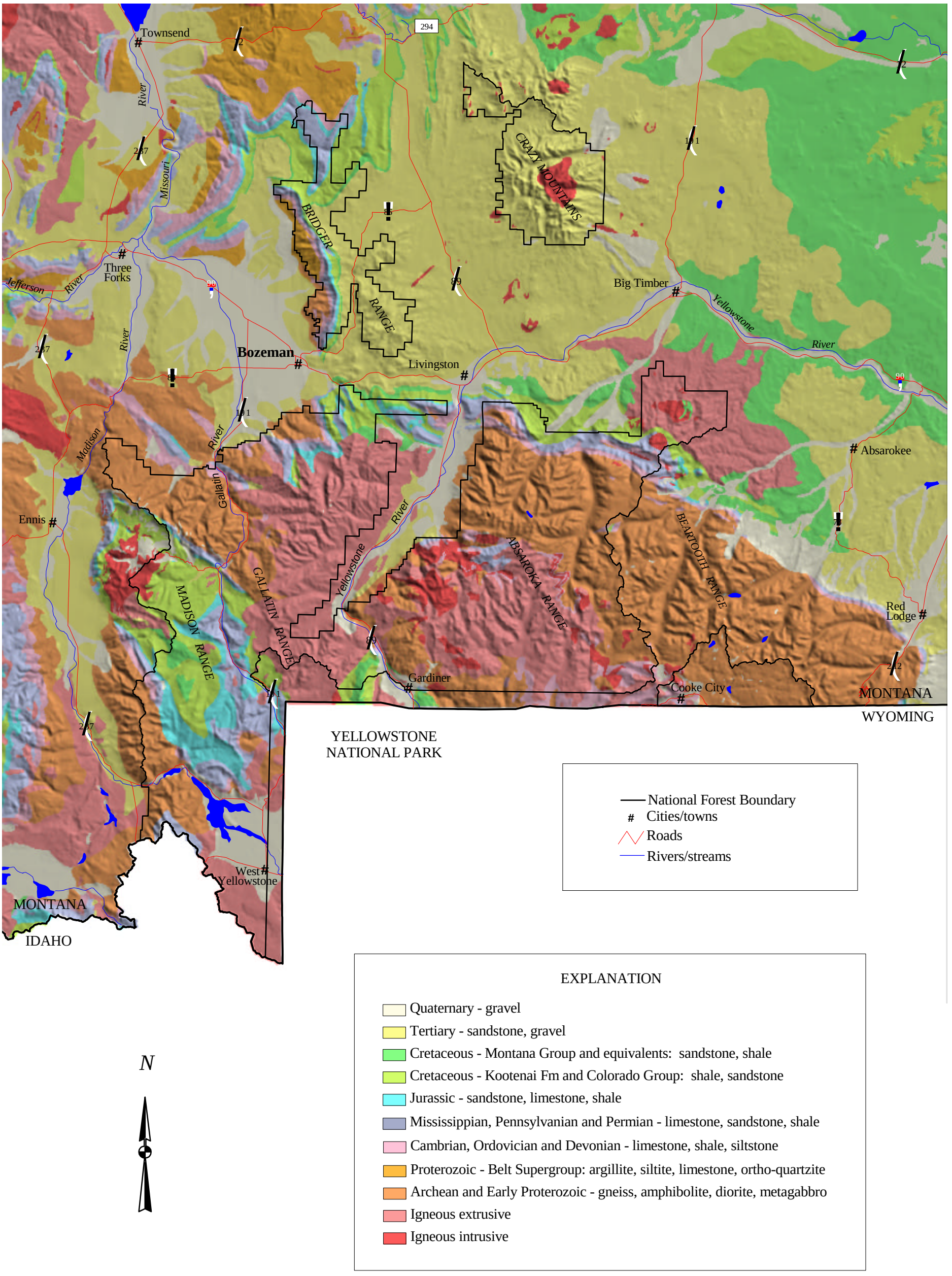


Figure 3. Generalized geologic map of the Gallatin National Forest (modified from Ross and others, 1955).

underlie the Bridger, Madison, Gallatin, and Absaroka ranges and the Beartooth Mountains. Paleozoic and Mesozoic sedimentary rock are found throughout area and are generally exposed along the flanks of the mountain ranges. Tertiary volcanics, consisting of andesitic and dacitic breccias, mafic lavas and rhyodacite tuffs, form widespread deposits in the southern half of GNF-administered land. Numerous intrusives have been emplaced throughout the Forest, and penetrate the older rock. The youngest deposits consist of unconsolidated Quaternary alluvium, glacial glacial deposits, landslides, and minor volcanic flows. These units generally occur along the major drainages and within valley bottoms.

The northern region of the GNF is located within the Bridger Range and the Crazy Mountains. The Crazy Mountains consist of Tertiary igneous instrusives that penetrate the surrounding Cretaceous sedimentary rock. The main igneous bodies are the Big Timber Stock (diorite and gabbro) and numerous radial dikes. Sedimentary rocks consist primarily of conglomerates, sandstones, siltstones and volcaniclastic sediments. The Bridger Range consists of uplifted Precambrian metamorphic rocks overlain by Paleozoic to Cenozoic sedimentary rocks. The Precambrian rocks are exposed on the west flank of the range and consist of two distinct rock types. To the south of the North Pass fault zone are extensive outcrops of Archean igneous and metamorphic rock; to the north are sedimentary rocks of the Proterozoic Belt Supergroup.

The southern half of the GNF encompasses the Gallatin Range and most of the Madison Range to the west, and the Absaroka Range and part of the Beartooth Mountains to the east. The Madison Range is a raised block cored by Precambrian metamorphic rocks overlain by folded Paleozoic and Mesozoic sedimentary formations. The Spanish Peaks area, at the northern end of the Madison Range, is almost entirely underlain by Archean metamorphics. Cretaceous intrusions of dacitic and andesitic composition and Tertiary volcanics are scattered throughout the range. The Gallatin Range is also an uplifted block of metamorphic, sedimentary and igneous rock. Basement rock is more widely exposed than in the Madison Range and sedimentary rocks are less evident. Tertiary volcanic and intrusive rocks associated with the Absaroka Volcanic Field cover large areas of the western Gallatin Range.

One of the most notable geologic features of the southeast portion of the GNF is the Beartooth Plateau. The Beartooth Plateau borders Yellowstone National Park and encompasses approximately 3,200 square miles, a large part of which is within the GNF boundary. The Absaroka Range forms the western end of the plateau and the Beartooth Mountains form the eastern area. The plateau is a broad, fault-bounded uplift cored by metamorphic rocks, mainly gneisses, amphibolites, and schists. Paleozoic and Mesozoic sedimentary and metasedimentary rocks locally overlie the metamorphic rocks. Along the northeast edge of the plateau, in the Beartooth Mountains, a 26-mile long mafic and ultramafic layered igneous intrusion forms the Stillwater Complex. The Stillwater Complex is geologically unique in the United States and contains important deposits of chromite, copper, nickel, and platinum-group metals. Large areas of the plateau in the Absaroka Range are covered by Tertiary volcanics, intrusives, and related volcanogenic sedimentary rocks. The major structural features of the Beartooth Plateau are the

east-west trending Mill Creek-Stillwater Fault and the northwest-trending structural low known as the Cooke City zone. Several Tertiary intrusive centers and their associated mineralized and altered areas are aligned along the Cooke City zone indicating it may have been a major control on the emplacement of Eocene intrusive centers and associated mineral deposits (Hammarstrom and others, 1993).

2.2 Economic Geology

The Gallatin National Forest-administered lands includes all or part of many mining districts. Most of the mining districts are located in the Upper Yellowstone watershed. The remainder are found in the Yellowstone Headwaters, Clarks Fork of the Yellowstone, and Gallatin River drainages. Figures 4, 5, 8, 13, and 19 show the location of mines and mills in the major drainage basins within the Gallatin National Forest boundaries. The more important mining districts in each drainage are discussed below.

Upper Yellowstone Drainage

The majority of the mining activity in the Gallatin National Forest has been in the Upper Yellowstone drainage basin. There are eight mining districts in the basin, as well as numerous prospects and small mines outside the recognized districts. The economic geology of the major districts is briefly summarized below. Some of the districts have been grouped under one heading for the purpose of this report.

Stillwater Mining District

The Stillwater mining district lies along the northeast edge of the Beartooth Plateau. The district includes the entire igneous Stillwater Complex which extends from just west of the Boulder River to West Fishtail Creek. The western portion of the district is within the boundaries of the Gallatin National Forest; the eastern half is within the Custer National Forest. Excellent summaries of the geology and mineral resources of the Stillwater mining district have been compiled by Hammarstrom and others (1993) and Czamanske and others (1985).

The Stillwater Complex is a mafic to ultramafic layered igneous intrusion of Late Archean age that extends in a southeasterly direction for about 28 miles. Deposits of nickel and copper were discovered in the district in 1883, chromite deposits were probably discovered around 1890, and the platinum-group metals (PGMs) were recognized in 1936 (Hammarstrom and others, 1993). The Stillwater Mining Company currently has active mining operations in the area. They are the world's largest producer of palladium and the only significant producer of platinum and palladium in North America. Production is from a stratiform sulfide-enriched zone known as the J-M Reef. Small amount of gold, silver, rhodium, copper, nickel, and chromium are recovered as by-products of the mining process. On Gallatin National Forest-administered land, the East

Boulder project is currently in the development phase and will be the second mine producing from the J-M Reef. The proven and probable reserves for the Stillwater Mine total contained 25,663 ounces of platinum and palladium (Stillwater Mining Company Annual Report, 1999).

Natural Bridge Mining District

The Natural Bridge mining district is located along the north flank of the Beartooth Plateau, adjacent to the Boulder River. The district borders the northwest end of the Stillwater mining district and has been included with the Stillwater district in reports by Elliot and others (1983) and Johnson and others (1993). The first claims in the Natural Bridge area were located in 1882 and small amounts of gold, silver and copper were mined intermittently from 1901 to 1937. Prospecting concentrated on numerous quartz-filled fissures in Precambrian metamorphic rocks (Stotelmeyer and others, 1983). Most of this district is now located within the Absaroka-Beartooth Wilderness area.

Emigrant-Mill Creek Mining District

The Emigrant mining district is located on the west flank of the Absaroka Range and includes the Emigrant district in the Emigrant Creek drainage, the Mill Creek subdistrict along the Mill Creek drainage, and the Sixmile subdistrict along North Fork Sixmile and Sixmile Creeks (Elliot and others, 1983). Placer gold deposits were discovered near the mouth of Emigrant Creek in 1863 and were worked until 1947. Hardrock mining began in 1895 and continued until 1968 (Reed, 1950; Johnson and others, 1993).

Mineralization in the area is related to early-Tertiary igneous rocks (Elliot and others, 1983). The Emigrant stock underlies most of the district, and has intruded older Precambrian gneiss and schist, Paleozoic sedimentary rocks, and Tertiary volcanic rocks. Mineral deposits associated with the Emigrant stock consist of stockwork, breccia-pipe, and vein-type deposits; deposits outside the stock are mostly vein and replacement types. A general alignment of faults and mineral deposits suggest an overall northeast-trending structural control on mineralization. The only significant production in the region has been of gold although numerous small deposits have been worked for lead, copper, zinc, silver and molybdenum. The district's mineral production has been estimated at about 40,000 ounces of placer gold and silver (Stotelmeyer and others, 1983). Lode deposits have yielded approximately 438 ounces gold, 942 ounces silver, 954 pounds lead, 318 pounds copper, and 318 pounds zinc (Reed, 1950).

Independence (Boulder) Mining District

The Independence mining district, also referred to as the Boulder, Cowles, or Haystack district, is located near the head of the Boulder River on the north side of the Beartooth Plateau. Gold was first discovered around 1864; sporadic mining continued until 1934. Most of the district lies within the Absaroka-Beartooth Wilderness and was included in a comprehensive study of mineral resources in the wilderness area completed by the U.S. Geological Survey and the U.S.

Bureau of Mines (Stotelmeyer and others, 1983). Reed (1950) and Johnson and others (1993) also summarized mineral resources in the district.

The geology and mineralization in the Independence mining district is similar to that described previously for the Emigrant-Mill Creek mining district. The Independence Stock underlies much of the district and intruded Precambrian gneissic rocks, Paleozoic sedimentary rocks, and Tertiary volcanics (Elliot and others, 1983; Johnson and others, 1993). The stock is the eroded root of the Independence volcano which was the source of most of the Eocene volcanic flows and breccias in the region. The majority of the ore deposits in the district are within the Independence Stock and comprise disseminated or stockwork, vein, and replacement types. Production from the area peaked in the early 1890's and continued sporadically until around 1942. Gold, silver, and copper were the primary metals mined in the district.

Deer Creek Mining District

The Deer Creek mining district is located along the northeast margin of the Beartooth Mountains and encompasses the area between the headwaters of Upper and Lower Deer Creek. Mining activity in the area probably began in the early 1900's. Most mineral deposits in the district are associated with the Iron Mountain Stock and several small porphyritic intrusions of early Tertiary age (Johnson and others, 1993). The mines generally were located near shear zones or veins. There is little published information on production from this district. Gold, silver, and copper were the primary minerals mined. The district was evaluated in the1970's as a possibly copper porphyry target and again in the late 1980's as a gold prospect.

Big Timber Mining District

The Big Timber mining district is located on the eastern slope of the Crazy Mountains, in the headwaters of Big Timber Creek. The first prospects were discovered around 1900 and mining ceased around 1950 (Reed, 1950; Johnson and others, 1993). Mineral deposits are associated with quartz and quartz-sulfide veins along shear zones in the Big Timber Stock. Known lode deposits are confined to regions of the stock that consist of diorite. Ore from the area contains lead and silver with minor amounts of gold and copper. Production appears to have been minimal.

Yellowstone Headwaters Drainage

Four mining districts are recognized in the Yellowstone Headwaters drainage. The Jardine (Sheepeater), Crevice, Horseshoe, and part of the New World (Cooke City) mining districts. The New World mining district also lies within the Clarks Fork Yellowstone and the Stillwater drainages. The economic geology of the New World mining district is discussed under the Clarks Fork Yellowstone drainage basin.

Jardine-Crevice Mining District

The Jardine and Crevice mining districts are located on the western edge of the Absaroka Range, in the Bear Creek drainage just north of Yellowstone National Park. These adjacent districts are geologically similar and are generally discussed as one (Seager, 1944; Reed, 1950; Johnson and others, 1993). Placer gold was discovered in the area around 1862 and during the next decade lode deposits were found on Mineral Hill and Crevice (Crevasse) Mountain. The gold-arsenic-tungsten lode deposits occur as replacement veins in Precambrian schist and quartzite (Elliot and others, 1983).

Most of the mining activity has been near Mineral Hill in the Jardine mining district (also referred to as the Sheepeater or Bear Gulch district). The mines consisted of more than 30 adits, approximately 7 miles of underground workings, and a number of open cuts (Reed, 1950). Mines were active in both districts until around 1942, although most of the production was from the Jardine Mine. Recorded production through 1949 totaled at least 201,000 ounces gold; 12,615,131 pounds arsenic trioxide; 766,122 pounds tungsten; 36,000 ounces silver, and minor amounts of copper and lead (Johnson and others, 1993). In 1979, a new phase of gold exploration began at the Jardine mine and production resumed in 1989. From 1989 through 1996, an additional 273,441 ounces of gold was recovered from the mine (R.B. McCulloch, personal commun., 2000). The mine was considered active until 2000 at which time the operator (TVX Gold, Inc.) halted production with the intention of quitting its position at Jardine.

Horseshoe Mining District

The mineral resources of the Horseshoe mining district were studied by Wedow and others (1975), and Johnson and others (1993). The district is located entirely within the Absaroka-Beartooth Wilderness area and is bordered to the north by Wounded Man Creek and to the south by Lake Abundance Creek. Both streams are tributaries of Slough Creek. Prospecting for gold began in the area in the 1890's and some of the oldest and most extensive lode deposits are found on the northwest side of Horseshoe Mountain. The lode-type deposits most often occur in hydrothermally altered parts of the Tertiary dacitic-rhyolitic porphyries which have intruded Cambrian and Precambrian sedimentary and metamorphic rocks (Wedow and others, 1975). Mineralization appears to be concentrated in silicified zones or quartz veins along north-, northwest-, and east-trending fracture zones. Placer gold has been recovered from several of the small tributaries draining Horseshoe Mountain. No information was available on production from this district.

Clarks Fork of the Yellowstone Drainage

New World (Cooke City) Mining District

The New World mining district is located in the southeast corner of the Gallatin National Forest. The district encompasses the headwaters of three separate drainage basins–the Yellowstone

Headwaters, Clarks Fork Yellowstone, and the Stillwater. The northern edge of the district lies within the boundary of the Custer National Forest. Lode silver-lead deposits were discovered in the area in 1869 (Sahinen, 1935) and significant mining took place from the 1870's through the 1920's. Mining was sporadic in following years and had ended by the 1950's. Exploration activities continued in the district until the 1990's.

Geologic units of the New World mining district are primarily Precambrian granitic and metamorphic rocks, Paleozoic sedimentary rocks, and Tertiary intrusives and volcanics (Johnson and others, 1993). The mineral deposits consist of complex gold-silver-copper-lead-zinc ores that occur mainly as vein, replacement, and disseminated deposits of early Tertiary age (Wedow and others, 1975). The district lies within the Cooke City structural zone which may have been a major control on the emplacement of Tertiary intrusives and associated mineral deposits (Hammarstrom and others, 1993). Most of the production has been from stratabound skarns in the Cambrian Meagher Limestone. Total reported production for the New World district is about 62,000 oz gold, 692,000 oz silver, 1.9 million lbs copper, 3.4 million lbs lead, and 920,000 lbs of zinc (Hammarstrom and others, 1993). The properties associated with the New World mining district were acquired by the Forest Service in 1998 and are now part of the New World Mining District Response and Restoration Project.

Gallatin Drainage

Three mining districts and a number of prospects and mines outside recognized districts are located in the Gallatin drainage basin. The Pass Creek mining district is the most important and is discussed below. The Eldridge (Taylor Fork) and West Fork (Spring Hill) districts are located on the western edge of the Madison Range and were primarily placer deposits (Sahinen, 1935; Lambeth and others, 1982). They will not be discussed further.

Pass Creek Mining District

The Pass Creek mining district is located in the west-central part of the Bridger Range, along Johnson Creek. The district was discovered prior to 1901 and has been a small producer of lead with minor amounts of silver, copper, and gold (Reed, 1951). Mineral deposits in this district occur in the Precambrian LaHood Formation which is part of the Belt Supergroup. Most of the mines appear to be associated with the northwest-trending Cross Range Fault. Mineralization occurs as either (1) fillings in epigenetic quartz and carbonate veins and in gouge zones along the Cross Range Fault, or (2) post-depositional, stratiform disseminations in the LaHood Formation (referred to as “shale hosted”) (Johnson and others, 1993). Minerals in the deposits are predominately galena, sphalerite, chalcopyrite, and pyrite. The Pass Creek Mine accounts for most of the production in the district although other areas have been worked. Production statistics for the district indicate that recovered metals included 35,508 lbs lead, 4 oz gold, 48 oz silver, and 40 lbs copper (Johnson and others, 1993).

2.3 Hydrology and Hydrogeology

The Gallatin National Forest includes parts of the Madison, Gallatin, and upper Yellowstone River drainages. Average annual precipitation ranges from about 14 inches in the valleys to more than 60 inches in the mountains. Most precipitation occurs as snow in late winter and early spring. All of the basins have large agricultural developments and rely on irrigation from streamflow derived from snow melt. Temperatures in the Gallatin National Forest range from well below freezing in winter to over 90E F in the summer months.

Madison River

The Madison River originates in Yellowstone National Park and drains northward into the Missouri River at Three Forks, Montana. The drainage has an area of 2,186 square miles above the U.S. Geological Survey gage station just below Ennis Lake. At this station (06041000), the monthly mean stream flow varies from 810 cubic feet per second (cfs) in October to 6,135 cfs in June for the period of 1939 to 1999 (Shields and others, 1999). The lowest recorded daily mean stream flow was 210 cfs on August 25, 1959 after an earthquake triggered slide blocked the river. The highest recorded daily mean stream flow (9,120 cfs) at station 06041000 occurred on June 11, 1970. The Quake Lake earthquake caused a wave and surge of over 10,000 cfs on August 17, 1959.

Streamflow is well regulated by controls at Ennis Lake and Hebgen Lake; about 23,000 acres are irrigated with water diverted from the lakes and the main channel of the river. A small hydroelectric facility uses flow from the Madison River just below Ennis Lake.

Ground water is used for irrigation and domestic supply throughout the basin. The towns of West Yellowstone and Ennis use both ground water and surface water for municipal-water supplies. Metesh and Kougioulis (2000) located about 330 domestic wells in the West Yellowstone area.

Gallatin River

The Gallatin River originates in Yellowstone National Park and drains northward to Three Forks, Montana where it joins with the Madison and Jefferson Rivers to form the Missouri River. At Logan, Montana, the drainage area upstream is 1,795 square miles and the annual mean discharge is 1,080 cfs. The flow varies from a low annual mean of 454 cfs to a high annual mean of 1,673 for the period of record from 1894 to 1999 (Shields and others, 1999).

About 110,000 acres are irrigated with water diverted from the river above Logan; some flow of the main stem is controlled by the Middle Creek Reservoir and several smaller reservoirs on tributaries near Bozeman. Domestic water supplies are primarily ground water and springs, particularly in the area of Big Sky and Bozeman.

Upper Yellowstone River

The upper Yellowstone River originates at the outlet of Yellowstone Lake in Yellowstone National Park and drains northward to Livingston and then eastward to Billings and northeastward to the Montana border near Fairview. The basin has a drainage area of 202 square miles above the Montana-Wyoming border near Mammoth with a mean annual discharge of 218 cfs for the period of 1939 to 1999 (Shields and others, 1999). At Livingston, the drainage area of the upper Yellowstone is 3,551 square miles and the mean annual discharge for the period of 1897 to 1999 is 3,771 cfs (Shields and others, 1999).

About 22,000 acres are irrigated with water diverted above Livingston; no discharge-control structures or dams are present. Domestic water supplies are primarily springs on the valley margins, and ground-water wells throughout the valley. Metesh and Kougioulis (2000) reported about 230 wells between the National Park boundary and Tom Miner Basin. The town of Gardiner uses both springs and wells for its water supply.

2.4 Summary of the Madison, Gallatin, Clarks Fork of the Yellowstone, Headwaters of the Yellowstone, and Upper Yellowstone River drainages

There are 462 mine and mill sites on or near the Gallatin National Forest within the Madison, Gallatin, upper Yellowstone, Yellowstone Headwaters, and Clarks Fork of the Yellowstone drainages. Of these, 9 were determined to have a potential to have adverse effects on soil or water quality on GNF-administered land. Of the 9 that have a potential of affecting the GNF-administered land, 7 sites have one or more discharges from workings or waste material and 4 sites exhibited signs of water or wind erosion.

The sites listed in bold exhibited one or more environmental problems and are discussed in the following sections. The mines in these drainages are presented generally upstream to downstream. The Madison and Gallatin River drainages are discussed first because they drain into the Missouri the farthest upstream toward the headwaters. The mines of the upper Yellowstone drainage and then the Clarks Fork of the Yellowstone River drainages are discussed, again, upstream to downstream.

If mine openings or other dangerous features (unstable structures, highwalls, steep waste-rock dumps) were observed at a site on GNF-administered land, they are identified by a ‘Y’ under the hazard heading in each table. In general, only those sites at which samples were collected were evaluated. Of the 458 sites inventoried, 54 sites on the GNF-administered land were identified as having potential safety problems. The summary figures in the following text are organized by Ranger District because of the scale at which it is best to display the approximate locations of the mine sites. The watershed boundaries are drawn on the figures but the tables are organized by drainage.

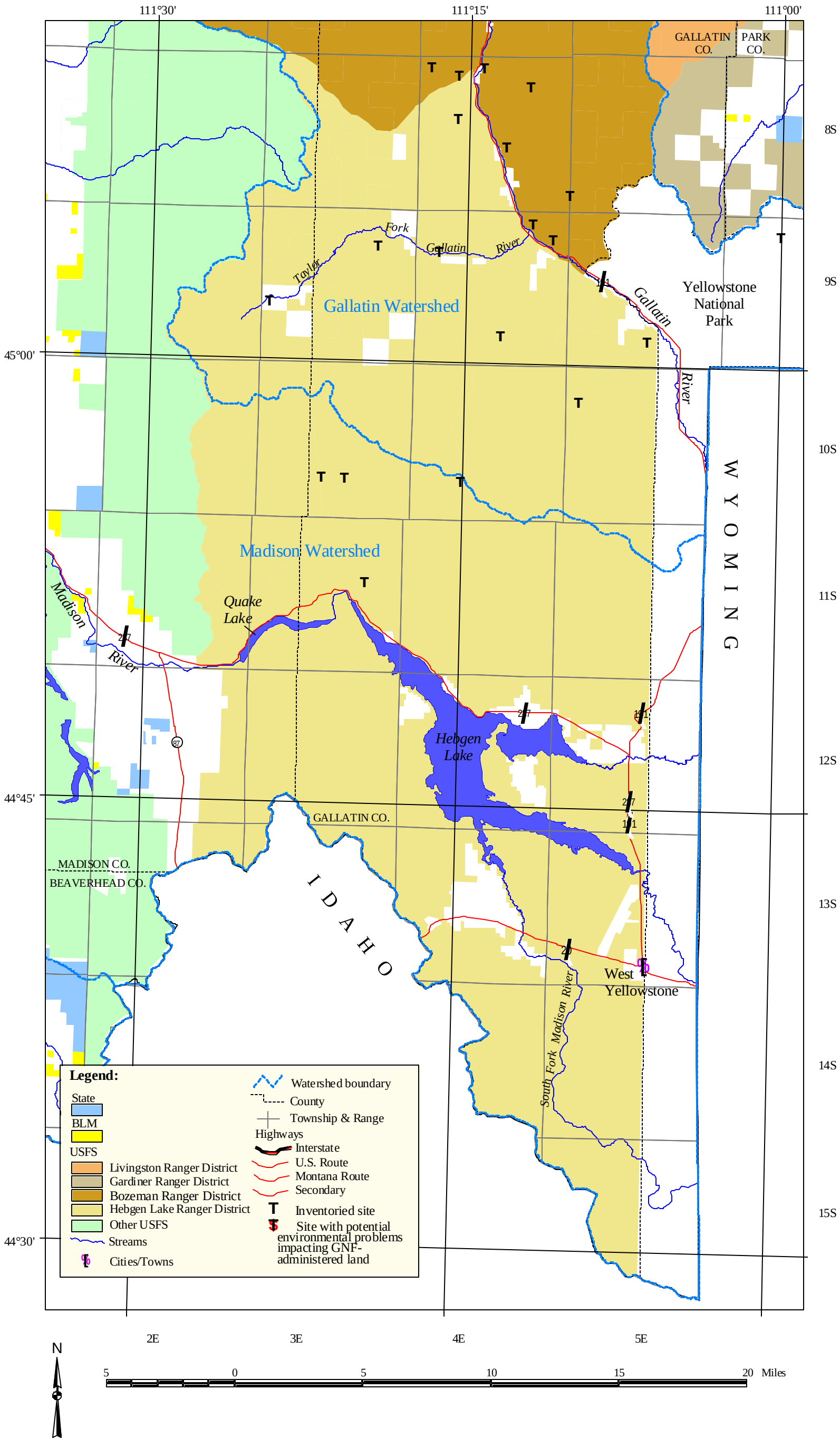


Figure 4. In the Hebgen Lake Ranger District, there were few mines, and no mines were sampled within its boundaries.

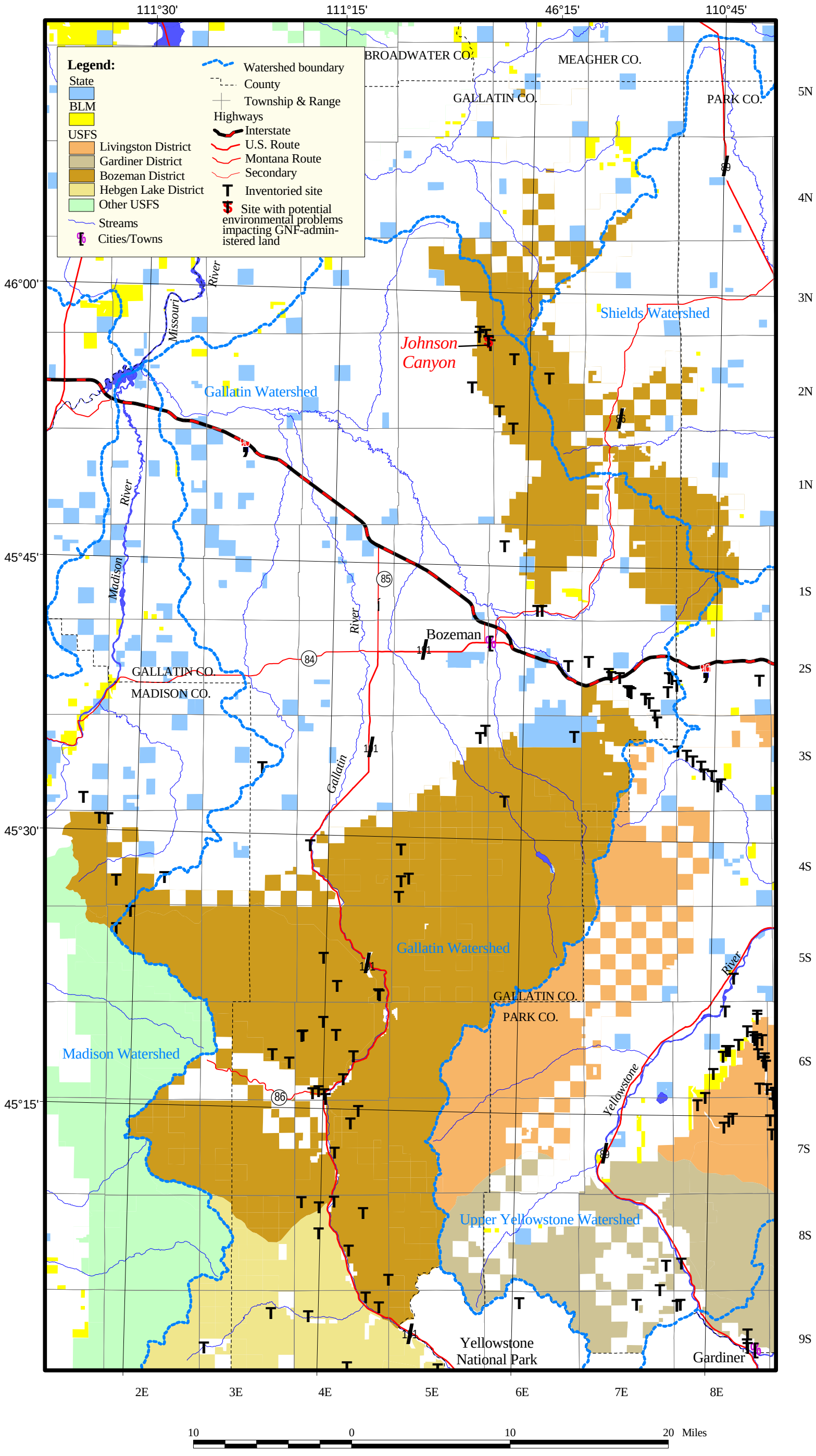


Figure 5. In the Bozeman Ranger District, there were only two discharging adits (Johnson Canyon) in the Gallatin watershed.

Table 8. The list of mines in the Madison drainage. No mines in this drainage were sampled.

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Bear Trap corundum/sillimanite MA003927	PRV	N	N	Bear Trap Creek	4S	2E	6		Screened out: private land.
Bear Trap Creek Sillimanite MA000589	NF	N	N	Bear Trap Creek	4S	1E	1		Screened out: prospect pits, no other workings or production.
Beaver Creek Gypsum GA004418	NF	N	N	Pika Point	10S	3E	27		Screened out: gypsum.
Beaver Creek Gypsum Deposit GA004183	NF	N	N	Pika Point	10S	3E	28		Screened out: phosphate.
Elk Creek Deposit GA004533	PRV	N	N	Ruby Mountain	3S	3E	22	A	Screened out: private land, corundum deposit.
Hargrove MA008671	PRV	N	N	Bear Trap Creek	3S	1E	35		Screened out: private land.
Hebgen Dam Phosphate GA004123	NF	N	N	Pika Point	11S	3E	14		Screened out: phosphate.
Sage Peak Phosphate GA004443	NF	N	N	Upper Teepee Basin	10S	4E	28		Screened out: phosphate; Lee Metcalf wilderness ?
Unnamed Rare Earth Deposit MA003205	NF	N	N	Cherry Lake	4S	2E	30		Screened out: inaccurate location, rare-earth deposit.

Table 9. The abandoned-inactive mines of the Gallatin River drainage. Bolded entries are sampled and are described in this report.

Mine name MBMG ID	Owner	Hazard	Visit	24K topo	T	R	Sec	Tract	Comments
Anaconda Copper Mines GA009022	PRV	N	N	Bozeman Pass	2S	7E	34	AAA	Screened out: private. Mine dump shown on topo next to Meadow Creek.
Apex Group GA008642	NF	Y	N	Big Horn Peak	9S	5E	34		Magnetite-copper deposit - 5 caved adits, 2 pits, 1-83 ft shaft.
Bailey and Beadle GA004043	PRV	N	N	Kelly Creek	2S	6E	13		Screened out: private, coal mine.
Bridger Canyon Warm Springs GA004068	PRV	N	N	Kelly Creek	1S	6E	34		Screened out: private, geothermal, unlikely to affect GNF-administered land.
Bridger Creek Limestone Deposit GA004178	MIX	N	N	Kelly Creek	1S	6E	34		Screened out: limestone/calcium deposit. Reference is MINOBRAS, 1975.
Buck Creek GA004153	NF	N	N	Lone Indian Peak	8S	4E	4		Screened out: phosphate prospect, no workings (Condit and others, 1927).
Buck Creek Phosphate GA003908	NF	N	N	Ousel Falls	8S	4E	5		Screened out: phosphate prospect, no workings.
Buck Lode GA004448	NF	N	N	Hidden Lake	5S	4E	36		Screened out:
Chestnut Mine / Rocky Canyon GA003853	PRV	N	N	Kelly Creek	2S	7E	20		Screened out: private, coal mine, downstream from GNF-administered land.
Cinnamon Creek Phosphate GA004148	NF	N	N	Ousel Falls	8S	4E	17		Screened out: phosphate prospect, no workings.
Connie Mo Mine MA004162	NF	N	N	Cherry Lake	5S	2E	7		Screened out - shallow prospect pit, no production.
Cooper (Lower) GA008534	NF	Y	N	Flathead Pass	2N	5E	1	DBAD	Visited general area, no discharges.
Cooper (Upper) GA008533	NF	Y	N	Flathead Pass	2N	5E	1	DBDA	Visited general area, no discharges.
Copper Pit GA008531	PRV	N	N	Flathead Pass	2N	5E	2		Screened out: private, one caved adit (Johnson and others, 1993).
Corbly Gulch GA004103	NF	N	N	Miser Creek	2N	6E	32		Screened out:
Coulston GA009021	PRV	N	N	Bozeman Pass	2S	7E	25	AADD	Screened out: private, coal mine, no effects on GNF-administered land.
Crows Nest MA008672	PRV	N	N	Willow Swamp	4S	2E	27	ACB	Screened out: private land.

Mine name MBMG ID	Owner	Hazard	Visit	24K topo	T	R	Sec	Tract	Comments
Deer Creek Prospect GA004583	NF	N	N	Hidden Lake	6S	4E	22		Screened out: prospect only; Lee Metcalf Wilderness.
Elkhorn Creek Phosphate GA004453	NF	N	N	Lone Indian Peak	8S	4E	11		Screened out: thin bedded (8 inches) phosphate deposit, no workings.
Gallatin River Phosphate GA004143	NF	N	N	Sunshine Point	9S	4E	2		Screened out: phosphate prospect, no data.
Gallatin River Placers GA003838	PRV	N	N	Gallatin Peak	7S	3E	35		Screened out: placer deposit on private ground
Gravel Pit GA003938	PRV	N	N	Wheeler Mountain	3S	5E	12		Screened out: private surface, sand and gravel.
Grouse Mountain Phosphate GA004498	NF	N	N	Sunshine Point	8S	4E	36		Screened out: phosphate prospect, no workings or production.
Harris-Murphy Mine GA004053	PRV	N	N	Bozeman Pass	2S	7E	28		Screened out: private, no references.
Harrison Mine GA003958	PRV	N	N	Bald Knob	3S	7E	2	DBAA	Screened out: private surface.
Hodson GA003968	PRV	N	N	Bozeman Pass	2S	7E	34		Screened out: private, coal mine.
Indian Cr-Taylor Cr Synclinal Area GA004158	NF	N	N	Sunshine Point	9S	4E	27		Screened out: phosphate prospect, no workings.
Jewell Property GA004493	MIX	N	N	Lincoln Mountain	9S	4E	7	D	Screened out: small (less than 2000 yds) placer operation.
Johnson Canyon Adits GA009109	**NF**	**Y**	**Y**	**Flathead Pass**	**2N**	**5E**	**1**	**DABC**	**Two discharging adits, one eroding waste dump.**
Karst Asbestos GA004613	NF	N	N	Hidden Lake	5S	4E	36	CDBD	Asbestos mine and mill, asbestos waste next to Gallatin River, no MCL exceeded according to DSL-AMRB (Pioneer Technical Services, 1995).
Lasich GA004048	PRV	N	N	Kelly Creek	2S	7E	18		Screened out: private, coal mine.
Last Chance Prospect GA004528	NF	N	N	Gallatin Peak	6S	3E	23		Screened out: prospect pit, no other workings.
Lava Lake Kyanite GA004603	NF	N	N	Hidden Lake	5S	4E	33		Screened out: kyanite occurrence; Lee Metcalf Wilderness.

Mine name MBMG ID	Owner	Hazard	Visit	24K topo	T	R	Sec	Tract	Comments
Lava Lake Pyrite GA004593	NF	N	N	Beacon Point	5S	4E	20		Screened out: pyrite occurrence; Lee Metcalf Wilderness.
Levinski Creek Prospect GA004458	MIX	N	N	Lone Indian Peak	7S	4E	3		Screened out: prospect only.
Meadow Creek limestone deposit GA004173	PRV	N	N	Bozeman Pass	2S	7E	20		Screened out: private, limestone occurrence.
Meadow Creek Mines GA004013	PRV	N	N	Bozeman Pass	2S	7E	28		Screened out: private, coal mines, general description.
Meadow Creek No. 1 and 2 and 3 PK008581	MIX	N	N	Emigrant	7S	9E	4		Screened out: no data.
Mica Creek Deposit GA004503	NF	Y	N	Garnet Mountain	4S	5E	31	CABA	Outcrop and shallow prospect.
Michener property GA004508	PRV	N	N	Gallatin Peak	6S	4E	32		Screened out: placer property on private land.
Mill Creek Canyon barite GA004193	NF	N	N	Flathead Pass	2N	6E	8		Screened out: barite occurrence, inaccurate location, MINOBRAS (1975) reference.
Miller Nos. 1 and 2 Mines GA003983	PRV	N	N	Bozeman Pass	2S	7E	28		Screened out: private, coal deposit, no data.
MKB Claims No. 1-7 GA008535	NF	Y	Y	Flathead Pass	2N	5E	1	DDBA	Trenches, one with a dangerous highwall, dry on ridgetop. May be adit (Johnson and others, 1993)
Moger Mica Claim MA004127	NF	N	N	Cherry Lake	5S	2E	5		Screened out: mica mine, shallow cut (Johnson and others, 1993).
Moon Lake Asbestos GA004568	NF	N	N	Gallatin Peak	6S	4E	18		Screened out: 3 small prospect pits on an asbestos deposit.
Moon Lake Kyanite GA004598	NF	N	N	Gallatin Peak	6S	4E	18		Screened out: reported kyanite deposit, no workings or production.
Mountain Goat No. 5 Claim GA004588	NF	N	N	Hidden Lake	6S	4E	9		Screened out: prospect; Lee Metcalf Wilderness.
Mountainside Mountain Side GA003988	PRV	N	N	Bozeman Pass	2S	7E	21		Screened out: private, coal mine.

Mine name MBMG ID	Owner	Hazard	Visit	24K topo	T	R	Sec	Tract	Comments
Payne Mine GA008555	PRV	N	N	Bald Knob	3S	7E	2	ABB	Screened out: private surface.
Porcupine Creek Phosphate GA004113	NF	N	N		7S	4E	10		Screened out: phosphate.
Porcupine Ridge Stone GA009003	NF	N	N	Lone Indian Peak	7S	4E	21		Screened out: commodity is stone, accuracy is +/- 1 km.
Ridge Prospect GA004578	NF	N	N	Gallatin Peak	6S	3E	24		Screened out: prospect trench with no potential for production.
Sage Creek Phosphate GA004438	NF	N	N	Upper Teepee Basin	10S	5E	7		Screened out: phosphate, Lee Metcalf Wilderness.
September Morn / Pass Creek GA004618	NF	Y	Y	Flathead Pass	2N	5E	1	ABCA	Visited, highwalls only, no water, 1 adit, 1 open cut, prospects.
Sheridan GA008532	PRV	N	N	Flathead Pass	2N	5E	2		Screened out: private, caved shaft and dozer cuts (Johnson and others, 1993)
Spanish Creek Res. Study GA003858	PRV	N	N	Beacon Point	4S	4E	18		Screened out: private land.
Sunshine Mine GA004608	NF	Y	Y	Wheeler Mountain	3S	6E	31	ADDA	Open cut, 20 ft only highwalls with some slope.
Sunshine Point Phosphate GA004463	NF	N	N	Sunshine Point	9S	4E	12		Screened out: phosphate prospect, no workings or production.
Table Mountain Prospect GA004563	NF	N	N	Gallatin Peak	6S	4E	8		Screened out: asbestos prospect pits on a mountain top, no production.
Taylor Creek Phosphate GA004138	NF	N	N	Lincoln Mountain	9S	3E	11		Screened out: phosphate deposit, no data (Johnson and others, 1993).
Taylor Creek Phosphorus MA003443	PRV	N	N	Koch Peak	9S	3E	19	C	Screened out: phosphate deposit, private surface.
Tepee Creek Phosphate GA004478				Big Horn Peak	9S	4E	1		Screened out: phosphate prospect in Yellowstone National Park, no workings or production.
Thompson #1 GA004168	NF	N	N	Garnet Mountain	4S	5E	30		Screened out: a reported mica occurrence, inaccurate location, +/-1km accuracy.
Thumper Lode #1 GA004473	NF	Y	Y	Garnet Mountain	4S	5E	30	ADAC	Open adit, dry, recent culvert on ground at portal.

Mine name MBMG ID	Owner	Hazard	Visit	24K topo	T	R	Sec	Tract	Comments
Timberline No. 1 and 2 GA003808	PRV	N	N	Bozeman Pass	2S	7E	24		Screened out: private, coal mine.
Unnamed Location GA004003	NF	N	N	Gallatin Peak	6S	4E	27		Screened out: inaccurate location (+/- 1 km), no other data.
Unnamed - Flathead Pass GA009001	NF	N	N	Flathead Pass	2N	6E	30		Screened out: no references, phosphate occurrence, unlikely to affect Forest.
Unnamed Location - Miser Creek GA009000	PRV	N	N	Miser Creek	1S	6E	8		Screened out: private, outside of the National Forest boundary, unlikely to affect.
Unnamed-New World Gulch GA004518	ST	N	N	Mount Ellis	3S	6E	12		Screened out: placer prospect on State land.
Unnamed Pumicite Deposit GA004128	PRV	N	N	Wheeler Mountain	3S	5E	12		Screened out: private land, pumice deposit, general location.
Upper Ross Mine / Ross Mine GA003803	PRV	N	N	Bozeman Pass	2S	7E	24		Screened out: private, coal mine.
W. Fork-Gallatin River Synclinal Area GA004203	NF	N	N	Ousel Falls	8S	4E	6		Screened out: phosphate deposit, no workings.
W. Fork-Gallatin River Phosphate GA004163	NF	N	N	Gallatin Peak	6S	4E	32		Screened out: phosphate deposit, no workings or production.
Walton Prospect GA004423	NF	N	N	Sunshine Point	8S	4E	22		Screened out: phosphate prospect, no data.
Washoe Mines GA003973	PRV	N	N	Bald Knob	2S	7E	35		Screened out: private, no references.
West Fork Gallatin River Placers GA003833	PRV	N	N	Gallatin Peak	7S	4E	5		Screened out: placer deposit on private ground.
Whitehead-Robinson Mine GA003978	PRV	N	N	Bozeman Pass	2S	7E	27		Screened out: private, no references.
Wilson Creek Asbestos GA004198	NF	N	N	Garnet Mountain	4S	5E	18		Screened out: inaccurate location (+/- 1 km) and no workings noted. Asbestos claim.
Xmas Tree Pits GA004078	NF	N	N	Flathead Pass	2N	5E	1		Screened out: inaccurate location, visited general area.

2.5 Johnson Canyon Adits

2.5.1 Site Location and Access

The two Johnson Canyon adits (figure 5) are located approximately 21 miles north of Bozeman via State Highway 411 turning east (right) on the Mill Canyon (marked as Johnson Canyon) road (Forest Route 6930). The road junction to the Johnson Canyon adits is 0.7 mi from the mine represented by the shaft symbol on the map. The adits are most easily accessible by four-wheel drive vehicle because of the steep, badly rutted roads covered with loose rock. They are located in DBDA sec. 1, T2N, R5E at an elevation of 7,160 ft.

2.5.2 Site History - Geologic Features

These two adits are not formally named in any of the literature on this area. They are to the south of the September Morn Mine. Originally, they were thought to be the Cooper adits but the location is not the same as listed in Johnson and others (1993) and the description differs significantly. The Cooper adits were driven eastward and these adits trended southwest or slightly southeast. Johnson and others also show these two adits in their Appendix B as a part of the Pass Creek Mine. They lie to the west of the NW-SE-trending Cross Range Fault.

The workings in this area are driven in Precambrian Lahood Formation arkoses and shales. Mineralization includes sulfides, including sphalerite, galena, molybdenite in a quartz-barite gangue (Reed, 1951). The adits are less than 500-ft long as estimated from the size of the waste dumps. The commodities produced in this district were primarily lead and silver. The entire district had a recorded production of 100 tons of ore yielding 31,000 lb lead, 34 lb copper, 52 oz silver, and 4 oz gold (Johnson and others, 1993). The lower adit was open and trended S.20EW. The upper adit trended approximately S.10EE. The waste rock dumps were primarily arkosic sandstone with minor iron staining.

2.5.3 Environmental Condition

The total disturbed area at the Johnson Gulch adits is approximately 2 acres; 1 acre at each adit. The discharges both are small (approximately 1 gpm) but they do flow across the sulfide bearing waste dumps. No obvious adverse effects were noted in the field visit.

2.5.3.1 Site Features - Sample Locations

Water-quality samples were collected from the upper adit discharge (JUNS40M) which was the start of the flow in Johnson Canyon. Downstream from this site but upstream of the lower adit, sample (JUNS20M) was taken. A third sample was taken of the lower adit discharge

(JUNS10M). Downstream of the lower adit, sample JUNS30M was taken immediately downstream from the waste dump. The flow rates at these locations were approximately 3 gpm except for the adit discharge which was measured as 1 gpm. The adit discharge was the only water that was below the lower pH limit. It measured 5.98 (lab=7.66) and the specific conductance was 167 (lab=173) µmhos/cm. Downstream, Johnson Creek pH was 6.57 (lab=7.75) and specific conductance was 173 (lab=157) µmhos/cm. Samples were collected on July 23, 1999. Site features and sample locations are shown in figures 6 and 7; photographs are shown in figures 7a and 7b.

2.5.3.2 Soil

Two waste samples were collected. JUND10H was a composite sample along the waste from top to bottom of the dump at the lower adit (figure 6). Gray sand-sized waste was sampled in 10 intervals with 7.5 ft between intervals for a total of 75 ft sampled. No sulfides were noted in the sample description. JUNDS20H was also along the erosional channel at the upper adit (figure 7). It was sampled in a composite of 20 intervals with 2.5 ft between intervals. Results are shown in table 10. Zinc levels are well above the Clark Fork Superfund background levels. Lead levels at the upper adit were over ten times what they were at the lower adit.

Table 10. Soil sampling results at the Johnson Canyon adits (mg/kg).

Sample Location	As	Cd	Cu	Pb	Zn
Soils (JUND10H)	3.93	7.35[1]	66.7[1]	572[1,2]	3,090[1,2]
Soils (JUND20H)	5.04[1]	8.14[1]	71.9[1]	8,270[1,2]	4,910[1,2]

(1) Exceeds one or more Clark Fork Superfund background levels (table 3).
(2) Exceeds phytotoxic levels (table 3).

2.5.3.3 Water

Of the four water samples taken at the Johnson Gulch adits, only the field pH of the adit discharge did not meet water-quality criteria. The flow was very low and only contacted the waste dump for a short distance. The zinc levels doubled downstream (from 32µg/L to 76.3 µg/L) but both measurements were well below the standards for zinc. The lab pH was 7.6; the field pH was 5.98. The other pH measurements were approximately 6.5 for the field and 7.6 for the lab measurements.

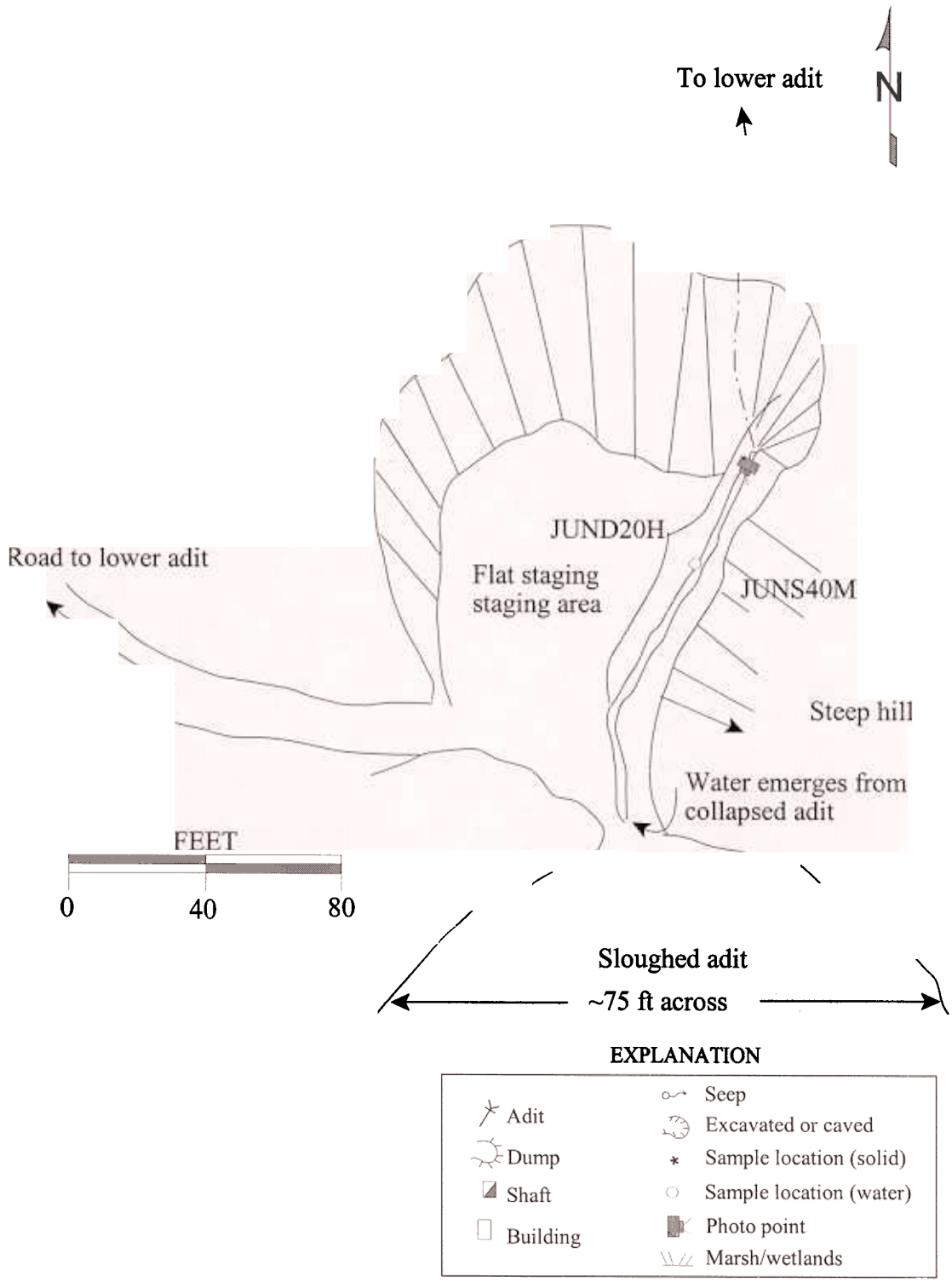


Figure 6. The upper Johnson Canyon adit discharged a small amount of water that formed the headwaters of Johnson Gulch.

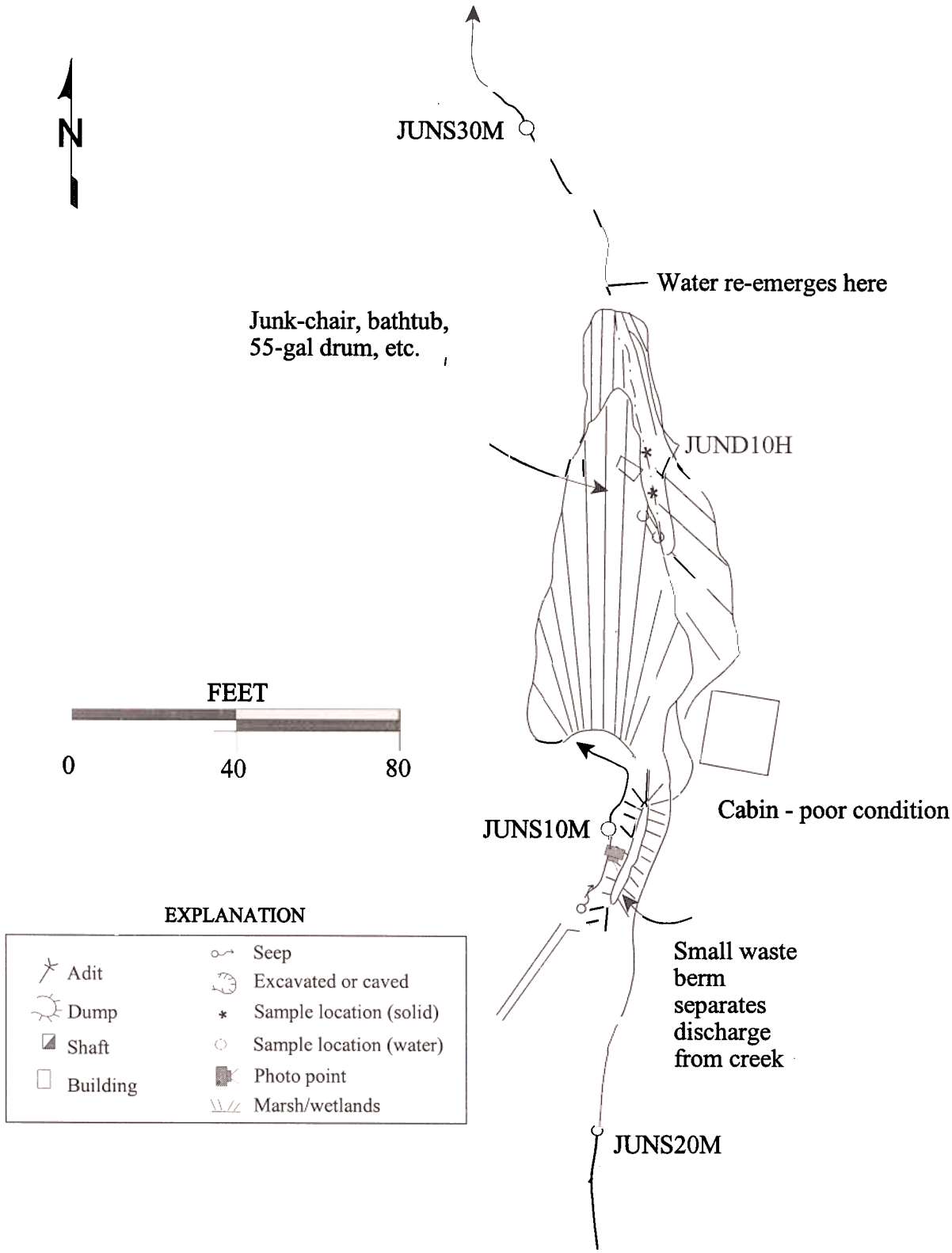


Figure 7. The lower Johnson Canyon adit on Johnson Gulch had a small discharge and also had an eroding waste dump, as mapped 07/23/99.

Figure 7a. The discharge at the upper Johnson Canyon adit marked the beginning of flow in the Johnson Canyon drainage.

Figure 7b. The lower Johnson Canyon adit was open and a small discharge leaked from in front of the adit and then infiltrated the waste dump.

Table 11. Johnson Gulch adits water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	pH
JUNS40M-upper adit discharge																		
JUNS20M-upstream of lower adit																		
JUNS10M-lower adit discharge																		S*
JUNS30M-downstream																		

Exceedence codes:
(*) Laboratory pH did not exceed standard.
Note: The analytical results are listed in appendix IV.

2.5.3.4 Vegetation

Vegetation on GNF-administered land does not appear to be impacted by the site. At the upper adit on the staging area, the vegetation was mostly grasses. No dead trees were noted and some small evergreens grew on the waste rock dump.

2.5.3.5 Summary of Environmental Conditions

Except for local effects, these sites showed little effect on the environment. Runoff was minimal probably only seasonally significant. Zinc levels in the waste were the most obvious problem but they were not reflected in the water analyses. Wildlife used the site as a water source.

2.5.4 Structures

One cabin in bad condition was on the upper edge of the waste dump at the lower adit. The roof was mostly caved and the walls tilted. It was of log construction. No structures remained at the upper adit although a pile of lumber was on the flat staging area in front of the adit.

2.5.5 Safety

The site had one open adit at the lower end. It was highly accessible and easily visible. The upper adit was completely caved.

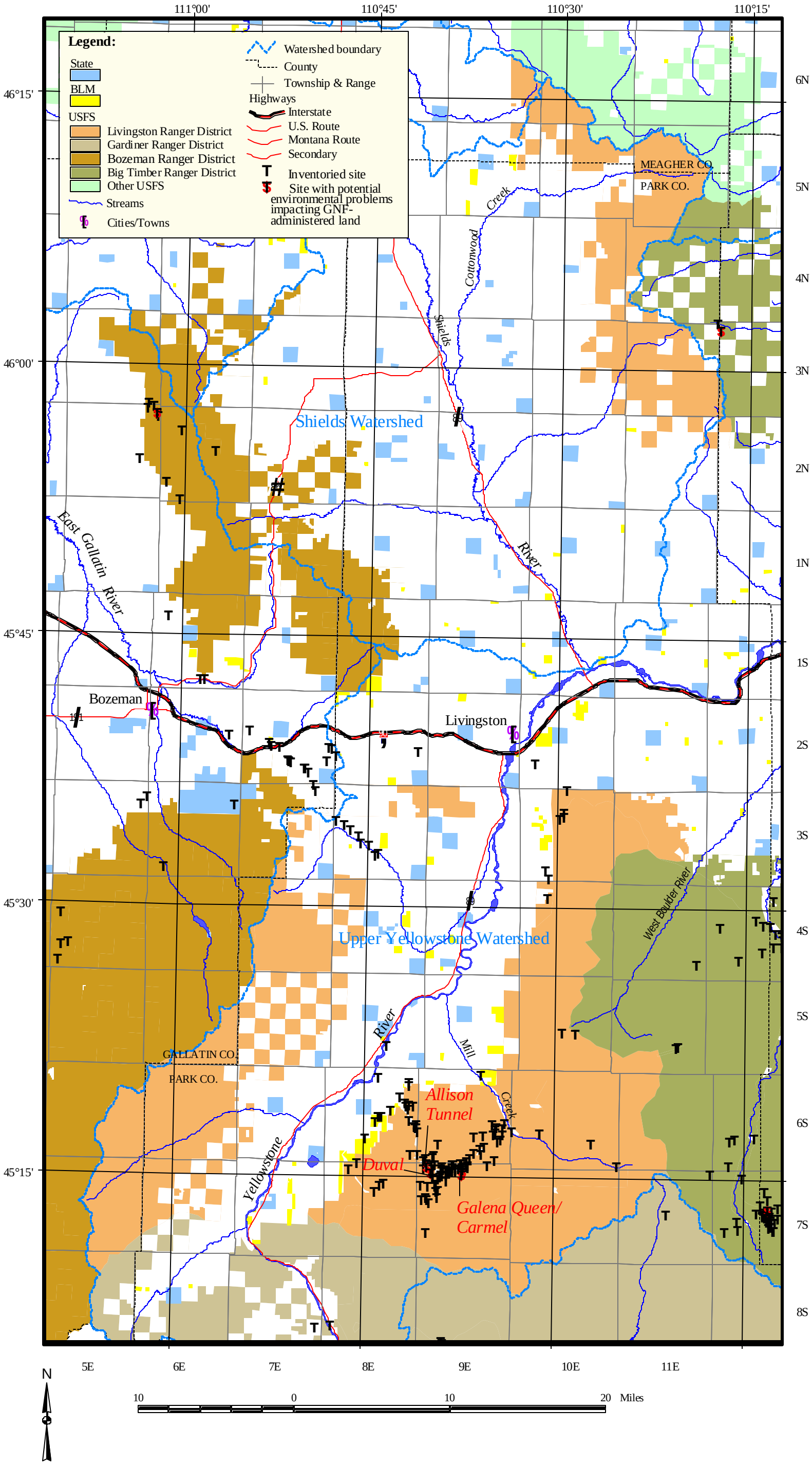


Figure 8. In the Livingston Ranger District, there were mine discharges sampled in the Emigrant and Mill Creek mining districts.

Table 12. The abandoned-inactive mines of the Upper Yellowstone watershed. Bolded entries were sampled and are described in this report.

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Accident SG001904	MIX	N	N	Haystack Peak	7S	12E	22		Screened out: no references, inaccurate location.
Alaska PK006222	MIX	N	Y	Emigrant	6S	8E	13		2 open adits according to Stotelmeyer and others (1983).
Aldridge Mine PK006370	PRV	N	N	Electric Peak	9S	7E	1		Screened out: private, near Corwin Springs.
Alice PK006835	MIX	N	N	Knowles Peak	6S	9E	35		Screened out: no data; inaccurate location.
Alice (Tunnel Springs Adit) PK006306	PRV	N	N	Emigrant	6S	8E	22		Screened out: private, one partially caved adit (Stotelmeyer and others, 1983).
Alice C. PK002058	PRV	N	Y	Knowles Peak	6S	9E	24		Screened out: patented claim, no access. Visited briefly during inspection of another site, 11/18/99. No impact to GNF-administered land.
Allen PK008607	NF	Y	N	Monitor Peak	7S	9E	18	ACBD	Although the creek has cut into one of the dumps, impacts are unlikely or minimal.
Allison Tunnel PK006290	**MIX**	**Y**	**N**	**Emigrant**	**7S**	**9E**	**6**	**BDAD**	**Adit discharge but it never reaches creek. Sampled discharge.**
Alpha PK008570	PRV	N	N	Emigrant	6S	8E	22		Screened out: private, one 16-ft inclined shaft, caved adit.
Amit No. 5 PK008666	MIX	N	Y	The Needles	7S	12E	5		Two open adits according to Stotelmeyer and others, 1983.
Anderson's Springs SG001820	MIX	N	N	Mcleod Basin	3S	13E	29		Screened out: probably private; unlikely to affect Forest, geothermal springs.
Annie PK008600	NF	N	N	Monitor Peak	7S	9E	8	BBA	Screened out: impacts to National Forest resources minimal or unlikely.
Annie No. 2 PK008597	NF	N	N	Monitor Peak	7S	9E	5	CDD	Screened out: impacts minimal or unlikely.
Arrasta Ridge Area PK008578	MIX	N	N	Emigrant	7S	9E	4		General area, ridgetop, did not visit.
Arrow Peak Claim PK008674	NF	N	Y	Knowles Peak	6S	10E	5		Screened out: 40 ft adit only, open according to Stotelmeyer and others, 1983.
Baboon Mountain SG008610	MIX	N	N	Haystack Peak	7S	12E	21		Visited general area, caved adits and shafts only, Moyle and others (1977) noted open adits.
Bank PK008574	NF	N	N	Emigrant	6S	8E	13		Screened out: one caved, 20-30 ft shaft (Stotelmeyer and others, 1983).

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Bar Group PK002370	NF	N	N	Monitor Peak	7S	9E	30		Screened out: several prospects in secs 5, 6, 7, 8, 9, 16, 17, 19, 20, 21, 30 T7S,R9E.
Bar No. 6 PK008594	NF	N	N	Monitor Peak	7S	9E	7	BC	Unable to locate; impacts to National Forest resources minimal or unlikely; 1 22-ft and 1 33-ft adit in steep ridge (Stotelmeyer and others, 1983).
Barbara Ann Mine PK002106	MIX	Y	Y	Knowles Peak	6S	9E	35	BBAA	Two open adits (~20 ft and 30 ft) & partly open shaft, recently worked, dry.
Basin Creek PK002238	NF	Y	N	Haystack Peak	7S	12E	16	DDBC	Visited general area, placer, no effect.
Big Daddy PK009006	NF	Y	N	Monitor Peak	7S	8E	10	CC	Impacts on National Forest resources are unlikely or minimal, placer claim.
Big Group Claims SG001862	NF	N	N	Picket Pin Mountain	5S	13E	3		Screened out: trenches and pits only. Iron occurrence.
Big Pine PK008676	NF	Y	N	Knowles Peak	6S	9E	23	DBAC	Visited 11/18/99, Stotelmeyer et al (1983) says open adit & inclined shaft, both now caved.
Blakely Cliff Deposit SG001868	NF	N	N	Chrome Mountain	4S	13E	30		Screened out: pits only.
Blue Lake Prospects / O.K. / Toledo SG008621	NF	Y	Y	Haystack Peak	7S	12E	23	DDDC	All adits caved but one had a 10 ft highwall.
Blue Manganese PK006558	NF	N	Y	Livingston Peak	3S	10E	9		Screened out: one adit 127 ft long (Stotelmeyer and others, 1983).
Bonanza Group SG001736	MIX	N	N	Chrome Mountain	4S	12E	14		Screened out: inaccurate location.
Boulder River Nickel (Riverside) SG001934	MIX	N	N	Chrome Mountain	4S	12E	23		Screened out: inaccurate location, shallow pits and two short adits (Reed, 1950).
Bridge Placer PK006634	MIX	Y	N	Mount Douglas	6S	12E	28	BBAA	Visited general area, small amount of placering noted.
Bridger Creek SG001940	NF	N	N	Sliderock Mountain	2S	15E	25		Screened out: reported calcite occurrence only. Commodity calcium.
Brilliant SG001238	MIX	N	N	Haystack Peak	7S	12E	23		Screened out: no references, inaccurate location.
Broken Glasses PK006350	NF	N	N	Emigrant	7S	9E	5		Screened out: viewed from the St. Julian, 1 partially caved 38 ft adit, Stotelmeyer and others, 1983.

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Bull Moose PK008678	MIX	Y	N	Knowles Peak	6S	9E	25		Observed from road 11/18/99, no visible impacts: one adit 7 feet long (Stotelmeyer & others, 1983).
Burnt Creek PK006494	NF	Y	Y	Knowles Peak	6S	9E	25	CBBD	One open adit on west fork of Mill Creek near junction with Burnt Creek.
Butte and Butte No. 1 Claims SG001586	NF	N	N	Sliderock Mountain	2S	14E	36		Screened out: plotted on dry ridgetop, probably unpatented claims.
Byam Bros.-merged with Hedges Mine PK006430	PRV	N	N	Chimney Rock	3S	8E	28		Screened out: coal mine on private land.
Carmel Claim PK006262	**NF**	**Y**	**Y**	**Knowles Peak**	**7S**	**9E**	**4**	**DCAA**	**Natural seep(?) exposed by dozer trench.**
Cartwright Crystal Spar Group SG001784	PRV	N	N	Ross Canyon	2S	15E	7	DCCB	Screened out: calcite occurrence, private land.
Cathy PK006202	MIX	N	Y	Knowles Peak	6S	9E	34		Screened out: but open adit according to Stotelmeyer and others, 1983.
Chico Hot Springs Geothermal PK002692	PRV	Y	N	Emigrant	6S	8E	1		Screened out: visited in conjunction with the MBMG GWUDISW program, geothermal.
Chico Hot Springs Travertine PK006314	MIX	N	N	Emigrant	6S	8E	12		Screened out: dimension stone, travertine, unlikely to impact.
Chromium Occurrence SG001910	MIX	N	N	Chrome Mountain	4S	13E	32		Screened out: chromite occurrence only, inaccurate location.
Chromium Occurrence SG001874	NF	N	N	Picket Pin Mountain	5S	13E	3		Screened out: general description only, chromium occurrence.
Clara SG008620	NF	Y	N	Haystack Peak	7S	12E	23		Caved workings and pits only.
Coish SG001946	MIX	N	N	Chrome Mountain	4S	12E	25		Screened out: CRIB is the only reference.
Commanche PK008580	MIX	N	Y	Emigrant	7S	9E	4		Ridgetop, Stotelmeyer and others (1983) noted open adit.
Copper Duke PK006498	MIX	N	N	Knowles Peak	6S	9E	24		Screened out: inaccurate location.
Copper Group PK002376	NF	N	N	Knowles Peak	6S	9E	25		Screened out: inaccurate location.
Copper Queen PK008568	NF	N	N	The Pyramid	7S	11E	26		Screened out: all adits badly sloughed according to Stotelmeyer and others (1983).

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Corbett PK008602	PRV	N	N	Monitor Peak	7S	9E	8	BC	Screened out: patented land
Corwin Hot Springs PK006811	PRV	N	N	Electric Peak	8S	7E	25		Screened out: private, geothermal
Corwin Springs PK006582	MIX	N	N	Electric Peak	8S	8E	30		Screened out: uranium occurrence, no references except CRIB.
Crow Mine SG001814	NF	Y	N	Sliderock Mountain	3S	14E	2	BBBC	One caved adit, one log cabin, poor condition on Box Canyon Creek
Crown SG008613	PRV	Y	N	Haystack Peak	7S	12E	23		Visited general area, private, no hazards on GNF-administered land.
Crown Point PK006330	MIX	N	N	Emigrant	6S	9E	32		Inaccurate location, trench and pit.
Crystal PK006502	MIX	N	N	Knowles Peak	7S	9E	4		Screened out: no data, inaccurate location.
Cumberland SG008622	NF	Y	N	Haystack Peak	7S	12E	23		One caved adit, one pit (Stotelmeyer and others, 1983) visited general area; unable to locate.
Daisy /Duffy/ Yager/ Treasure State SG001850	**MIX**	**Y**	**N**	**Haystack Peak**	**7S**	**12E**	**15**	**CADD**	**Most disturbances on private, sampled downstream.**
David PK006218	NF	Y	Y	Knowles Peak	7S	9E	4	ADBC	One open adit, partly caved at portal.
Deer Creek SG001838	NF	N	N	Sliderock Mountain	3S	15E	6		Screened out: ridgetop location, inaccurate location.
Delta SG008617	PRV	Y	N	Haystack Peak	7S	12E	23		Visited general area, no effects to GNF-administered land.
Dixie SG008625	NF	Y	N	Haystack Peak	7S	12E	24		Visited general area, found what may have been 20 ft caved adit.
Dixie PK006354	NF	N	Y	Emigrant	7S	9E	4		One open adit (Stotelmeyer and others, 1983).
DUV 19 Group / Duval PK006490	**NF**	**Y**	**N**	**Emigrant**	**7S**	**9E**	**6**	**DACC**	**Three flowing exploration drill holes; Duval Corporation**
Duv Minnie Bell No 2 PK006450	MIX	N	Y	Emigrant	7S	9E	6		Screened out: part of exploration area, Stotelmeyer and others, 1993 noted one 178-ft adit.
Duval 12 PK006466	MIX	N	N	Emigrant	6S	9E	31		Visited general area; see other Duval entries.
East Boulder Plateau SG001964	MIX	N	N	Chrome Mountain	4S	13E	32		Screened out: general area, between East Boulder River and Gish area. Outcrops and shallow pits.
East Boulder River SG001958	NF	N	N	Picket Pin Mountain	5S	13E	3		Screened out: pits and trenches (Johnson and others, 1993).

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Elvin Clayton PK006714	MIX	N	N	Emigrant	6S	8E	24		Screened out: +/- 5km accuracy, no data according to Johnson and others, 1993.
Emigrant Gold Mining Co. PK002418	NF	N	N	Emigrant	6S	8E	25		Screened out: placer, visited general area, but inaccurate location.
Emigrant Gulch Molybdenum PK002262	MIX	N	N	Emigrant	7S	9E	6		Screened out: general area, covered by other mine site descriptions.
Emma PK008688	MIX	N	N	Dailey Lake	7S	8E	5	DB	Screened out: private, impacts unlikely or minimal.
Empire No. 2 (Minnie Mund No. 2) PK008561	MIX	N	N	Chrome Mountain	4S	12E	15		Screened out: inaccurate location.
Esperanza PK006270	MIX	N	N	Emigrant	7S	9E	6		Visited general area.
Eve Group (Moonlight) SG008564	MIX	N	N	Chrome Mountain	4S	12E	23		Screened out: no data, inaccurate location.
Falls PK006526	NF	N	N	Knowles Peak	6S	9E	34		Screened out: no data. Did visit general area, no impacts from mining.
Featherstone Mine PK006438	PRV	N	N	Chimney Rock	3S	8E	21		Screened out: coal mine on private land, last produced in early 1900's.
First Out PK006775	PRV	N	N	Brisbin	4S	10E	8		Screened out: private, one caved adit (Johnson and others, 1993)
Floyd Counts Claim PK006286	NF	Y	N	Knowles Peak	7S	9E	3		Unable to locate, walked approximate area, may be covered by talus.
Forgotten Mine PK006374	PRV	N	N	Emigrant	6S	8E	11		Screened out: private, near Chico.
Foster Mine PK006414	PRV	N	N	Electric Peak	9S	7E	3		Screened out: private land, coal deposit.
Fox SG001856	PRV	N	N	Ross Canyon	2S	15E	19		Screened out: private, no references.
Free Silver PK008604	NF	N	N	Monitor Peak	7S	9E	8	CC	Screened out: impacts to National Forest resources minimal or unlikely.
Frog Pond Adit SG001172	MIX	N	N	Picket Pin Mountain	4S	13E	28		Part of the active claim group for the Stillwater
Frozen Lake Group PK002358	NF	N	N	Mount Cowen	5S	10E	21		Screened out: same as Mount Cowen molybdenum?

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Froze-to-Death Creek PK002334	NF	N	N	West Boulder Plateau	4S	12E	18		Screened out: placer.
Galena Queen PK002298	**NF**	**Y**	**Y**	**Knowles Peak**	**7S**	**9E**	**4**	**DACB**	**Adit discharge, flooded shaft, natural iron/manganese bogs and seeps**.
Garland Counts PK006266	NF	N	Y	Emigrant	7S	9E	5		One open 38-ft long adit, Stotelmeyer and others (1983).
Gasaway Mine PK006434	PRV	N	N	Bald Knob	3S	8E	20	DBDD	Screened out: private surface.
Gish Chromite Claims SG001844	MIX	N	N	Chrome Mountain	4S	12E	13		Screened out: commodity was alumina/aluminum, claims only, see Gish Mine for chromite deposit.
Gish Mine SG001526	PRV	N	N	Chrome Mountain	4S	12E	24		Screened out: private, no access.
Gold Bug PK008595	NF	N	N	Monitor Peak	7S	8E	10	ADB	Screened out: impacts minimal or unlikely.
Gold Bug Placer PK006718	NF	N	N	Emigrant	6S	8E	24		Screened out: placer, one unpatented claim.
Gold Hill Mill SG009002	**NF**	**Y**	**N**	**Sliderock Mountain**	**3S**	**14E**	**1**	**DBDD**	**Tailings in floodplain, sulphides**
Gold Hill Mine SG001976	NF	Y	N	Sliderock Mountain	3S	14E	1	DBCB	One caved adit, no waste in floodplain, mill is described separately.
Gold King PK008592	NF	Y	Y	The Needles	7S	12E	3		Unable to locate, visited general area, Stotelmeyer and others (1983) noted open adit.
Gold Leaf SG008612	NF	Y	N	Haystack Peak	7S	12E	23		Visited general area; unable to locate.
Gold Leaf and Gold Leaf No. 2 PK006258	MIX	N	N	Emigrant	6S	9E	31	DD	One caved shaft, 1 caved 110 ft adit in limonite stained andesite according to Elliot and others, 1977.
Grand View PK006206	NF	N	N	Emigrant	7S	9E	5		One caved adit (Stotelmeyer and others, 1983).
Great Eastern and Great Western PK006250	MIX	Y	N	Emigrant	6S	8E	36	DAAC	Two patented claims, and 54 unpatented claims, workings obliterated.
Half Moon Mine SG001802	NF	N	N	Haystack Peak	7S	12E	14		Screened out: location inaccurate, in Independence mining district.
Half Moon Mine PK006829	NF	N	N	Crazy Peak	3N	11E	1	AABD	Visited general area, adits caved, no discharge, in Big Timber mining district.

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Helen PK008596	PRV	N	N	Monitor Peak	7S	9E	5		Screened out: private land.
Henke-Beer Placer PK006832	NF	N	N	Iron Mountain	7S	12E	20		Screened out: placer, no data in Johnson and others (1993).
Hidden Treasure SG001592	PRV	Y	N	Haystack Peak	7S	12E	15	CACA	Private, mill shared with Daisy Mine.
Honolulu PK008558	PRV	N	N	Brisbin	3S	10E	32		Screened out: private land, one caved 50 ft adit (Johnson and others, 1993).
Hope PK006522	NF	N	N	Knowles Peak	6S	9E	26		Screened out: no data.
Hope Group PK002388	MIX	N	N	Emigrant	6S	8E	36		Screened out: inaccurate location, unpatented claims?
Hot Shot 3-5 PK006474	NF	N	Y	Knowles Peak	6S	10E	19		Screened out: travertine deposit at Montanopolis Springs (Johnson and others, 1993).
Huckleberry North Area PK008599	NF	N	N	Monitor Peak	7S	9E	6	DDD	Screened out: caved adits, no significant assays.
Huckleberry South Area PK008601	PRV	N	N	Monitor Peak	7S	9E	8	BC	Screened out: private land.
Ida B SG008623	NF	Y	Y	Haystack Peak	7S	12E	23		Visited general area; unable to locate; Stotelmeyer and others (1983) noted open adit.
Independence "A" SG001154	MIX	N	N	Haystack Peak	7S	12E	23		Duplicate? Of Independence Mine (SG001598). Info from the files of R. Stotelmeyer, WFOC, Spokane.
Independence Mine SG001598	MIX	Y	Y	Haystack Peak	7S	12E	23	CCDC	Workings mostly on private, one open adit (Stotelmeyer and others, 1983).
Intermediate Mine PK006422	PRV	N	N	Bozeman Pass	9S	8E	6		Screened out: private, coal mine, no effect.
Iron Dike SG001580	MIX	Y	Y	Chrome Mountain	4S	12E	23		One open adit, may not be "the" Iron Dike, but is in the same location..
Iron Hill PK008569	PRV	N	N	Emigrant	6S	8E	14		Screened out: private, 2 pits and one caved adit (Stotelmeyer and others, 1983).
Iron King PK008577	NF	N	Y	Emigrant	7S	9E	5		One 178-ft open adit according to Stotelmeyer and others (1983). General area visited.
Iron Mountain-Camp Ni-Cu SG001160	NF	N	N	Picket Pin Mountain	5S	13E	12		Screened out: active permit. Also in the Custer National Forest.

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Jay PK008603	NF	N	N	Monitor Peak	7S	9E	8	C	Screened out: impacts to National Forest resources minimal or unlikely.
Jeanette PK006210	NF	N	Y	Emigrant	7S	9E	4		One open adit (Stotelmeyer and others, 1983).
Jewell PK006506	NF	N	N	Knowles Peak	7S	9E	4		Visited general area; dry, steep slope.
Julie Ellen PK006510	MIX	N	N	Emigrant	7S	9E	4		Screened out: no data.
Jumbo PK006322	MIX	N	Y	The Needles	5S	11E	26		Open adit according to Stotelmeyer and others (1983).
Kelly (Badger Group) SG001808	**NF**	**Y**	**Y**	**Crazy Peak**	**3N**	**12E**	**6**	**BCCC**	**Adit discharge, one open adit.**
Klu Klux Claim PK006226	NF	N	Y	Emigrant	6S	8E	13		Three open adits according to Stotelmeyer and others (1983).
Knapp Mine SG001574	NF	N	N	Sliderock Mountain	2S	14E	36	DDDA	Screened out: dry ridgetop, Pete Northcutt reported adit caved, no water.
Kountz Mine PK006442	PRV	N	N	Bald Knob	3S	8E	20	BDAB	Screened out: private.
Lea No. 34 PK006514	NF	N		Monitor Peak	7S	9E	17		Screened out: impacts to National Forest resources minimal or unlikely.
Lightning PK006246	MIX	N	N	Knowles Peak	6S	9E	35		Screened out: visited general location.
Lilliput Fraction (221) SG001124	MIX	N	N	Haystack Peak	7S	12E	23		Screened out: USGS 77-700 states that this property consists of 1 50-ft caved adit.
Little Chief PK006298	PRV	N	N	Emigrant	6S	8E	22		Screened out: private, one 24-ft inclined shaft (Stotelmeyer and others, 1983).
Little Falls Creek (& Oregon Lode) PK002328	NF	N	N	West Boulder Plateau	4S	11E	36		Screened out: placer occurrence with little or no workings (Lyden, 1948).
Lori Kay / Black Diamond /War Eagle PK006458	NF	N	Y	The Needles	7S	12E	5		Unable to locate, open adits according to Stotelmeyer and others, 1983.
Lost Cabin PK006338	NF	N	N	Knowles Peak	6S	9E	26	A	Screened out: visited general area, no effects to GNF-administered land. Shallow pit only.
Lower East Fork Emigrant Creek PK008572	NF	N	Y	Emigrant	7S	9E	6		General area, no open adits noted in MBMG visit but USGS: Stotelmeyer and others (1983) noted open adits.
Lower Falls No.1/ #1 PK006470	PRV	N	N	Emigrant	6S	8E	24		Originally one 42-ft adit (Stotelmeyer and others, 1983). On private land by road.

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Lucky Allen PK006518	MIX	N	N	Emigrant	6S	8E	24		Screened out: no data.
Magnetic PK008606	NF	Y	N	Monitor Peak	7S	9E	18	BCAD	Could not be located on 11/16/99, no evidence of impacts noted.
Magnitite Group PK002394	NF	N	N	Monitor Peak	7S	8E	10		Screened out: several prospects scattered over sections 2, 10, 11, 12, 18, 21, 24, 25 T7S R8E.
Majestic and Flora B Claims -McHugh SG001562	MIX	N	N	Mcleod Basin	4S	12E	11		Screened out: two patented claims with two short adits (Johnson and others, 1993).
Marble Claire PK006294	PRV	N	N	Emigrant	6S	8E	28		Screened out: private, one pit 5 ft deep and 10 ft in diameter.
Margaret PK006454	MIX	N	N	Emigrant	7S	9E	5		Screened out: no data, inaccurate location.
Maxey Bros. Nos. 1 and 2 and 3 Mines PK006402	PRV	N	N	Chimney Rock	3S	8E	28		Screened out: private.
Mc Adow Group / Mcadow Claim Group PK006214	MIX	N	N	Emigrant/ Knowles Pk	7S	9E	4		Visited general area, no environmental problems.
Mc Adow No. 2 PK006242	NF	N	Y	Emigrant	7S	9E	5		One open adit (Stotelmeyer and others, 1983).
Merriman Quarry PK002322	PRV	N	N	Emigrant	6S	8E	3		Screened out: private, quarry.
Midnight PK008687	NF	Y	N	Knowles Peak	7S	9E	4	DABB	Iron-manganese deposit, no hazards.
Midnight Bell SG001970	MIX	N	N	Haystack Peak	7S	12E	22		Screened out: no references, inaccurate location.
Mill Claim PK008583	MIX	Y	Y	Emigrant	7S	9E	5		Information from Stotelmeyer and others (1983).
Mill Creek PK002304	NF	N	N	The Pyramid	7S	11E	6		Screened out: placer, Lyden 1948.
Montana PK006326	NF	Y	N	Knowles Peak	7S	9E	3		Visited general area, unable to locate. Prospect pit only (Stotelmeyer and others, 1983)
Montana PK006310	MIX	N	Y	The Needles	5S	11E	26		Open adit cited in Stotelmeyer and others (1983).
Montana Queen-Corbett PK006278	PRV	N	N	Monitor Peak	7S	9E	8	CB	Screened out: private land.

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Morning Star PK006766	MIX	N	N	Emigrant	6S	8E	22		Screened out: may be BLM or private land ownership.
Mortar PK008608	NF	Y	N	Monitor Peak	7S	9E	18		Impacts on National Forest resources unlikely or minimal.
Mountain House Mine PK006398	PRV	N	N	Bald Knob	3S	8E	18	DB	Screened out: private surface.
Mountain Lion PK008575	MIX	N	N	Emigrant	6S	8E	13		Unable to locate.
Mt Cowan Molybdenum / Mount Cowen PK002268	NF	N	N	Mount Cowen	5S	10E	22		Screened out: shallow location cuts only, molybdenum (Reed, 1950).
Mt. Goat PK008598	NF	N	N	Monitor Peak	7S	9E	7	AAA	Screened out: caved adit, no significant assays.
Mud Lake Prospects SG008614	NF	Y	N	Haystack Peak	7S	12E	23		Visited general area, no hazardous workings noted.
Nabob PK006362	MIX	N	N	Emigrant	7S	9E	4		Screened out: no data, inaccurate location.
Nancy PK002112	NF	N	N	Knowles Peak	6S	9E	24		Screened out: inaccurate location (Reed, 1950), may be on private.
Newton Mine PK006426	PRV	N	N	Electric Peak	9S	8E	7		Screened out: private.
Nicon Group SG008562	MIX	N	N	Chrome Mountain	4S	12E	14		Large group of unpatented mining claims
North Star SG001142	PRV	Y	N	Haystack Peak	7S	12E	23		Walked general area, no effects to GNF-administered land.
Northern Pacific PK006772	NF	N	N	Livingston Peak	3S	10E	9		Screened out: inaccurate location.
Northern Pacific Coal Co. Mine PK002656	PRV	N	N	Hoppers	2S	8E	24		Screened out: private land, coal mine.
Oliver PK008547	NF	N	N	Livingston Peak	3S	10E	3		Screened out: one caved 30 ft shaft (Stotelmeyer and others, 1983).
Omega SG008616	PRV	Y	N	Haystack Peak	7S	12E	23		Private, visited general area, no effects to GNF-administered land
Oregon PK008563	MIX	N	Y	Chrome Mountain	4S	12E	15		Stotelmeyer and others (1983) state that the 75 ft long adit was open.
Oro-y-Plate PK006769	NF	N	N	Livingston Peak	3S	10E	16		Screened out: one caved adit (Stotelmeyer and others, 1983).

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Overlap Claim PK008605	NF	Y	N	Monitor Peak	7S	9E	18	BADD	Site visited on 11/16/99, impacts unlikely or minimal.
Peacock PK006318	NF	N	N	Knowles Peak	6S	9E	25		Screened out: four pits only, sloughed on talus slope (Stotelmeyer and others, 1983).
Peter Pear/Pete Pear/Ossian PK002406	NF	Y	N	Emigrant	7S	9E	31	CDAA	All adits obliterated by talus, small amount of crushed ore.
Pilgrim-St Croix PK006334	PRV	N	N	Knowles Peak	6S	9E	34		Screened out: patented, two caved adits and prospect pits.
Placer (East and West) SG001136	PRV	Y	N	Haystack Peak	7S	12E	15		Private, visited general area, Daisy and Hidden Treasure mine waste in bottom.
Platinum Ridge PK006234	NF	N	N	Knowles Peak	6S	9E	23		Screened out: inaccurate location.
Poor Man / Poorman SG008615	MIX	Y	N	Haystack Peak	7S	12E	22	ACAB	Visited general area, no open adits or shafts noted.
Poor Man No. 2 SG008618	PRV	N	N	Haystack Peak	7S	12E	23		Visited general area, all workings private, caved and dry.
Pyrite PK006358	NF	Y	N	Knowles Peak	7S	9E	4		Visited general area, no workings noted. Stotelmeyer and others, 1983, noted shallow pit only.
Queen Esther PK008579	MIX	Y	N	Emigrant	7S	9E	4		Visited approximate area, unable to locate.
Queen Victory SG008611	NF	N	Y	Haystack Peak	7S	12E	14		One 15-ft adit according to Stotelmeyer and others (1983)
Ray & Al Rudd Property PK006802	MIX	N	N	Iron Mountain	7S	12E	21		Screened out: uranium prospect with only CRIB as a reference.
Red Fox Group PK002730	NF	N	N	Chrome Mountain	4S	12E	27		Mill site noted in Stotelmeyer and others, 1983.
Robert E Lee Copper Occurrence PK006254	PRV	N	N	Knowles Peak	6S	9E	3		Screened out: private, downstream from GNF-administered land.
Ross Mine SG001766	NF	Y	Y	Sliderock Mount	3S	15E	6	AABC	One open adit 2' by 5' by 15' (at least), partially caved at portal, dry.
Rudd or Raymond Rudd No. 2 PK006746	NF	N	N	The Needles	7S	12E	6		Screened out: small pit only (Stotelmeyer and others, 1983).

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Seismoneit Mine PK006814	NF	N	N	Knowles Peak	6S	9E	27		Screened out: inaccurate location.
Sharon Sue and Contact PK006238	NF	N	N	Knowles Peak	6S	9E	26		Screened out: two adits, both caved according to Stotelmeyer and others, 1983.
Shawn Marie PK008593	NF	Y	N	The Needles	7S	12E	3		Visited general area, no shaft noted, Stotelmeyer and others (1983) says one 10-ft shaft; unable to locate.
Sheep Corral Mine PK002476	PRV	N	N	Bald Knob	3S	8E	18	BCB	Screened out: private surface.
Sheila Claim PK006274	NF	N	N	Monitor Peak	7S	9E	7	DB	Screened out: impacts expected to be minimal or unlikely; on talus slope.
Shirley PK006346	NF	N	N	Knowles Peak	7S	9E	3		Unable to locate, visited general area, is east of the Floyd Counts claim.
Silver King Mine SG001772	NF	Y	N	Sliderock Mountain	3S	15E	6		Visited general area, unable to locate.
Silver Star PK006302	MIX	N	N	Emigrant	6S	8E	22		Screened out: no data, inaccurate location.
Sixty Five / Sixty-five PK006698	PRV	N		Brisbin	3S	10E	32		Screened out: one caved adit on private land (Johnson and others, 1993).
Ski Line / Skiline / Mountain View SG001826	NF	N	Y	Haystack Peak	7S	12E	10		Open adit noted in Stotelmeyer and others (1983), probably no longer open. On talus slope.
Skillman -Milwaukie & Montana PK008559	NF	N	N	West Boulder Plateau	4S	12E	28		Mill site noted in Stotelmeyer and others, 1983.
Sky Baby Claims SG001778	MIX	N	N	Chrome Mountain	4S	12E	25		Screened out: no references except for CRIB, inaccurate location.
Skylark SG001148	MIX	N	N	Haystack Peak	7S	12E	23		Screened out: no references, inaccurate location.
Springfield SG001130	PRV	Y	N	Haystack Peak	7S	12E	15		Visited general area, private, no effects to GNF-administered land.
St. Julian PK008589	MIX	N	N	Emigrant	7S	9E	5		General location, most mining disturbances on private land.
St. Julian Group PK008582	MIX	N	N	Emigrant	7S	9E	5		Visited general area, most disturbances on private land.
St. Julian Mine PK006820	MIX	Y	Y	Emigrant	7S	9E	5	DCBB	Most workings on patented land; one small adit on GNF-land on knob to the south is open.

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Standard (Drago) Mine PK008560	NF	N	N	Chrome Mountain	4S	12E	15		Mill site noted in Stotelmeyer and others (1983).
Stemwinder Prospect SG001568	NF	N	N	Crazy Peak	3N	11E	6		Visited general area, no impacts.
Stevenson Mine PK002614	PRV	N	N	Bald Knob	3S	8E	17	CCC	Screened out: private surface.
Stillwater Anorthosite SG001532	NF	N	N	Picket Pin Mountain	4S	13E	25		Screened out: general location of anorthosite, no workings.
Stillwater PGM Resources SG001538	MIX	N	N	Picket Pin Mountain	4S	13E	26		Active mine area.
Surprise Mine SG001790	**NF**	**Y**	**Y**	**Sliderock Mountain**	**3S**	**15E**	**6**	**ACBA**	**Open adit with small discharge of water.**
The Four Sevens / 7777 PK002022	NF	N	Y	Iron Mountain	7S	12E	20		Unable to locate, Stotelmeyer and others (1983) states there is one open adit.
Twilight PK006282	MIX	N	N	Knowles Peak	7S	9E	4		Screened out: no data, inaccurate location.
Unnamed Copper Mine - Squaw Peak SG001610	PRV	N	N	Squaw Peak	3S	13E	10		Screened out: private, unlikely to impact. No references.
Unnamed Gold PK006678	MIX	N	N	Knowles Peak	6S	9E	35		Screened out: inaccurate location. No data.
Unnamed Gold Prize Creek Prospects PK009013	NF	Y	Y	Dailey Lake	7S	8E	4	BBB	One open adit, no evidence of discharge.
Unnamed Mine PK006790	MIX	N	N	Emigrant	6S	8E	24		Screened out: unnamed mine, inaccurate location, no data.
Virginia PK006342	NF	Y	N	Knowles Peak	6S	9E	34		Visited area, no workings noted on hillside, one prospect pit noted in Stotelmeyer and others (1983).
Vivienne Claim PK006482	MIX	N	N	Emigrant	7S	9E	4		Screened out: pit on ridgetop north of McAdow claim (Stotelmeyer and others, 1983).
W. M. Clayton Placer PK006823	MIX	N	N	Emigrant	6S	9E	29		Screened out: placer, no data according to Johnson and others (1993).

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Wheelon SG008624	NF	Y	Y	Haystack Peak	7S	12E	23		Visited general area, no open adits located, Stotelmeyer and others (1983) noted two open adits.
Winona F PK006462	MIX	N	N	Monitor Peak	7S	9E	8		Screened out: no data, inaccurate location.
Wisconsin PK006366	MIX	N	N	Emigrant	6S	8E	13		Screened out: no data, inaccurate location.
Yellow Jacket No. 2 SG008619	PRV	Y	Y	Haystack Peak	7S	12E	22		Screened out: private, Moyle and others (1983) says one open adit.
Yellowstone River PK002286	PRV	N	N	Emigrant	5S	8E	27		Screened out: placer, private, no effect to GNF-administered land.

2.6 DUV (Duval) Project

2.6.1 Site Location and Access

The site is on the Emigrant 7.5-min. quadrangle and is to the south of the East Fork of Emigrant Creek in D sec. 06, T7S R9E at an elevation of 7,560 ft (figure 8). These exploration holes are only a few feet off the side of the road leading to the St. Julian Mine and are plainly visible. They appear to be core holes and are plotted on plate 4, in the USGS Bulletin 1505– the North Absaroka study area report. They are plotted as "N.D." on the plate. They lie approximately 2,800 feet S.38E E. of the Allison Tunnel. The abbreviation "N.D." was not explained in the text but may stand for "no data"(?).

The area is reached by traveling 5 miles up Forest Route 3272 from Old Chico. One stream crossing of Emigrant may require four-wheel drive but the rest of the road is passable by two-wheel drive of ample clearance even though it cuts over a large scree slope just after the creek crossing. It is only seasonally accessible in the summer and early fall because of snow and ice.

2.6.2 Site History - Geologic Features

This lithologies of this site are described in Stotelmeyer and others (1983) as being in acid intrusive or fine-grained intrusive, mainly dacites. It was explored for gold, silver, copper, and molybdenum. According to the geologic map in Stotelmeyer and others (1983), the drilling may have been exploring the contact of the later Tertiary granodiorite porphyry and the earlier dacite porphyry. Most of the deposits in the area have auriferous pyrite as the ore mineral.

The area was actively being explored in 1983 when the wilderness study was being conducted; the companies were exploring for porphyry-type, disseminated copper-molybdenum deposits associated with the Emigrant stock.

2.6.3 Environmental Condition

Water flows freely from the boreeholes, but the effects at the surface are extremely localized. The immediate, saturated area where the water is flowing is devoid of vegetation but the surrounding vegetation is healthy and appears unaffected by the water. The effects on ground water is unknown and may be of some concern. It was not within the scope of this study to investigate the subsurface conditions present.

2.6.3.1 Site Features - Sample Locations

Water-quality samples were collected from 2 of the 3 drill holes that had flowing water. The lower one was EWEG10M and the upper one was EWEG20H. Both were on GNF-administered land. The flow rates at these locations were 1.8 and 2.1 gpm, respectively. Discharge from the lower hole had a field pH of 5.31 (lab pH = 4.97) and specific conductance was 179 (lab = 182) Fmhos/cm. The second hole sampled had a pH 7.33 (lab = 7.18) and specific conductance was 237 (lab = 284) Fmhos/cm. Samples were collected on August 26, 1999. The third hole had a flat piece of steel welded to the top in an attempt to cap it. Water squirted out from a gap between the flat steel and the casing. Further sampling was not done because the flow never reached the active drainage. Site features and sample locations are shown in figures 9; photographs are shown in figures 9a and 9b.

2.6.3.2 Soil

No waste was associated with this site and no soil samples were taken.

2.6.3.3 Water

The concentration of analytes in the two flowing drill holes had exceedences (table 2) but the pH was below the water quality criteria level. The sample in the lower water sample exceeded the secondary MCL by 30 times and more than twice the acute and chronic aquatic life standard for aluminum. The lower hole had two times the acute aquatic life standard for copper and three times the chronic aquatic life standard. Both holes exceeded the secondary standard for iron and manganese but only the lower one exceeded the acute standard for iron. Only the lower hole was two times the accepted acute and chronic zinc standard. The holes may have penetrated different lithologies and/or they may have hit varying amounts of vein material to account for the differences in water quality.

Table 13. DUV flowing wells water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	pH
EWEG10M - lower well	SAC					AC	SA		S				AC					S
EWEG20H - upper well							S		S									

Exceedence codes:

S - Secondary MCL
A - Acute aquatic life criteria
C - Chronic aquatic life criteria

Note: The analytical results are listed in appendix IV.

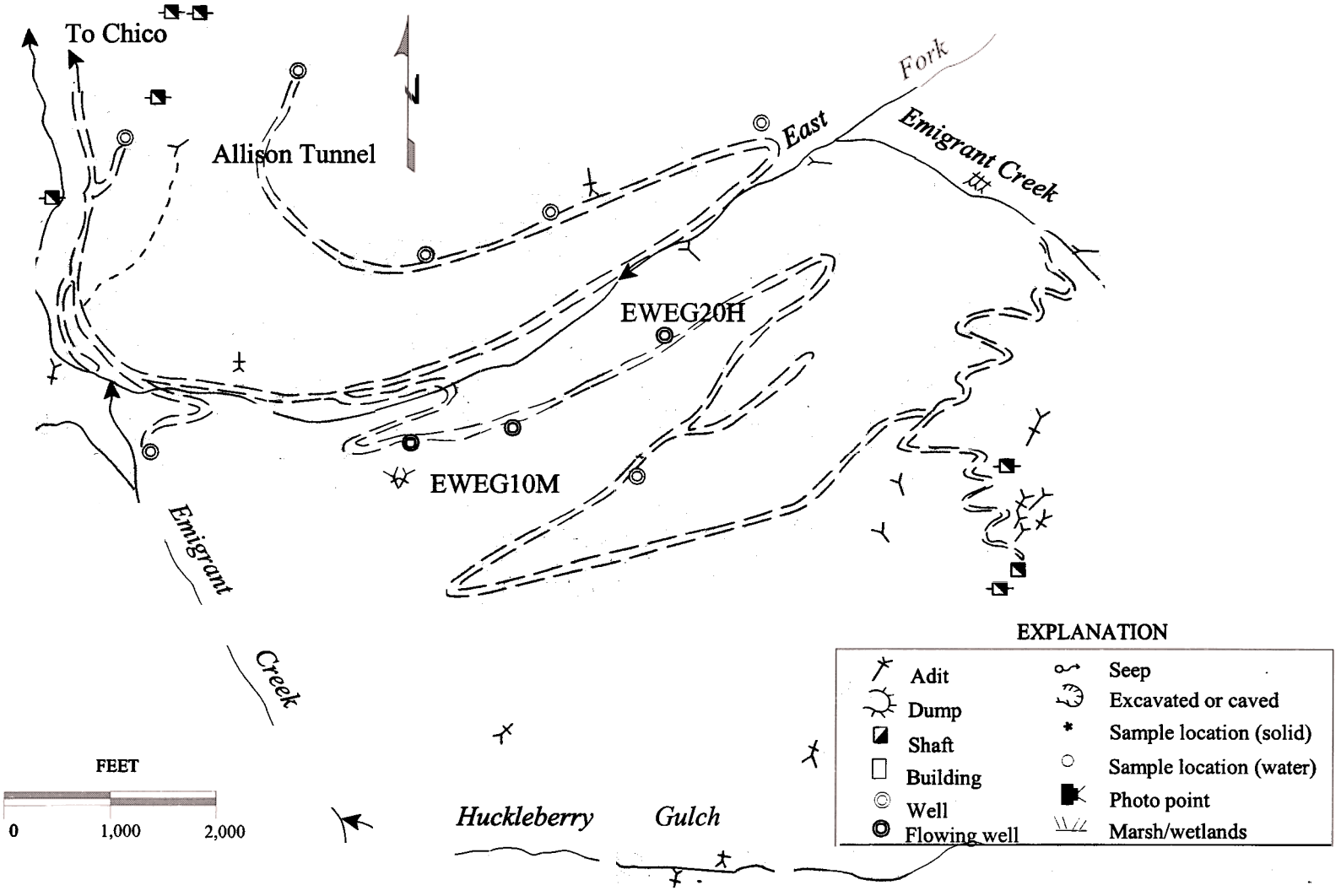


Figure 9. Two of the three flowing wells south of Emigrant Gulch were sampled on 08/26/99, map is based on Stotelmeyer and others, 1983.

Figure 9a. The lower well flowed even with a four-ft stand of pipe. The pipe had mineral deposits on it.

Figure 9b. The water from the upper well also deposited iron and other minerals in the casing and on the ground.

2.6.3.4 Vegetation

Vegetation on GNF-administered land does not appear to be greatly impacted by the site. Although the small, immediate area surrounding the flowing drill holes was devoid of vegetation, the adjacent vegetation appeared healthy. Alders, bushes, grasses and conifers grew along the road.

2.6.3.5 Summary of Environmental Conditions

The effects of the flowing holes appear very localized. The conditions in the subsurface are unknown. No evidence of adverse effects to wildlife or humans was observed.

2.6.4 Structures

No structures were associated with this site. It was primarily an exploration project and so had no permanent structures.

2.6.5 Safety

No physical safety concerns were noted at the site. Although the site was visited in August, it may be speculated that the discharges would flood the road in the winter and create a sheet of ice that would block the road until late in the year. This was never confirmed.

2.7 Allison Tunnel

2.7.1 Site Location and Access

The Allison Tunnel can be found on the Emigrant 7.5-min. quadrangle in BDAD sec. 06 T07S R09E at an elevation of 7,650 ft (figure 8). Forest Service road 3272 turns south-southeast from the Chico Hot Springs road. It parallels Emigrant Creek and the East Fork of Emigrant Creek. The general area is accessible in good weather and road conditions by four-wheel-drive vehicle and by most two-wheel-drive vehicles. The last quarter mile must be hiked because the old mining road is impassable. Much of the year the entire area of Emigrant Gulch is poorly accessible because of snow and mud. Iron staining resulting from the adit discharge is visible from FS road 3272.

2.7.2 Site History - Geologic Features

Stotelmeyer and others (1983) summarized the history of the Allison Tunnel. The area was first explored in 1885. Peter Clausen drove the lower adit 560 ft. George Allison then worked the claim until 1914. The Metallic group of molybdenum claims were located in 1927. Later exploration included the USGS investigation of the property that was then known as the Molybdenum Nos. 1-6 claims. In 1943, the adit was 700 ft long with a 50 ft drift in the molybdenite zone. In 1947, the property was explored by Hodges Mining Company. Minerals Exploration Company (of Union Oil Company) was active in 1966 to 1968, and in the 1970's, Duval Corporation had an exploration program in which they drilled 11 deep holes in the target area to try and define a copper-molybdenum deposit. The tunnel was open at least until the 1980's when the USGS geologists (Stotelmeyer and others) conducted their study. The USBM sampled the area in 1991 and the results of 65 samples are in their 1993 report (Johnson and others, 1993). The adit was totally caved in 1999 when it was inventoried and the discharge was sampled.

The adit was driven entirely in a Tertiary dacite porphyry (also described as flow-banded rhyolite or trachyte porphyry), and ore appeared to be in a breccia pipe that was approximately 150 ft in diameter (Stotelmeyer and others, 1983). According to Johnson and others (1993), who quoted Pfau (1981), the breccia pipe "consists of strongly altered, extremely angular breccia fragments as much as 3 ft across that have little or no rotation". An area of strong pyrite alteration characterizes a large area in the Emigrant Gulch area. The primary minerals found in the area are pyrite and chalcopyrite with lesser bornite, galena, magnetite, molybdenite and sphalerite in trace amounts. A map of the accessible underground workings, 13 sample localities, and analytical results appear in Stotelmeyer and others (1983).

2.7.3 Environmental Condition

The Allison Tunnel's discharge is readily visible from the public road, however, it's effects are relatively local. The extent of the disturbance is less than 2 acres.

2.7.3.1 Site Features - Sample Locations

Water-quality samples were collected from the adit discharge on GNF-administered land, including one duplicate. Upstream and downstream samples were not taken because the flow from the tunnels infiltrated into the ground and never reached Emigrant Creek. Also, more samples were not collected because of the private land position along the creek. The flow rate of the discharge was approximately 25 gpm. The field pH of the adit discharge 3.31 and the lab pH was 3.34 (and 3.36). Specific conductance was 247 Fhos and 314 (348 in the duplicate) Fhos. Samples were collected on August 27, 1999. Site features and sample locations are shown in figure 10; photographs are shown in figures 10a and 10b.

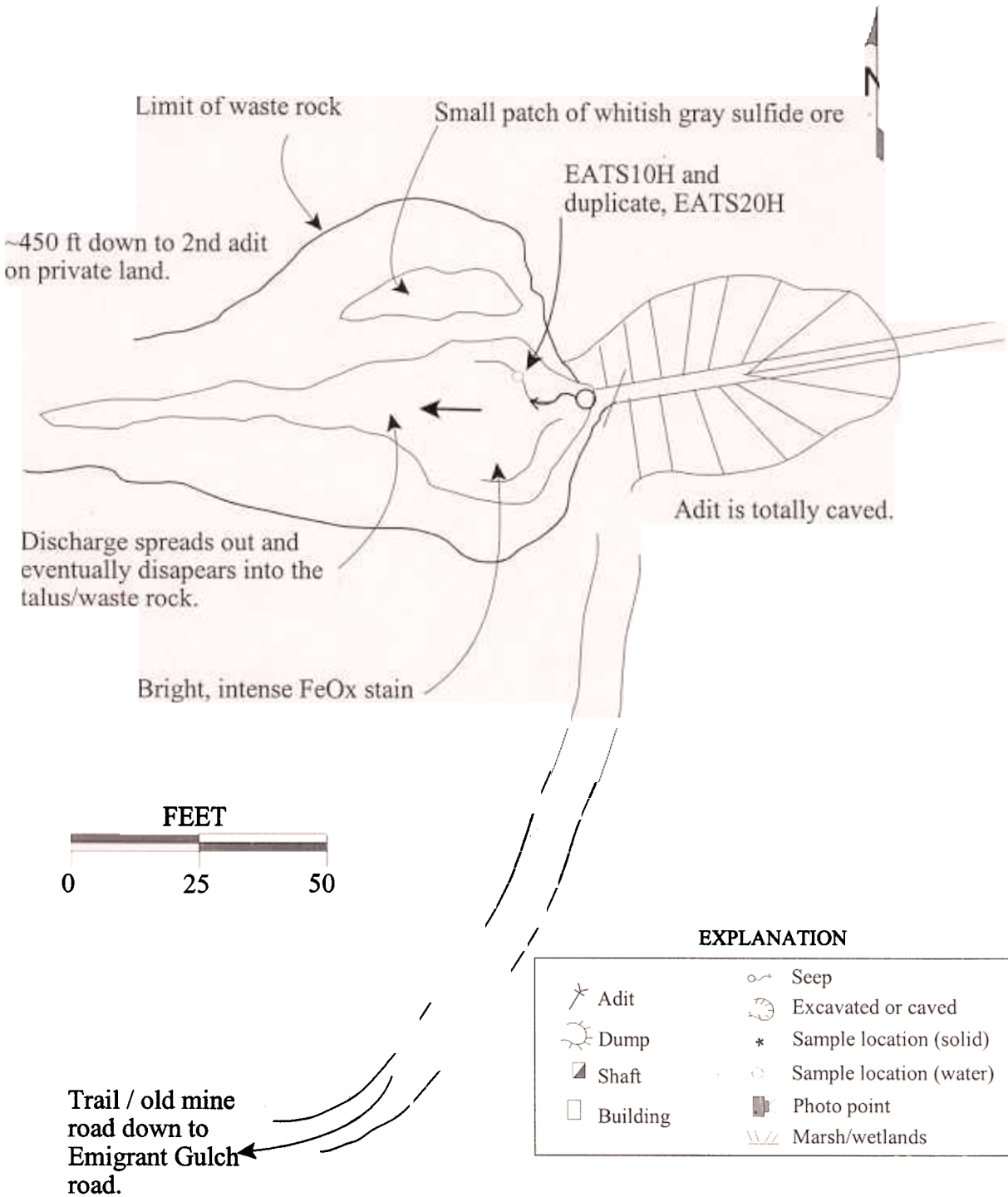


Figure 10. The Allison Tunnel was completely collapsed, but it discharged ~25 gallons of water that cascaded down the hillside, as mapped 08/27/99.

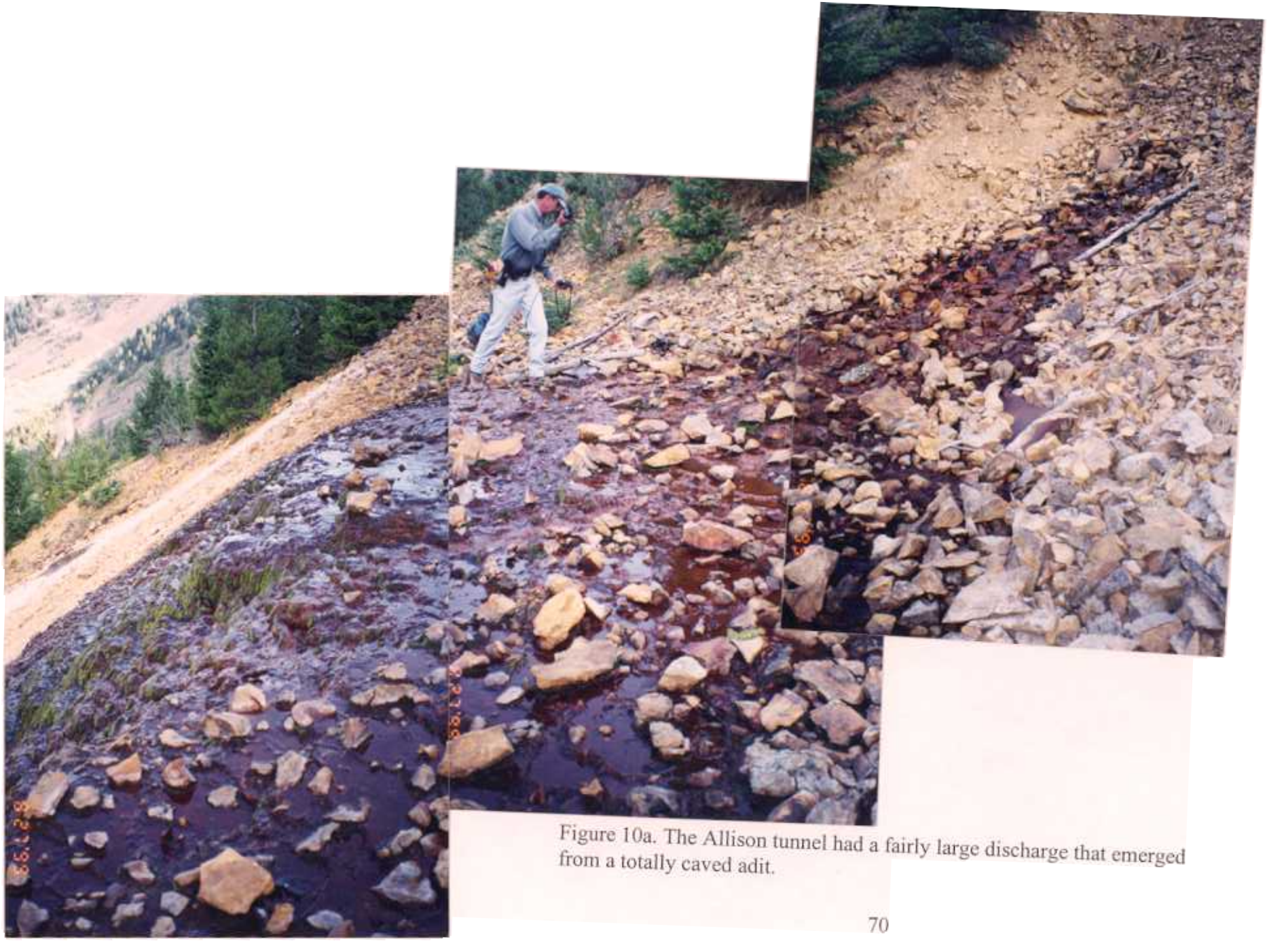


Figure 10a. The Allison tunnel had a fairly large discharge that emerged from a totally caved adit.

2.7.3.2 Soil

No soil samples were taken at the Allison tunnel. The waste dump was high and dry, and private, patented land lay between the Allison's waste dump and Emigrant Gulch.

2.7.3.3 Water

The concentrations of analytes in the adit discharge samples (EATS10H and EATS20H)) exceeded water-quality standards for six metals. The pH fell well below the allowable limit of 6.5 (table 14). The concentrations of aluminum in the samples exceeded the secondary MCL, and the acute and chronic aquatic life standards. Cadmium exceeded the chronic aquatic life level. Both copper and zinc exceeded acute and chronic aquatic life levels. Manganese and iron exceeded secondary MCL standards, and iron also exceeded the acute aquatic life standard.

Table 14. Allison Tunnel mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	pH
EATS10H-adit discharge	SAC			C		AC	SA		S				AC					S
EATS20H-duplicate	SAC			C		AC	SA		S				AC					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 IV.

2.7.3.4 Vegetation

Vegetation on GNF-administered land appears to be slightly impacted by the site. The area of the discharge has trees growing on it, but the slope so steep and dry that vegetation generally does not easily grow there.

2.7.3.5 Summary of Environmental Conditions

The effects of the Allison Tunnel are localized, although many water-quality standards are exceeded in the adit discharge. The disturbed area surrounding the Allison Tunnel is less than 5 acres.

2.7.4 Structures

No structures remain at the Allison Tunnel site. Some cabins remain near the creek on private land but they are about 1,000 ft or more from the discharging adits.

2.7.5 Safety

No safety hazards were identified at the Allison Tunnel. No structures remain and the adit was completely caved. The slope formed by the waste dump was steep (15—20 percent) but no steeper than the surrounding topography.

2.8 Galena Queen Mine and Carmel Claim

2.8.1 Site Location and Access

This site (figure 8) is located on a small unnamed fork of Arrastra Creek and Arrastra Creek, proper, which flows into the West Fork of Mill Creek that joins Mill Creek and then flows into the Yellowstone River. Access is via Forest Route 486, turning south at the Bow and Arrow Ranch on Forest Route 3271 and then turning west onto Forest Route 3274 which is four-wheel drive to the mine site (impassible in the winter and early spring months). The actual workings must be accessed by foot for the last quarter mile. Access was by a 2-mile foot trail along Arrastra Creek from the Barbara Anne mine as late as the 1950's (Reed, 1950). The mines are located in sec. 4, T07S, R09E, on the Knowles Peak 7.5-min. quadrangle at elevations of 8,400 ft to 8,600 ft. The entire site is on GNF-administered land; no patented claims are associated with the mine.

The Carmel claim lies to the southwest of the Galena Queen. The actual claim and its workings are dry but there is a seep to the north along the old mining road. Because it is separate from the Galena Queen, it was given a different site name although the basic information is all the same. The seeps are probably caused by the same geologic conditions.

2.8.2 Site History - Geologic Features

The original workings consisted of a 55-ft shaft and a >200 ft adit (Stotelmeyer and others, 1983 and Reed, 1951). The area was worked in the 1870's when it produced primarily gold. Reed (1950) listed the mine as a lead producer.

A gash structure in a sheeting zone in highly pyritized dacite (previously described as rhyolite) was explored by the workings. The adit which followed the sheeting zone was driven S.65EW. to N.80EW. Stotelmeyer and others (1983) noted the limonite terraces that occur near the mine.

Mineralization includes pyrite, galena, with lesser sphalerite, and chalcopyrite in quartz. A sample by Reed (1950) of disseminated galena in the sheeted zone contained 0.1 percent lead and traces of silver and gold.

2.8.3 Environmental Condition

Many of the limonite-stained seeps are assumed to be natural and not associated with mining. The seep exposed by a bulldozer cut near the Carmel mine may have been natural but has recently been further exposed by the road building and exploration activities. The leaky adit and flooded shaft are the obvious man-made features. The actual disturbed area attributed to the Galena Queen mine is less than 2 acres. The deeply eroded gully to the north of the mine area and south of the road may have been a result of recent logging and the mining activity to the west.

2.8.3.1 Site Features - Sample Locations

Water-quality samples were collected from upstream (AGQS30M and AGQS40M) on both Arrastra Creek proper and the small tributary to the west that flows by the adit and shaft. A sample from the adit discharge (AGQS20M) was taken immediately after the water left the adit. AGQS50M was taken as a representative sample from the natural seeps in the area and AGQS10M was taken from the water that was cascading down the slope from near the Carmel claim. A cumulative sample from the seeps near the Carmel claim was represented by ACAS10M. Downstream (AGQS60M) of the site a sample was taken immediately upstream from the culvert on the small mining road that ends in the talus to the east. The flow rates at the site locations were 45 and 40 gpm and downstream was 300 gpm, respectively. Upstream, Arrastra Creek and its tributary's measured pH was 7.55 (lab=5.55) and 8.09 (lab=6.24) and specific conductance was 132 (lab=125) and 195 (lab=193) Fmhos/cm. Downstream, Arrastra Creek pH was 7.64 (lab=7.44) and specific conductance was 158 (lab=132) Fmhos/cm. Samples were collected on October 12, 1999. Site features and sample locations are shown in figures 11 and 12; photographs are shown in figures 11a and 11b, and figure 12a.

2.8.3.2 Soil

One soil sample was taken at the site (table 15). The five major metals exceeded the Clark Fork Superfund background levels for soils. Zinc also exceeded the phytotoxic concentration limit by almost 5 times.

Stotelmeyer and others, 1983 reportedly sampled the rock in the adit with no significant assays reported, possibly because of the leaching by the ground water and the limonite coatings on all the workings. Stotelmeyer and others also reported that a sample taken from a site east of the

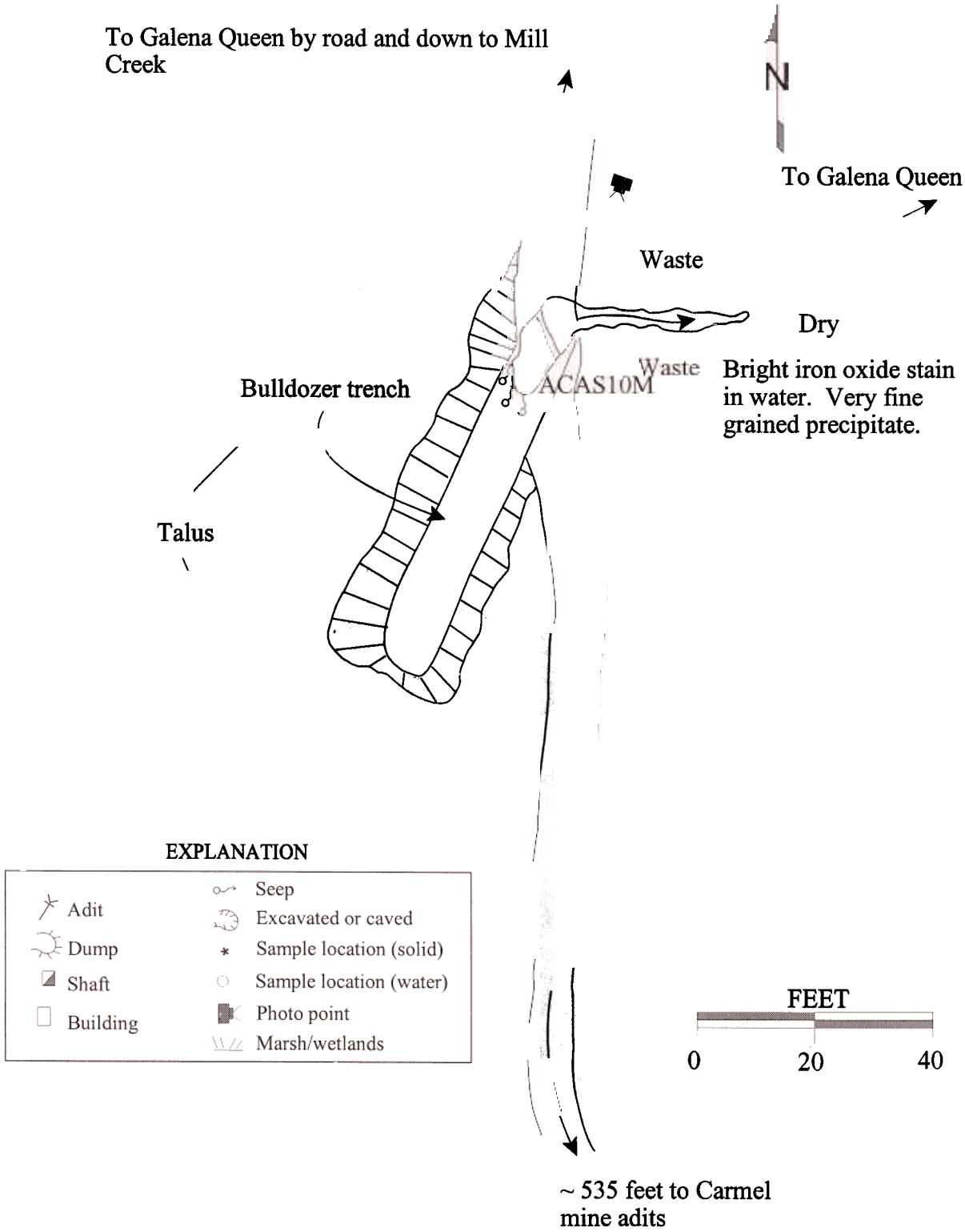


Figure 11. A bulldozer trench near the Carmel claim adits exposed an iron-stained seep and provided a depression in which water pooled, as mapped 10/12/99.

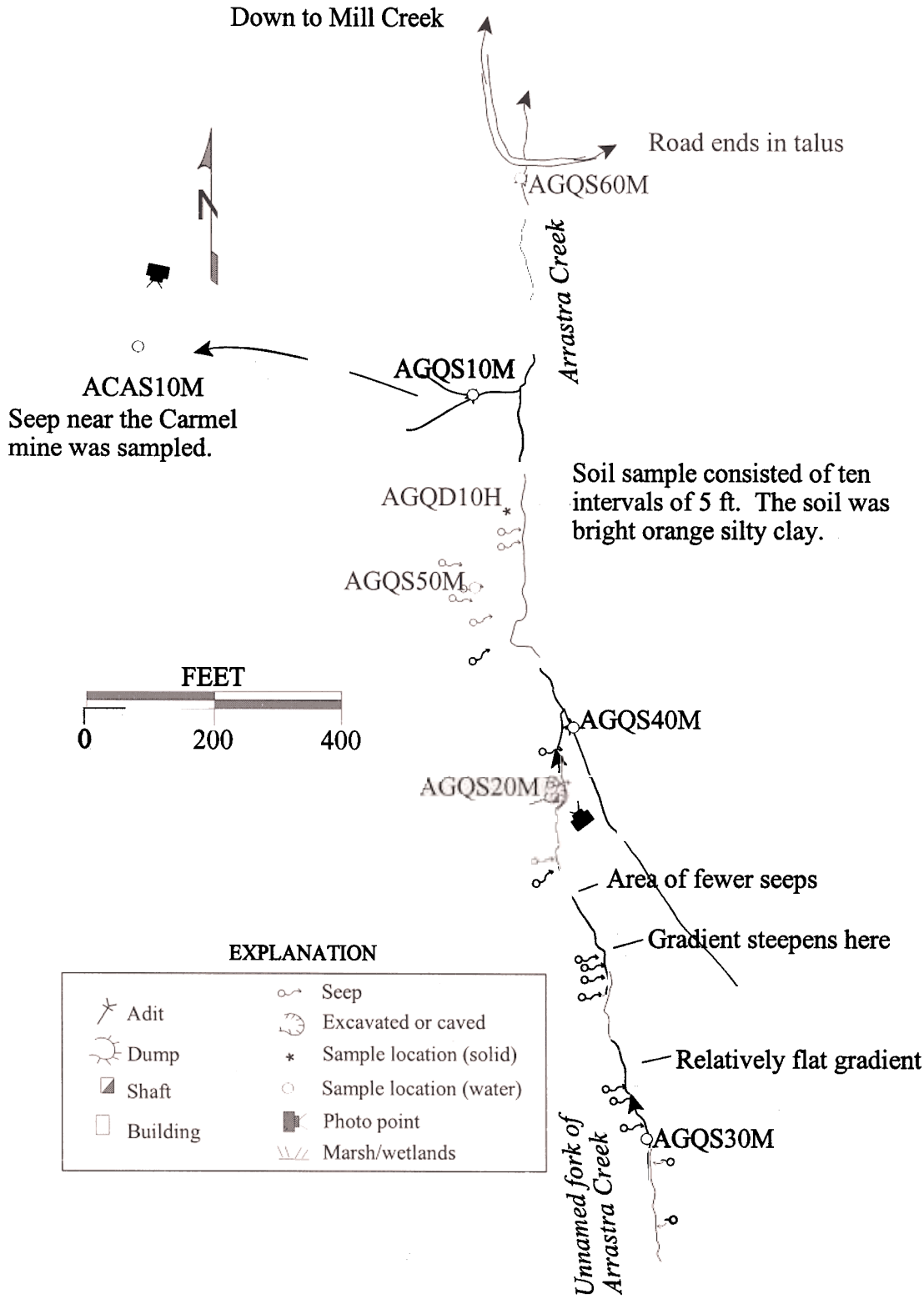


Figure 12. A complex series of iron-stained seeps and adit discharge contribute water to Arrastra Creek, near the Galena Queen Mine, as mapped 10/14/99.

Figure 12a. A seep at the Carmel claim had been further exposed by exploration and road building.

Figure 12b. The flooded shaft and open adit posed physical hazards at the Galena Queen as well as discharging iron-stained water as seen 10/12/99.

creek had negligible metals values but a sample of the dump assayed 0.12 opt gold, 0.15 opt silver, and 046 percent lead.

Table 15. Soil sampling results at the Galena Queen Mine site (mg/kg).

Sample Location	As	Cd	Cu	Pb	Zn
Soil (AGQD10H)	42.2[1]	3.98[1]	17.7[1]	158[1]	3450[1,2]

(1) Exceeds one or more Clark Fork Superfund background levels (table 3).
(2) Exceeds phytotoxic levels (table 3).

2.8.3.3 Water

The concentrations of analytes in the upstream samples (AGQS30M and AGQS40M) did not exceed water-quality standards (table 2). The downstream sample (AGQS60M) had no exceedences either. Only the natural seep downstream from the mine had an exceedence in zinc but the level of 199Fg/L was not much greater than the standard of 120Fg/L. The two seeps and the adit discharge exceeded the secondary and acute standards in iron and manganese. The two seeps also had low pH's of 6.27 and 6.31, just below the standard of 6.5.

Table 16. Galena Queen mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	pH
AGQS30M upstream-tributary																		S*
AGQS40M upstream-Arrastra Creek																		S*
AGQS20M adit discharge							SA		S									S*
AGQS50M seep							SA		S				AC					S
AGQS60M downstream																		
ACAS10M Carmel seep							SA		S									S

Exceedence codes:
S - Secondary MCL
A - Aquatic Life Acute
C - Aquatic Life Chronic
(*) Laboratory pH exceeded the secondary MCL standard; field pH did not.
Note: The analytical results are listed in appendix IV.

2.8.3.4 Vegetation

Vegetation on GNF-administered land does not appear to be impacted by the site. Trees grew well immediately adjacent to the iron-rich springs. Saturation by water did impede the growth of vegetation, but the springs were considered natural.

2.8.3.5 Summary of Environmental Conditions

The discharge from the adit is very similar in composition to that of the natural waters being discharged by the numerous seeps in the area. The area of disturbance is very small and the creek remains in its original drainage. The downstream sample did not exceed any criteria and the analysis was very similar to that of the upstream composition. It appeared that much of the iron precipitated out as soon as the discharge encountered the surface water. The area immediately surrounding the discharge was brightly orange stained but the Arrastra Creek bed was not iron stained.

2.8.4 Structures

No structures were associated with the site. The closest cabin was near the junction of the mining road leading to the David adit and the road that continued up to the Emigrant Creek/Mill Creek divide and the McAdow claims. It was near the Midnight manganese deposit. This cabin appeared to have been recently seasonally occupied and was still in good condition. No other cabin site was found in the area. No mills were noted in the immediate area and no mention of a mill was found in the literature.

2.8.5 Safety

The flooded shaft and open adit posed safety concerns. The adit was extremely wet and water streamed from the back. It was accessible and was entered by the USGS geologists in the late 1970's. The flooded shaft was obscured by floating timbers, debris, and iron deposits. The extremely still water was deceptive as to the presence of the dangerous vertical shaft. Although the area is remote and accessible only by four-wheel drive vehicle and by walking, the open workings would be ranked very hazardous.

Two open adits are also present on the Carmel claim to the southwest. These are dry and the upper one was accessed with difficulty by climbing a steep slope. The lower one was partially caved at the portal; the upper one was intact but did have minor spalling near the portal.

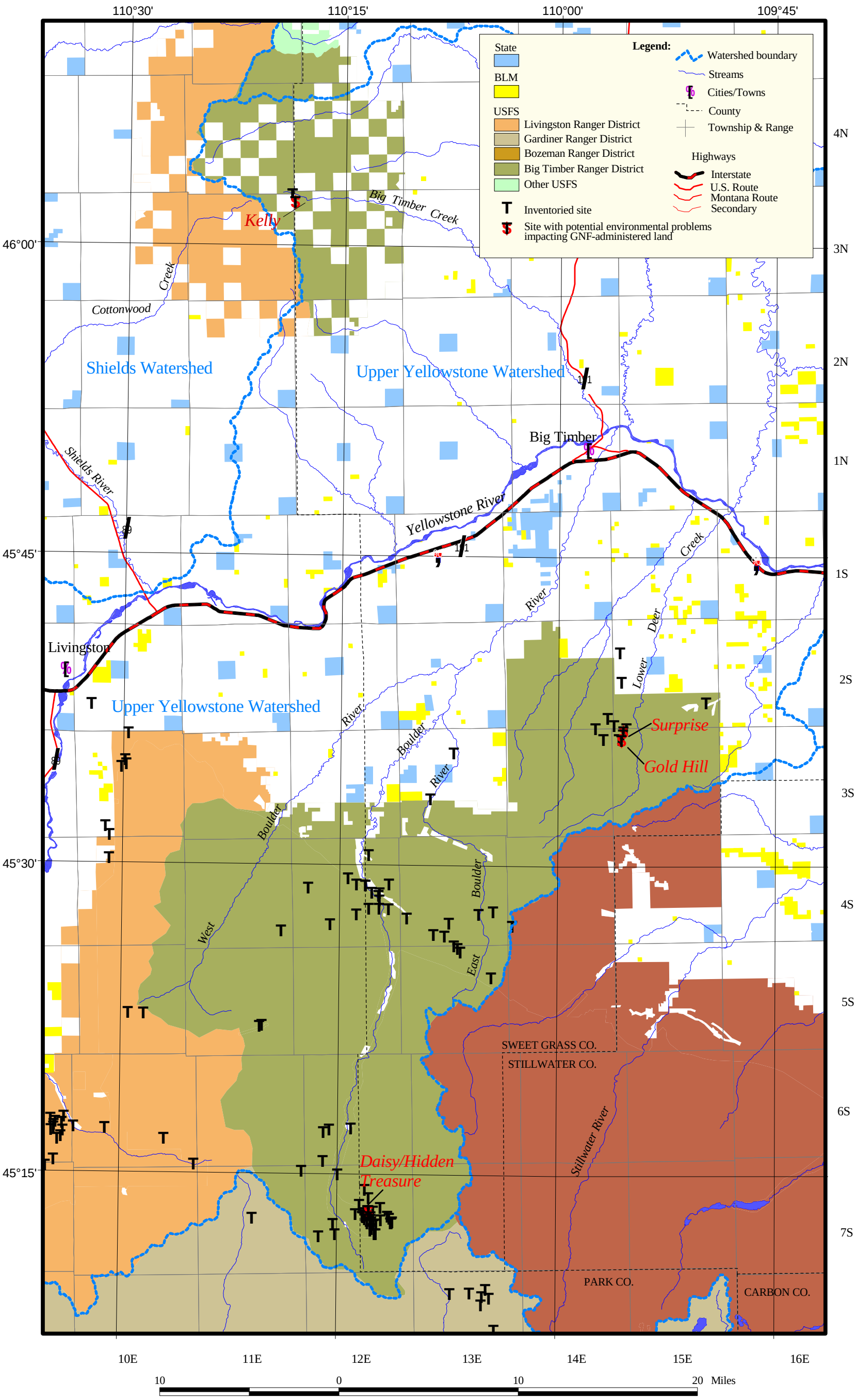


Figure 13. In the Big Timber Ranger District, sites were sampled in the Independence, Gold Hill, and Big Timber mining districts.

2.9 Kelly Mine

2.9.1 Site Location and Access

The Kelly Mine (figure 13) is located in the Crazy Mountains and is accessed by the Big Timber Creek trail. The site is reached by Highway 191 from Big Timber. At 10.7 miles, turn west onto County Road 25 and at 2.0 miles turn west (right) onto Forest Route 197. The Forest Service boundary is 11.3 miles from the highway on Forest Route 197. The trailhead is 15.3 miles from the highway. The Kelly is on Forest Service Trail #118 about 3½ miles from the Half Moon Campground. It is in sec.6, T03N, R12E at an elevation of 8,600 ft.

2.9.2 Site History - Geologic Features

The Kelly was operated as the Belle Mining Company of Butte, Montana and was active from 1900 to 1929 (Reed, 1950). Exploration activity in the area was conducted by the Half Moon Mining Company in the 1950's. The original adit was approximately 500 feet long along a N.25EW. vertical fracture (Reed, 1950). It explored the southeast reach of the same fracture/vein mined at the Half Moon Mine (Johnson and others, 1993). The Stemwinder Mine lies to the south of Granite Lake.

The dump was composed of approximately 25 percent of a coarse-grained, black and white intrusive, and 75 percent altered, iron-stained intrusive. The altered rock tended to be ¾-in. fragments while the larger pieces were the unaltered intrusive.

2.9.3 Environmental Condition

The site's disturbed area is less than 2 acres in extent. The adit has a small discharge which never reaches a perennial drainage. It was sampled only because it had a discharge, not because of any evidence of metal leaching or signs of detrimental environmental effects.

2.9.3.1 Site Features - Sample Locations

Water-quality samples were collected from the adit discharge on GNF-administered land. The flow rate at this location was estimated at 2–3 gpm. The sample was collected on July 22, 1999. More samples were not collected because of the limited extent of surface water in the area. The discharge had no apparent impact on the surface water in the lakes and streams. Site features and sample locations are shown in figures 14 and 15; photographs are shown in figures 15a and 15b.

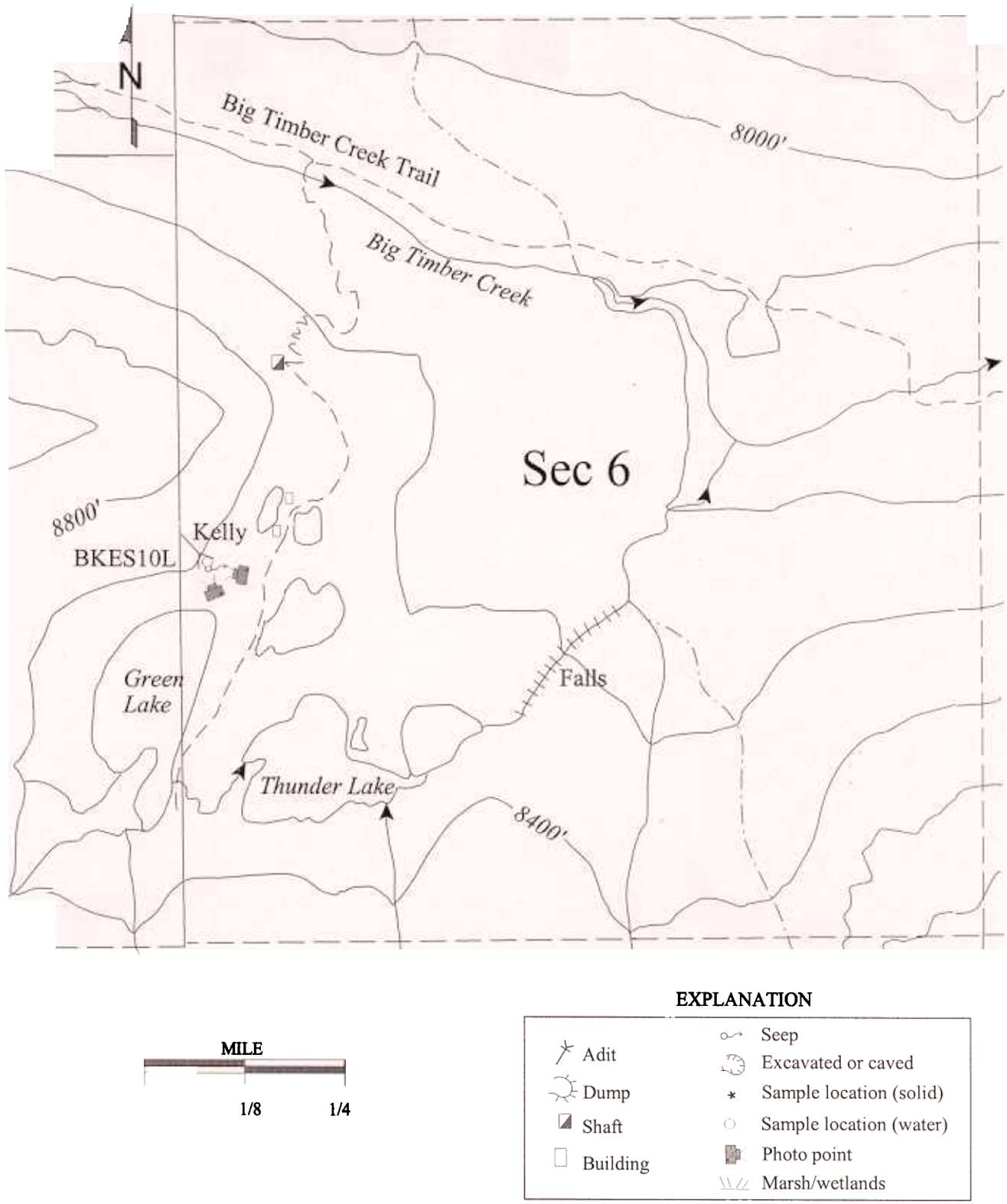
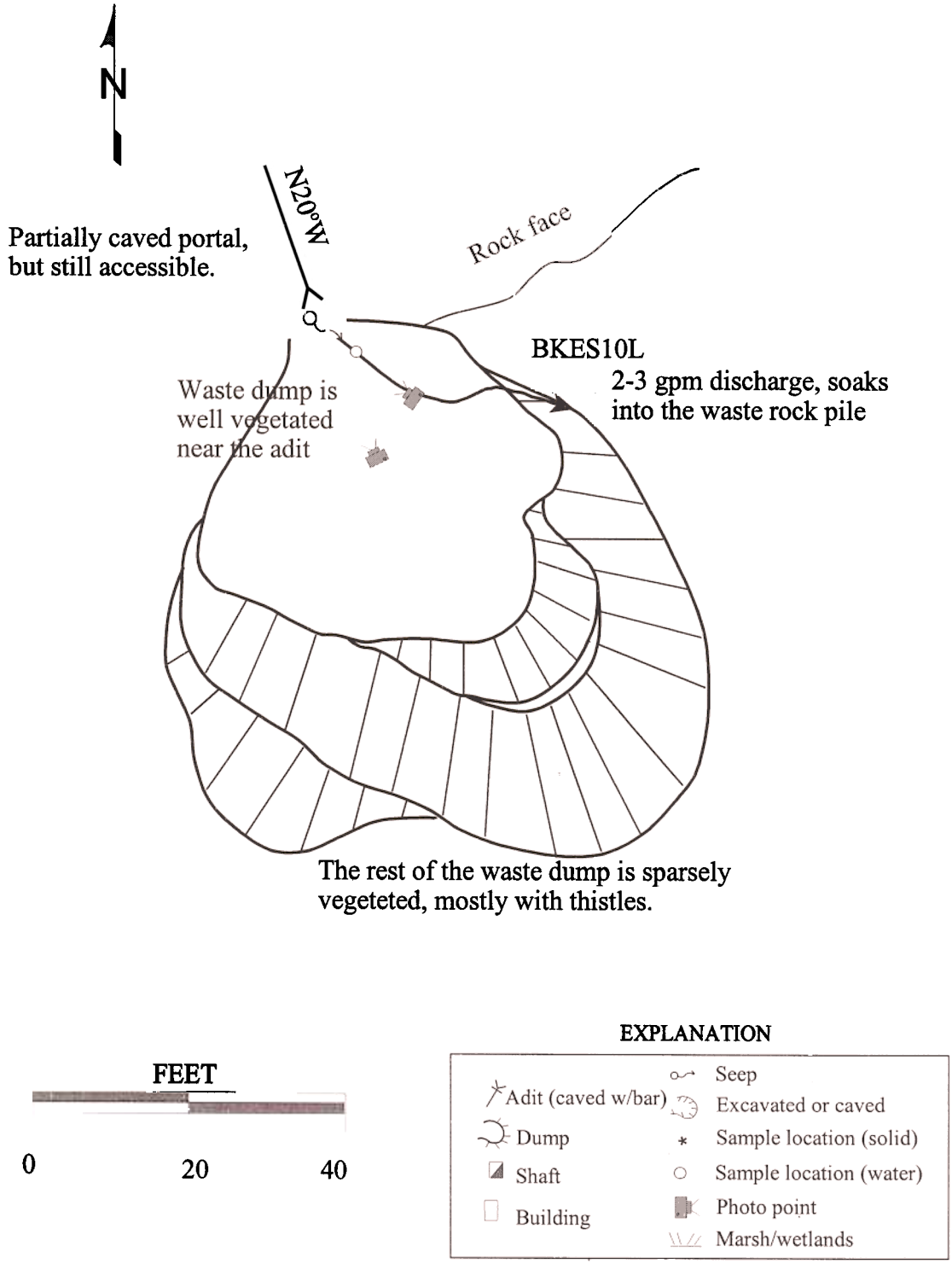


Figure 14. Schematic of the Big Timber Canyon area where the Kelly Mine is located on the Crazy Peak 7.5-min. quadrangle, as visited 07/22/99.



Figuere 15. The Kelly Mine in the Crazy Mountains was predominantly caved but still accessible and had an adit discharge when visited on 07/22/99.

Figure 15a. The Kelly adit was partially collapsed but still considered accessible.

Figure 15b. The discharge from the Kelly adit had plants growing along it.

2.9.3.2 Soil

No soil, tailings, or waste samples were taken at the Kelly adit. The waste dump was not in contact with the creek or lake. The rock that was present appeared fairly innocuous with few sulfides. The fragments were large with little probability of wind or water erosion.

2.9.3.3 Water

The concentration of analytes in the adit discharge sample did not exceed any water-quality standards (table 17). Most values were at or below the detection limits for the analytes. The pH, as measured in the analytical lab, was 6.1 which is below the accepted range for pH. The pH as measured in the field was 7.1 to 7.3, however. The specific conductance of the discharge was approximately 50 Fmhos.

Table 17. Kelly Mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	pH
BKES10L - adit discharge																		S*
BKES20L - duplicate																		S*

Exceedences:

S - Secondary MCL

(*) The laboratory pH was below the secondary MCL standard, but the field pH met the standard.

Note: The analytical results are listed in appendix IV.

2.9.3.4 Vegetation

Vegetation on GNF-administered land does not appear to be impacted by the site. The adit discharge channel had lush vegetation growing in it, including hellebores, bluebells, grasses, and cow parsnip.

2.9.3.5 Summary of Environmental Conditions

This site is a very small mine with little or no impact to the overall environmental condition of the Forest. It is remote and not likely to have much human visitation.

2.9.4 Structures

The small unnamed lakes to the northeast of the adit had three cabins in bad condition. They were log cabins and only the bottom rows of logs remaining.

2.9.5 Safety

The adit was partially collapsed with a 1-ft by 3-ft maximum opening. It was still considered accessible and hazardous. The adit was well away from the trail and not highly visible. Evidence of frequent recreational use in conjunction with the nearby lakes was noted. Access is limited because of the road closure.

2.10 Daisy and Hidden Treasure Mines and Mills

2.10.1 Site Location and Access

The Daisy and Hidden Treasure mines are contiguous in sec. 15, T07S, R12E in the Independence mining district (figure 13). The mines plot on the Haystack Peak 7.5-min. quadrangle. Seasonal access is via a rough road beginning at the Box Canyon ranger station approximately 42 miles from Big Timber. It is another 4.5 miles to the old Independence townsite where the road worsens and another 2 miles to the patented claims surrounding the Independence mining district. The site is inaccessible by vehicle in late-fall, winter and spring months.

2.10.2 Site History - Geologic Features

Reed (1950) wrote a summary of the area and described the geology. Moyle and others (1989) conducted a detailed study of the Independence mining district and studied the Daisy and Hidden Treasure as a part of the larger study. Much of the following summary is from these two reports. Other previous studies at the Daisy and Hidden Treasure mines include sampling by the U.S. Bureau of Mines in their mineral assessment of the Gallatin National Forest (Johnson and others, 1993). Pioneer Technical Services also sampled this site in 1993 in the study for the Abandoned Mine Reclamation Bureau (Pioneer Technical Services, 1995).

The Independence district's heyday was from 1888 to 1893. Two separate 10-stamp mills were set up for the Hidden Treasure and the Daisy. At least four other stamp mills operated in the district. The Daisy Mine workings are largely on patented land to the south and east of the Hidden Treasure. It has also been known as the Yager, the Duffy, or the Treasure State.

In 1892, a stamp mill at the Hidden Treasure was built along Basin Creek (Moyle and others, 1989). It operated until 1904 when it burned down; operations at the Hidden Treasure were suspended.. The Hidden Treasure was re-opened in the 1930's when a 35-ton per day gravity concentrator was built at the Daisy Mine. The lack of oxidized ore and the inability to economically process the sulfide ore made the operation cease again.

Production records from 1901 to 1904 showed a total of 91 oz gold and 750 oz silver was produced from 103 tons of ore from this property. Three adits totaling over 1,000 feet of workings were attributed to the Hidden Treasure by 1904. Later workings include 11 pits, 2 trenches and 2 adits (caved). The mines explored near-vertical, northwest-trending quartz-pyrite-sericite veins. These structures are sub-parallel to and west of the mineralized structures at the Daisy Mine.

Moyle and others (1989) estimated mill tailings in the meadow to the south of the Daisy and Hidden Treasure to be 4,000 tons. In addition, ore was also transported to the mill at the Independence townsite for processing.

2.10.3 Environmental Condition

The area surrounding the Independence mining district and the Daisy, Yager, and Hidden Treasure mines specifically have an obvious physical impact to this setting but a less obvious environmental impact. Exposed sulfides were a product of the mining and milling process but most were deposited on the patented claims in the area.

2.10.3.1 Site Features - Sample Locations

No upstream sample could be collected because Basin Creek’s headwaters begin on private land in the meadow where the Daisy tailings were deposited. One water-quality sample was collected from downstream (BDAS10L) of the site on GNF-administered land. The flow rate at this location was 224 gpm. The samples were collected on September 29, 1999. More samples were not collected because of the private land position. Site features and sample locations are shown in figure 16; a composite photograph is shown in figure 16a.

2.10.3.2 Soil

No soil samples were taken because of the private land position. Pioneer Technical Services (1995) reported on the soil analyses at this site. Moyle and others (1989) analyzed a series of tailings samples in the impoundment on private land as well as several rock samples in the area.

2.10.3.3 Water

The concentration of analytes in the downstream sample (BDAS10L) did not exceed any water-quality standards (table 2) except for the inconclusive pH reading. The field pH measured 5.35 which is well beow the standard but the laboratory pH was 7.28. Pioneer Technical Services (1995) studied this site and found the four adit discharges (on private land) to exceed chronic aquatic life criteria for copper/lead, copper, copper/nickel/zinc, and iron/lead. Acute aquatic life criteria for copper in the second discharge, and copper/zinc in the third discharge. The discharges varied in flow from 5 gpm to 15 gpm. Pioneer found Basin Creek water to have exceedences (chronic and acute) in copper. Copper in the sample MBMG took farther downstream did not exceed any limits.

Table 18. Daisy mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	pH
BDAS10L downstream																		S*

Exceedence codes:

S - Secondary MCL

* - Either the laboratory or field pH did not exceed secondary MCL standard.

Note: The analytical results are listed in appendix IV.

2.10.3.4 Vegetation

Vegetation on GNF-administered land does not appear to be impacted by the site. As previously stated, the majority of the mine workings and mills were on patented land. The GNF-administered land was unaffected.

2.10.3.5 Summary of Environmental Conditions

While patented claims in the area were visibly affected by the mining in this area, the GNF-administered land was not affected. By the time the flow in Basin Creek reaches GNF-administered land, it had either been diluted to within acceptable limits, or at the time of this study, the flow in Basin Creek had not been influenced by the mining activity upstream

2.10.4 Structures

All structures associated with this site are on private property and were not evaluated or inventoried. Cabins at Cowles Camp were still in fair condition and one was in good condition.

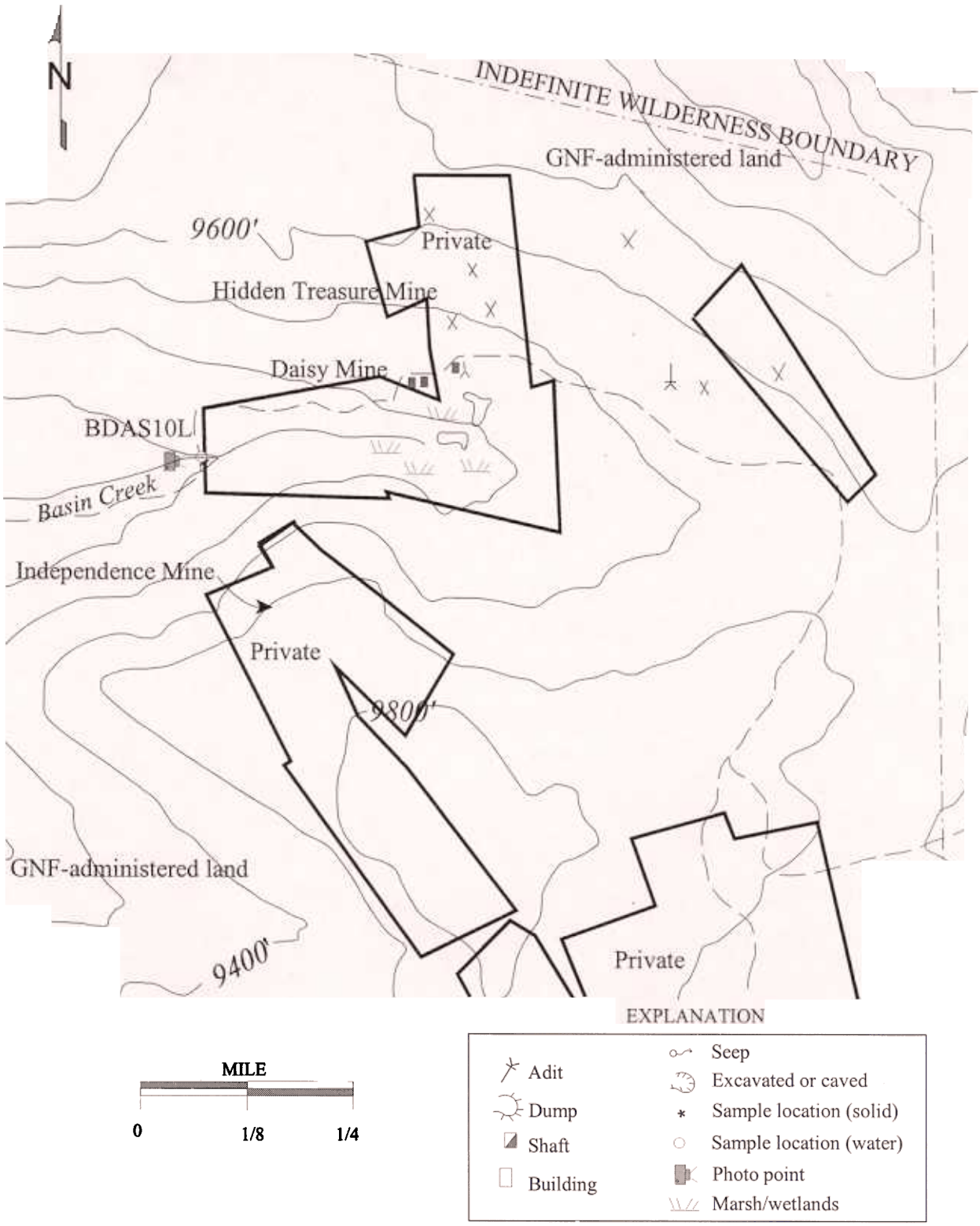


Figure 16. The Daisy and Hidden Treasure mines are on patented claims but their influence was tested downstream on Basin Creek on GNF-administered land on 09/29/99.

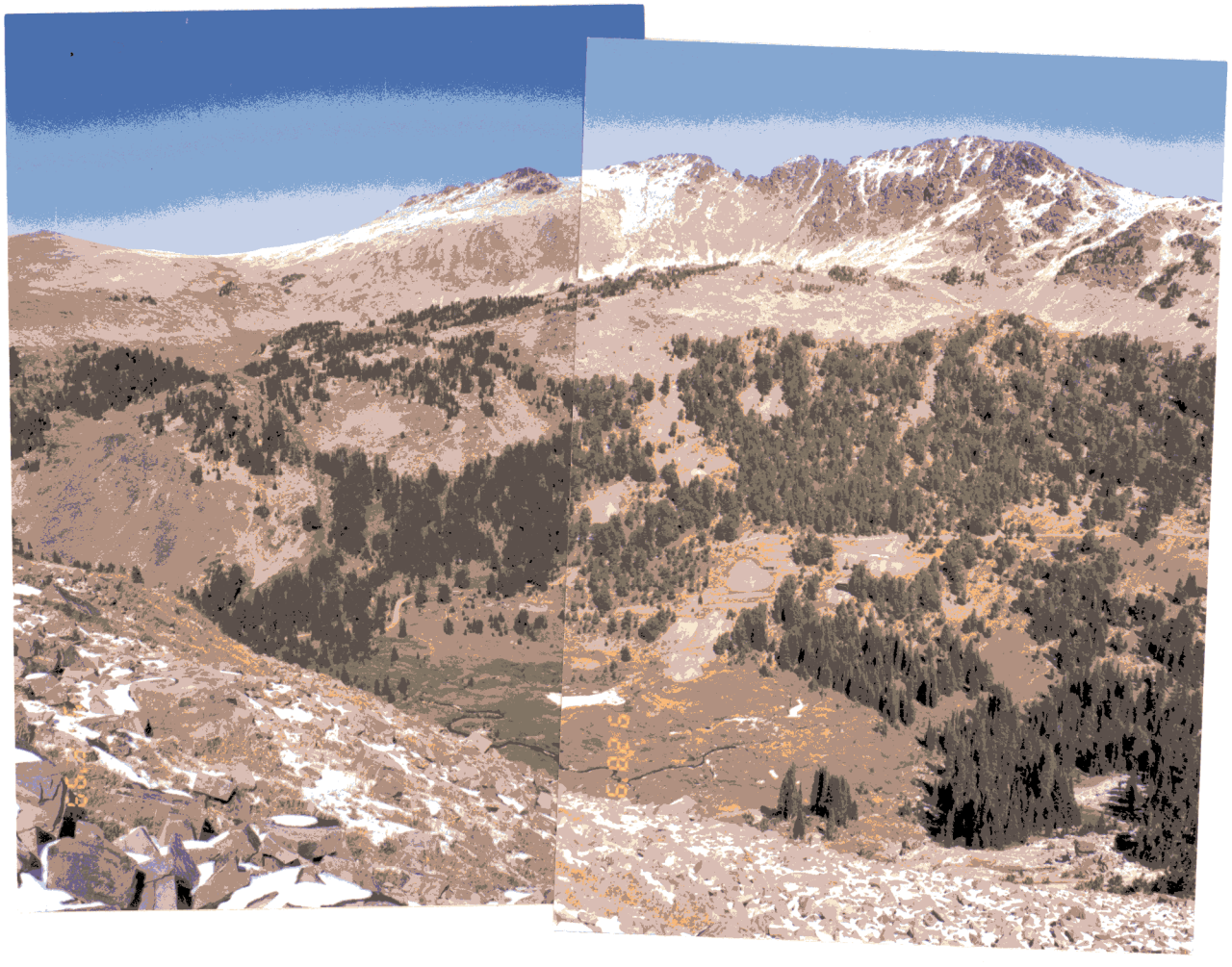


Figure 16a. An overview of the Daisy and Hidden Treasure mines and mills in the Independence mining district as viewed from the ridge to the south. Tailings are deposited in the grassy area in the center of the photo.

2.10.5 Safety

The patented claims in the area appear to have most, if not all, of the safety concerns in the area. Some of the property boundaries were uncertain, but the private land had all the structures and open mine workings.

2.11 Surprise Mine and Gold Hill Mill

2.11.1 Site Location and Access

Both these sites are located on the Sliderock Mountain 7.5-min. quadrangle. The mines are among several that are spaced along the Placer Gulch drainage, and are located in ACBC, sec. 6, T3S, R15E at 5,320 ft elevation (figure 13). A mill is on the upper end of the Placer Gulch near where the drainage splits in DBDD sec. 1, T3S, R14E.

Access is by hiking in from Grouse Ridge just past Iron Mountain. A small parking spot is immediately before a gate blocking the road. It is a little over a mile to the Gold Hill mill and approximately 2 miles to the adit near the Surprise mine. A jeep road leads up from Deer Creek, but access this way was not attempted; it was thought to cross private land.

2.11.2 Site History - Geologic Features

Little information was located on the Gold Hill Mill and Surprise Mine. Johnson and others (1993) found no production records for the mill and had no information on the Surprise adit. Pete Northcutt, a mining engineer who had claims in the area, reported that this mill was a mercury amalgamation facility.

The mineralization in the area is found in Paleozoic and Mesozoic sedimentary rocks and volcaniclastic sediments. Johnson and others (1993) categorized the area as similar to a porphyry copper system with other mines located in the skarn associated with the Iron Mountain Stock.

Ore minerals are pyrite and minor chalcopyrite. The Gold Hill mine, upstream from the mill, is in a strongly altered quartz latite.

2.11.3 Environmental Condition

Total length of the adit near the Surprise mine was estimated at less than 100 ft. The waste dump had minor sulfides and the water discharging from the adit never reached the active Placer Gulch drainage.

The mill had a small amount of sulfide-rich tailings and these, while not in direct contact with the creek, were being eroded towards the creek.

2.11.3.1 Site Features - Sample Locations

Water-quality samples were collected from upstream of the mill (PGHS20H) and downstream (PGHS10H) of the mill (which serves as the upstream sample for the Surprise mine) on GNF-administered land. The flow rates at these locations were 1 and 75 gpm, respectively. Upstream, Placer Gulch pH was 7.85 and specific conductance was 374 Fmhos/cm. Downstream, Placer Gulch pH was 7.46 and specific conductance was 386 Fmhos/cm. A site was sampled downstream of the adit discharge (PSUS20H) and this sample's pH was 7.93 and the specific conductance was 389; the flow was estimated to be 300 gpm. The adit discharged only 1 gpm; the pH of sample PSUS10H was 6.2 (although the lab pH was 7.72) and the specific conductance was 489 Fmhos. Samples were collected on July 20, 1999. Site features and sample locations are shown in figures 17 and 18; photographs are shown in figures 18a and 18b.

2.11.3.2 Soil

One soil sample was collected of the eroding tailings and soil on the downhill side of the tailings pile towards the creek. The sample was a composite along 8 feet in 1-ft increments. The material was brightly orange stained and was silt-sized particles.

Table 19. Soil sampling results at the Gold Hill mill (mg/kg).

Sample Location	As	Cd	Cu	Pb	Zn
Soils (PGHD10H)	350[1,2]	<2.5	44.1[1]	146[1]	127[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 3).
(2) Exceeds phytotoxic levels (table 3).

2.11.3.3 Water

None of the water-quality samples had exceedences in metals concentrations. The adit discharge did not meet the minimum pH of 6.5; it measured 6.2. The laboratory pH measurement was 7.72, however.

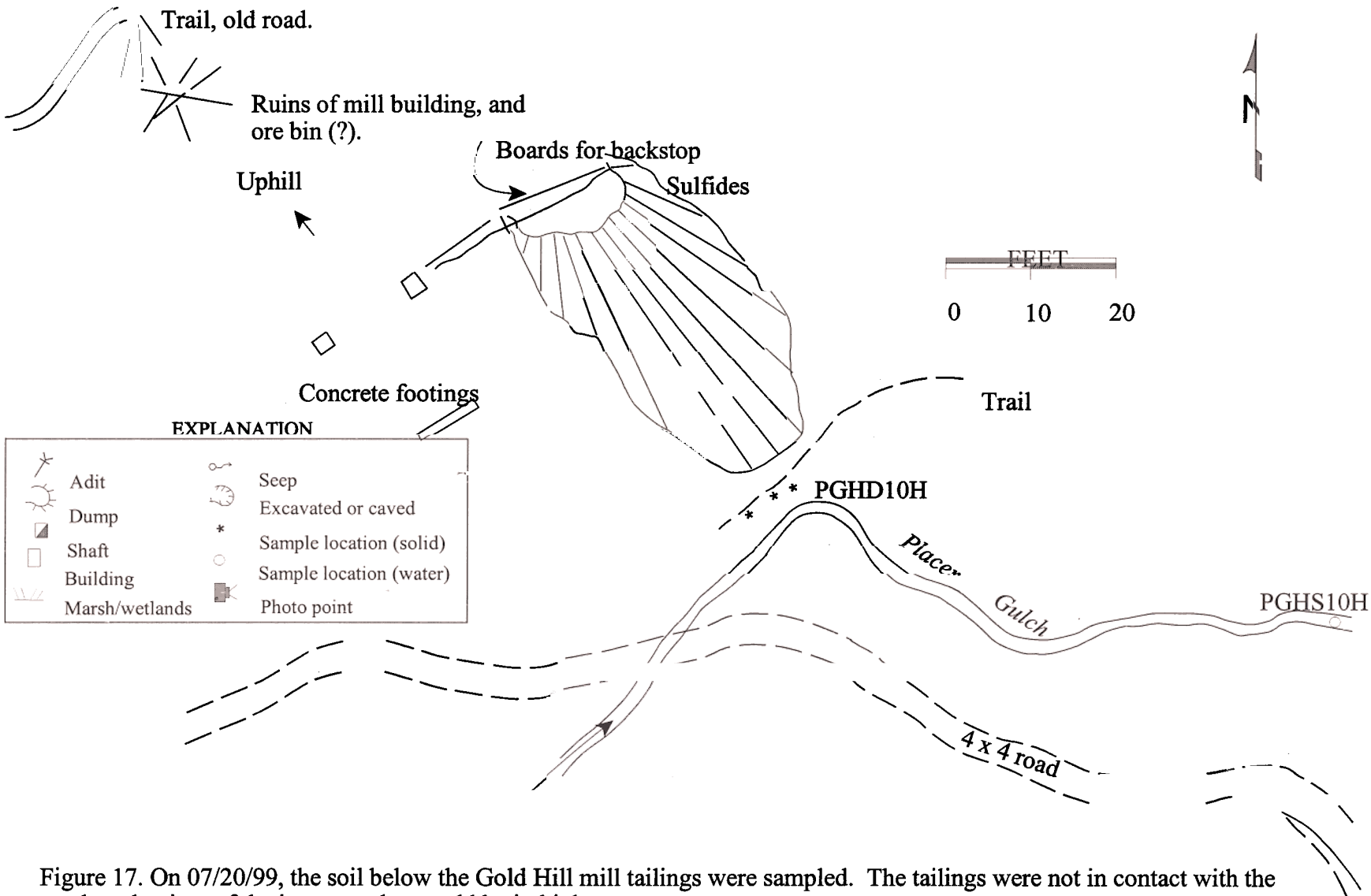


Figure 17. On 07/20/99, the soil below the Gold Hill mill tailings were sampled. The tailings were not in contact with the creek at the time of the inventory but could be in high water.

Figure 17a.The Gold Hill Mill was obscured by brush and trees. It had a small tailings pile that eroded toward Placer Gulch.

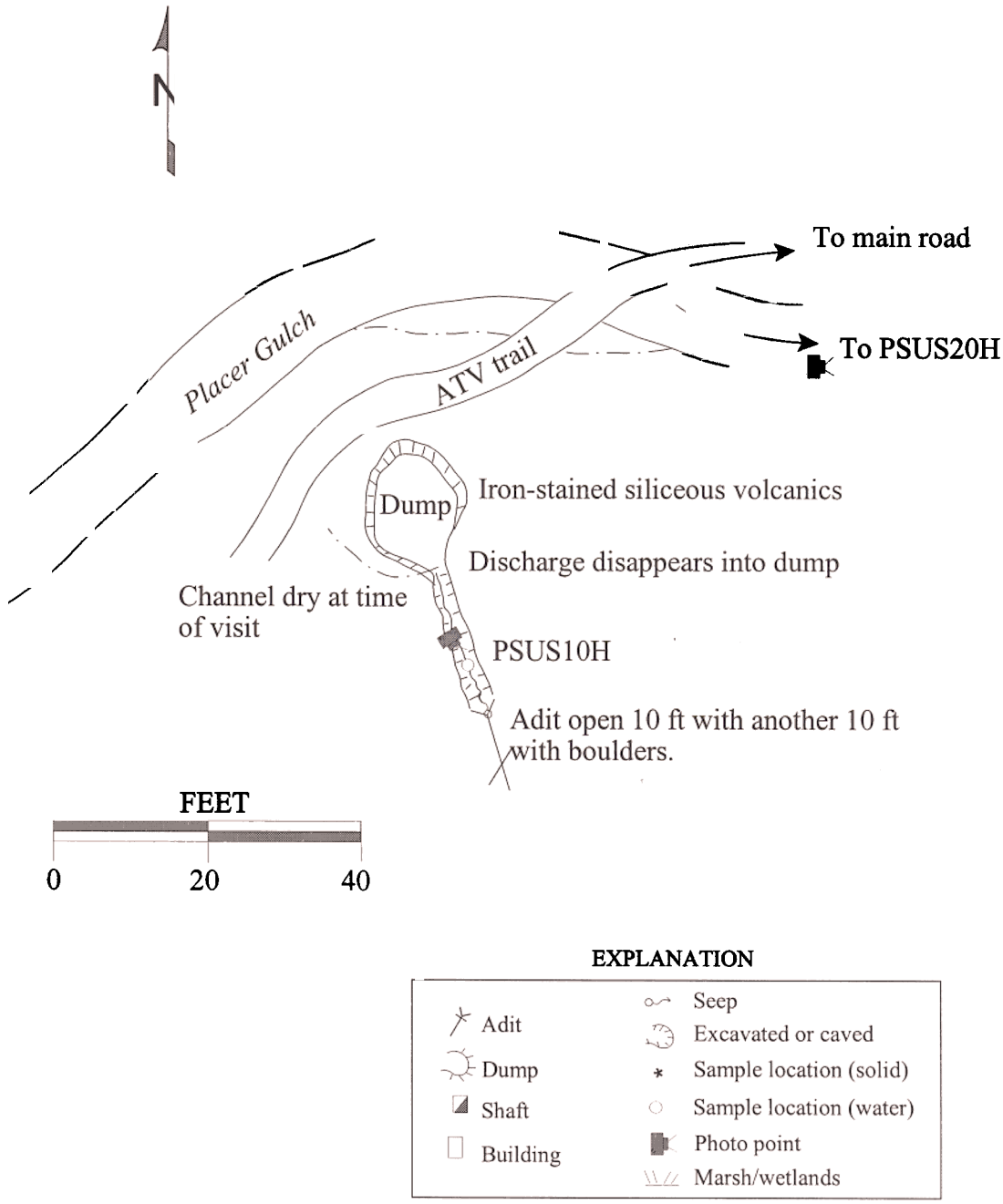


Figure 18. The adit discharge at the Surprise mine infiltrated into the waste rock dump before it ever reached the active drainage of Placer Gulch, as mapped 07/20/99.

Figure 18a. The adit discharged one gpm at the Surprise and was sampled at site PSUS10H.

Figure 18b. Placer Gulch was sampled downstream from the Surprise adit on 07/20/99. It was not visibly affected by the upstream mining activity.

Table 20. Gold Hill mill and Surprise mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	pH
PGHS20H - upstream of all mining																		
PGHS10H - downstream of mill; upstream of mine																		
PSUS10H - adit discharge																		S*
PSUS20H - downstream of mill and mine																		

Exceedence codes:
S - Secondary MCL
(*) Laboratory pH did not exceed the secondary MCL standard
Note: The analytical results are listed in appendix IV.

2.11.3.4 Vegetation

Vegetation on GNF-administered land does not appear to be greatly impacted by the mining activity. Trees, shrubs, and grasses grew up to the edge of the discharge at the mine and to the edge of the tailings at the mill. The tailings themselves were devoid of vegetation. Arsenic in the soil was three and a half times the phytotoxic concentration limit which may account for this lack of vegetation.

2.11.3.5 Summary of Environmental Conditions

Although these two sites are small in scale, the presence of arsenic at the mill site is of concern. The pH of the adit discharge was not duplicated in the laboratory's reading. Generally, the field pH is the more reliable. The amount of water in the discharge is very small and never reached the active drainage at the surface.

2.11.4 Structures

The mill has been reduced to scattered piles of sawn lumber. Reinforced concrete footings remain as evidence of the mill. No other structures were found at the site.

2.11.5 Safety

The site did not have any obvious safety concerns. Access was restricted by the road closure to only hikers, hunters, and to 4-wheel ATV users. The site was off the main trail.

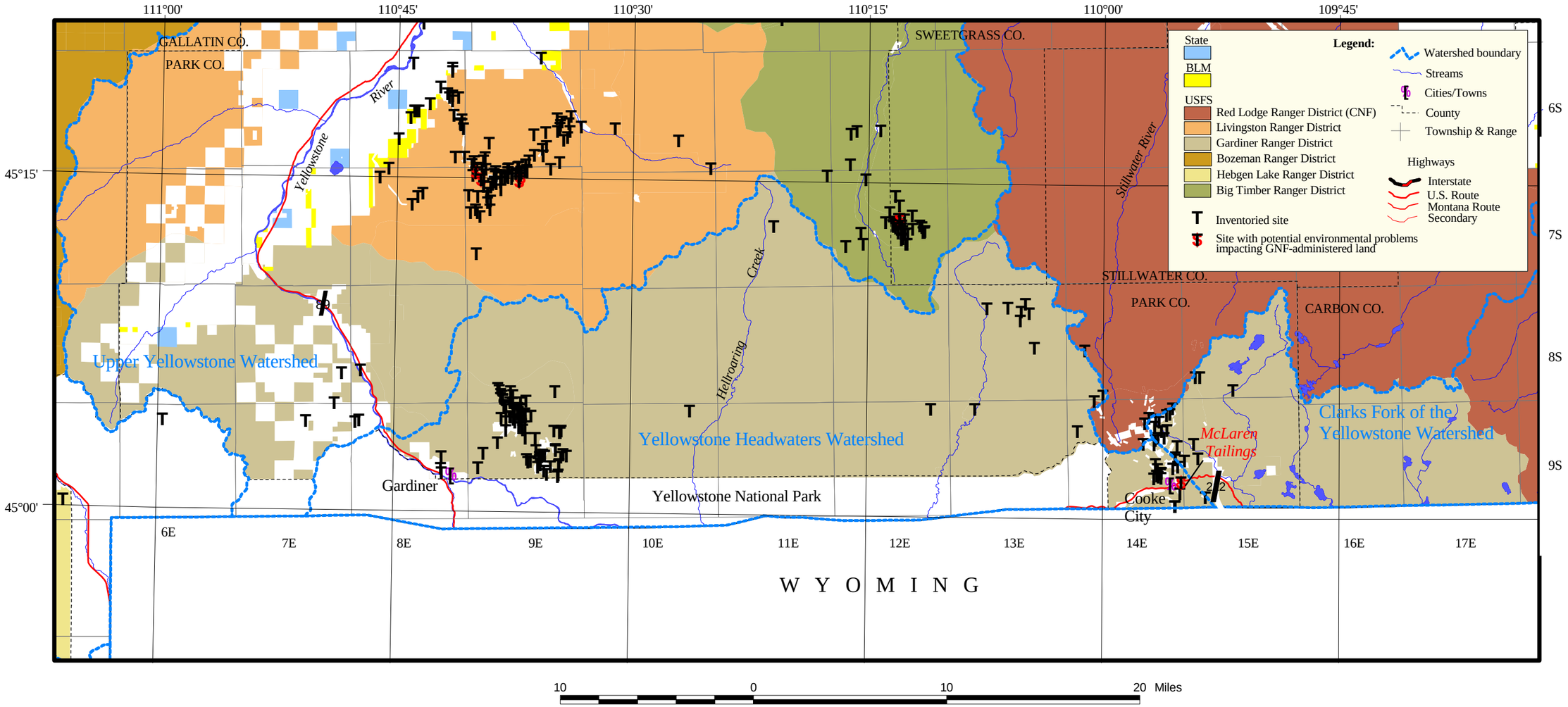


Figure 19. The Gardiner Ranger District of the Gallatin National Forest had only one site (the McLaren tailings) that was sampled. The site was in the Yellowstone Headwaters watershed.

Table 21. Mines of the Yellowstone Headwaters drainage.

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Adit West of 7562' Elev Hill PK009086	NF	Y	Y	Ash Mountain	9S	9E	4	ADCB	One short adit, open only ~8 feet.
Alice E PK002232	PRV	N	N	Cooke City	9S	14E	24		Screened out: private, also part of the New World Reponse and Restoration Project, mill noted in literature.
Apex Ole Claim PK006734	NF	Y	N	Ash Mountain	8S	9E	35		Visited general area, trench as described in Wedow and others not found.
Bald Mountain Adits PK009007	NF	Y	N	Ash Mountain	9S	9E	9	DDDB	Prospects and caved adits.
Bar D PK006574	MIX	N	N	Haystack Peak	8S	13E	8		Screened out: no references, inaccurate location, reported gold occurrence.
Bear Creek Placer PK002310	MIX	Y	N	Gardiner	9S	9E	17		Screened out: placer, visited general area, no effects.
Bear Creek Springs PK006781	NF	Y	N	Gardiner	9S	9E	19		Visited area for Yellowstone Study, no development noted, general location in Waring (1965).
Bears Den Lode Claim PK002208	NF	N	N	Roundhead Butte	9S	12E	1		Screened out: three sloughed prospect pits (Wedow and others, 1975).
Big Blue Mine PK001986	PRV	N	N	Cooke City	9S	14E	26		Screened out: private, also part of the New World Response and Reclamation Project.
Black Warrior PK002064	PRV	N	Y	Cooke City	9S	14E	15		Screened out:part of the New World Mining District Response and Restoration Project; two adit discharges.
Blacksmith Shop Tunnel PK009064	PRV	N	N	Ash Mountain	9S	9E	23	CCBB	Screened out: private, described in Seager, 1944.
Bowers and Jones Mines PK006418	MIX	N	N	Electric Peak	9S	8E	8		Screened out: coal mine.
Carlton PK002466	MIX	N	N	Cooke City	9S	14E	24		Screened out: part of the New World Response and Restoration Project.
Conrad Group (Guest Tunnel-Etc) PK002160	MIX	Y	Y	Ash Mountain	9S	9E	22	DABD	Most workings on private ownership, no hazards on GNF-administered land.
Crevasse Crk / Crevice Creek PK002292	NF	Y	N	Ash Mountain	9S	9E	23	DCBD	Placer, visited general area, no effects
Crevice Mountain Mine PK002088	MIX	N	N	Ash Mountain	9S	9E	15		Screened out: inaccurate location and description.

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Crown Butte & Melissa Mine PK002274	MIX	N	N	Cooke City	9S	14E	10		Screened out: part of the New World Response and Restoration Project.
Discovery #4 (Jar 10) PK009082	MIX	Y	Y	Ash Mountain	9S	9E	4	ACDB	Open adit within view of, and east of, the Bear Creek Road (FS 493).
Discovery (Lower Pine Creek) PK009081	MIX	Y	Y	Ash Mountain	9S	9E	4	DBBD	On bend on Bear Creek Road, two partially open adits.
Discovery Patented Claim PK009087	PRV	Y	Y	Ash Mountain	9S	9E	4	ACDA	One open adit, portal is 6' high X 5' wide, small adit to the south is included.
Dryden PK002148	NF	Y	N	Ash Mountain	9S	9E	23	DCDB	Two caved adits just north of the YNP boundary.
Duke Claim / Street PK002040	MIX	N	N	Cooke City	9S	14E	26		Screened out: part of New World Response and Restoration Project, all workings caved.
Early Day PK001998	MIX	N	N	Cooke City	9S	14E	26		Screened out: part of the New World Response and Reclamation Project.
East of Horseshoe Shafts (2) PK009096	NF	Y	N	Gardiner	8S	9E	4	BABD	Only a 1' X 1' hole. No discharge.
East Side of Horseshoe Ridge PK009095	NF	Y	N	Gardiner	8S	9E	33	CACD	Three adits on the east side of a ridge to the west of Bear Creek, all caved.
Elk Tunnel PK009105	PRV	N	N	Ash Mountain	9S	9E	9	ACCA	Screened out: private, active.
Empire Hill -Misc. Mines PK002190	MIX	Y	N	Ash Mountain	9S	9E	11	DABC	All workings dry and caved, see Wedow and others (1975) for description.
Empire State / Vanity Fair PK006586	MIX	Y	N	Ash Mountain	9S	9E	11	DABB	Visited 08/10/00; all workings caved and dry.
Fire Clay Claim PK006590	MIX	N	N	Cooke City	9S	14E	22		Inaccurate location; also is a clay prospect.
First Chance (Lewis-McBride) PK002142	PRV	N	N	Ash Mountain	9S	9E	22	ACDA	Private, patented claims
Former Arsenic Mill PK009107	PRV	N	N	Gardiner	9S	9E	9	BABB	Screened out: reclaimed, private land.
Frank Group / Spotted Horse Claim PK006594	NF	Y	N	Ash Mountain	9S	9E	14		Visited general area, inaccurate location, unable to locate with certainty (mill sSite, Seager, 1944).

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Gardiner Travertine Quarry PK002802	MIX	Y	N	Gardiner	9S	8E	14		Visited general area, no environmental effects, still active.
Gardiner Travertine Saw PK006750	MIX	N	N	Gardiner	9S	8E	23		Screened out: location inaccurate and dimension stone saw, no effects.
Gold Dollar PK002214	PRV	N	N	Pinnacle Mountain	8S	13E	10		Screened out: private, patented claim.
Graham PK009103	PRV	N	N	Ash Mountain	9S	9E	9	ABDA	Screened out: private, active at the time of this inventory.
Great Republic Smelter PK008466	MIX	Y	N	Cooke City	9S	14E	25	CBDD	Woody Creek flows by the site. Part of the New World Response and Restoration Project.
Hanlon Hill - East Side PK009101	NF	Y	N	Gardiner	9S	9E	8	AAAD	One caved adit, one open cut in outcrop.
Hanlon Hill Workings PK009016	NF	Y	N	Gardiner	9S	9E	5	DCDA	Prospects, adits and shafts; all dry.
Hazel PK006762	NF	Y	Y	Gardiner	8S	9E	32	DDC	One partially caved adit, but still accessible.
Horseshoe PK008635	NF	Y	Y	Gardiner	8S	9E	33	CBAA	Minor workings, 2 8-ft shafts and pits (Stotelmeyer and others, 1983). One near vertical shaft-8 ft.
Horseshoe Mountain Area PK008627	NF	N	N	Pinnacle Mountain	8S	13E	10		Screened out: general area consisting of at least 56 pits, and other caved workings (Wedow & others, 1975)
Irma-Republic PK002010	MIX	Y	Y	Cooke City	9S	14E	36		Visited area, open adits on private land, no discharges.
Iron Duke PK009102	PRV	N	N	Ash Mountain	9S	9E	9	ABAB	Screened out: private, also active area at the time of inventory.
Iron King PK006566	NF	Y	Y	Gardiner	9S	9E	4	BDDC	One open adit on west side of Bear Creek; also one partially caved adit & shaft.
Jar 1 Claim PK009084	NF	Y	N	Ash Mountain	9S	9E	4	ABAD	One trench.
Jar 22-unnamed Adit PK009089	NF	Y	Y	Ash Mountain	9S	9E	4	DDAB	Three adits, two partially open.
Jar 245 and 109 Adits PK009108	NF	N	N	Ash Mountain	9S	9E	10	CDDD	Shown on TVX map.
Jar 9 Claim PK009083	NF	Y	Y	Ash Mountain	9S	9E	4	ACBD	Two partially caved adits west of FS Road 493, one caved adit.
Jn17 Unpatented Claim PK009085	NF	Y	Y	Ash Mountain	8S	9E	33	DDDD	One partially open adit, 3' x 4' opening, short adit.

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Jumbo Placer PK006722	MIX	Y	N	Gardiner	9S	9E	8		Screened out: placer, visited general area.
Kathy B or Emma PK009100	MIX	Y	N	Ash Mountain	9S	9E	15	DCDB	Caved shafts and prospects. Dry.
Kennebec Claim PK006610	PRV	N	N	Ash Mountain	9S	9E	15		Screened out: private, patented claim.
Kreiger Ditch Adit PK002100	NF	Y	Y	Ash Mountain	9S	9E	13	CCBC	One 40 ft adit only, dry, remote location.
Last Chance Patented Claim PK009088	PRV	Y	Y	Ash Mountain	9S	9E	4	ACDD	Adits caved, but two still have small crawl-spaces.
Long Tom Placer PK002220	NF	N	N	Cutoff Mountain	8S	14E	32		Screened out: placer, small occurrence.
Longstreet PK002454	PRV	N	N	Cooke City	9S	14E	24		Screened out: private, part of the New World Mining District Response & Restoration Project.
Lower Bald Mountain Adits PK009014	NF	Y	Y	Ash Mountain	9S	9E	9	DABA	One adit, open at least 20 ft, with 3 ft by 3 ft opening at portal, dry.
Lower Pine Creek PK002184	MIX	Y	Y	Ash Mountain	9S	9E	4	DADA	All workings dry, three open adits.
McCauley (& George Washigton Fract) PK002136	PRV	N	N	Ash Mountain	9S	9E	22	ACAB	Two patented mining claims; the Mccauley & the Geo. Washington Fraction, scheelite
Mclaren Tailings PK008467	**MIX**	**Y**	**N**	**Cooke City**	**9S**	**14E**	**25**	**ADCA**	**Part of New World Mining District Response and Restoration Project**
Medona PK002154	PRV	N	N	Ash Mountain	9S	9E	15	DDBA	Screened out: private, patented claims. Mill site noted in Seager, 1944, plate 10.
Mineral Hill / Jardine / TVX PK002736	MIX	N	Y	Gardiner	9S	9E	9	BAAC	Active mine at the time of this inventory.
Mohawk Warrior / Mohawk PK002400	MIX	N	N	Cooke City	9S	14E	25	D	Screened out: part of the New World Response and Restoration Project.
Moonlight PK006793	MIX	N	N	Gardiner	9S	8E	23		Screened out: inaccurate location, CRIB is only reference.
Morning Star PK002034	PRV	N	N	Cooke City	9S	14E	23		Screened out: private, part of the New World Response and Restoration Project.

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Mountain Chief PK009106	PRV	N	N	Ash Mountain	9S	9E	9	ADBC	Screened out: private, active at the time of this inventory.
Nebraska No. 1 and 2 Placers PK006796	MIX	N	N	Ash Mountain	9S	9E	15	CCCC	Screened out: placer, inaccurate location.
New World PK002028	PRV	N	N	Cooke City	9S	14E	23		Screened out: private, part of the New World Mining District Response and Restoration Project.
New World Project PK006386	MIX	N	N	Cooke City	9S	14E	2		Screened out: part of the New World Mining District Response and Restoration Project.
North Bank of Pine Creek Adit PK009091	NF	Y	N	Ash Mountain	9S	9E	4	DADA	Two short adits on the north bank of Pine Creek, caved.
North End Mt. Abundance PK002070	NF	N	N	Cutoff Mountain	9S	14E	5		Screened out: Wedow and others (1975) state one caved 25-50 ft adit or prospect.
Oregon Mountain Area PK008641	NF	Y	N	Ash Mountain	9S	9E	14	DDCB	Visited general location, August 2000, dry, workings shallow or caved.
Oro Cache / Ore Cache /Cache of Ore PK006390	PRV	N	N	Cooke City	9S	15E	32	B	Screened out: two patented claims.
Palmer Mountain Crevice Mtn Saddle PK002178	MIX	Y	N	Ash Mountain	9S	9E	14	ACCC	Prospects and short caved adits only (Wedow and others, 1975). Visited 08/10/00.
Pig's Eye Placer PK001992	NF	N	N	Cutoff Mountain	9S	14E	7		Screened out: placer, inaccurate location, small occurrence.
Pine Creek Placer PK009092	NF	Y	N	Ash Mountain	9S	9E	4	DBCD	Possible placer operation?
Pop Incline PK002340	MIX	Y	N	Ash Mountain	9S	9E	23	ACAB	Visited 08/11/00, dry, all workings caved.
Pratt PK006710	PRV	N	N	Ash Mountain	9S	9E	23		Screened out: private, patented claim. Open cuts, shallow shafts, short adits (Seager, 1944).
Republic Mill PK009017	NF	Y	N	Cooke City	9S	14E	36	CDDD	Tailings pond contained, part of the New World Response and Restoration Project.
Rock Creek Placer PK002046	NF	N	N	Cutoff Mountain	8S	13E	23		Screened out: Placer, small occurrence, inaccurate location.

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Shoo Fly PK002250	MIX	N	N	Cooke City	9S	14E	23		Screened out: part of the New World Response and Restoration Project.
Sin Nombre / Sinombre /Sin Hombre PK002280	MIX	N	N	Ash Mountain	9S	9E	22	ABCD	Screened out: active claims in 2000, TVX geologic map shows no workings.
Slough Creek Placer PK002172	MIX	N	N	Roundhead Butte	9S	13E	5		Screened out: placer, no workings, near Frenchy's Meadow.
Snowshoe Mill PK009063	MIX	Y	N	Ash Mountain	9S	9E	22	ABDB	Took two samples of dry tailings; PSNT10L and PSNT20L.
Snowshoe Mine (Hulse Group) PK002082	PRV	N	N	Ash Mountain	9S	9E	15	DCDD	Private, patented claims; see separate entry for mill site.
Southside Oregon Mountain PK009098	NF	Y	N	Ash Mountain	9S	9E	23	ACAB	One shaft, caved, dry.
Southside Oregon Mountain-prospect PK009099	NF	Y	Y	Ash Mountain	9S	9E	23	ACAC	One trench or open cut, 12' highwall.
Southwest Corner Discovery Claim PK009090	PRV	Y	N	Ash Mountain	9S	9E	4	DBCA	One caved adit, west of FS Road 493 (Bear Creek).
Standard Group PK008634	NF	Y	N	Gardiner	9S	9E	4		Visited, all workings dry.
Stump Mine PK002052	PRV	N	N	Cooke City	9S	14E	26		Screened out: private, part of the new world response and restoration program.
Tiny Jack PK002094	NF	Y	N	Ash Mountain	9S	9E	14	DDAB	Gold/tungsten prospect, visited 08/10/00, dry. Cabin, rocker and trenches present.
Tip Top PK009104	PRV	N	N	Ash Mountain	9S	9E	9	AACC	Screened out: private, active area.
Tower Grove (And Pratt) PK006706	PRV	N	N	Ash Mountain	9S	9E	23	BCDA	Screened out: private, patented claim. One adit. 725 ft of workings.
Unnamed Mineral Hill Adit PK009015	NF	Y	N	Ash Mountain	9S	9E	9	ADAA	One collapsed adit trends S30EE under road.
Unnamed N Fk Bear Cr Adit PK009070	NF	Y	Y	Gardiner	8S	9E	32	DBAD	One open adit, can be seen from N. Fork Bear Creek.
Unnamed N Fk Bear Cr Adit PK009073	NF	Y	N	Gardiner	8S	9E	32	DCAD	Caved adit, azimuth 300E. No discharge.

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Unnamed N Fk Bear Cr Adit PK009079	NF	Y	N	Gardiner	9S	9E	4	CCAB	Caved adit, azimuth 345E. No discharge.
Unnamed N Fk Bear Cr Adit PK009074	NF	Y	N	Gardiner	9S	9E	5	AACD	Caved adit, azimuth 265E. No discharge.
Unnamed N Fk Bear Cr Adit PK009069	NF	Y	N	Gardiner	8S	9E	32	DACC	Caved adit, no discharge.
Unnamed N Fk Bear Cr Adit PK009075	NF	Y	N	Gardiner	9S	9E	5	ADBA	One caved adit, azimuth 245 degrees.
Unnamed N Fk Bear Cr Adit PK009077	NF	Y	N	Gardiner	9S	9E	4	CCAB	Caved adit, azimuth 20E. No discharge.
Unnamed N Fk Bear Cr Adit PK009076	NF	Y	N	Gardiner	9S	9E	5	ADBA	Caved adit, azimuth 240E. No discharge.
Unnamed N Fk Bear Cr Adits PK009071	NF	Y	N	Gardiner	8S	9E	32	ACBB	Two caved adits, mining scrap remains.
Unnamed N Fk Bear Cr Adits PK009068	NF	N	Y	Gardiner	8S	9E	32	DDC	Two caved adits, lower adit partly open, no discharge.
Unnamed N Fk Bear Cr Adits PK009067	NF	Y	N	Gardiner	9S	9E	5	ADDD	Two caved adits, heavily overgrown. No discharge.
Unnamed N Fk Bear Cr Pit PK009078	NF	Y	N	Gardiner	9S	9E	4	CCAB	Prospect pit, no discharge.
Unnamed N Fk Bear Cr Prospect Pit PK009072	NF	Y	N	Gardiner	8S	9E	32	ACDC	Prospect pit about 4' x 4' x 3' deep. No discharge.
Unnamed Prospect PK006738	NF	N	N	Pinnacle Mountain	8S	13E	10		Screened out: all caved, description in Wedow and others (1975).
Unnamed Prospect Pit	MIX	N	N	Ash Mountain	9S	9E	3	C	Screened out: inaccurate location, may be same as lower Pine Creek area.
Unnamed- Wedow's 14-16 PK008626	NF	N	Y	Pinnacle Mountain	8S	13E	11		Screened out: Wedow and others, 1975 says there is an open shaft, depth unknown.
Unnamed Prospects PK006726	MIX	N	N	Ash Mountain	9S	9E	4		Screened out: inaccurate location, no references, may be same as lower Pine Creek area.
Unnamed -Wedow's 1-8 PK006702	NF	N	N	Pinnacle Mountain	8S	13E	10		Screened out: caved adits (Wedow and others, 1975).

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Unnamed sec 18 9S 9E PK009080	NF	Y	N	Gardiner	9S	9E	18	DACC	One caved adit west of the Gardiner-Jardine road.
Upper Hellroaring - Regina/Red Chief PK002196	NF	N	N	Iron Mountain	7S	11E	16	D	Screened out: general area, Wedow and others describe two prospects only.
Upper Pine Creek Area PK008640	MIX	Y	Y	Ash Mountain	9S	9E	11	DBBB	One open adit near switchback in the Palmer Creek trail.
Vindicator PK002346	NF	N	N	Ash Mountain	9S	9E	22	BBCA	Screened out: active permit.
Watson Group - Crosscut & Rio Grande PK002166	NF	N	N	Ash Mountain	9S	9E	22	ABBA	Screened out: part of active permit area.
West of Bear Creek PK009097	NF	Y	Y	Gardiner	9S	9E	4	BCCD	Small, 4' x 1' opening, one adit.
Whitewood Girl PK002202	NF	N	N	Specimen Creek	9S	10E	1		Screened out: prospects only, unlikely to impact Forest.

Table 22. Mines within the Clarks Fork of the Yellowstone drainage. Sampled sites are in bold.

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Adit Claim / Gold Dust PK006570	NF	Y	Y	Cooke City	9S	14E	11	DDBA	Part of the New World Mining District Response and Restoration Project.
Bog Copper PK009005	MIX	N	N	Cooke City	9S	14E	11		Part of the New World Mining District Response and Restoration Project; surficial deposit.
Bull Elk Lode PK006674	MIX	N	N	Cooke City	9S	14E	14		Screened out: part of the New World Response and Restoration Project. No data.
Chipmunk claim PK002472	PRV	N	N	Cooke City	9S	14E	1		Screened out: private, part of the New World Response and Restoration Project.
Commonwealth PK002364	MIX	N	N	Cooke City	9S	14E	1		Part of the New World Mining District Response and Restoration Project; west slope of Sheep Mountain.
Daisy/Little Daisy PK006394	PRV	Y	N	Cooke City	9S	14E	14	ABC	Screened out: part of the New World Mining District Response and Restoration Project.
DMH Group PK002382	MIX	N	N	Cooke City	9S	14E	12		Screened out: part of the New World Response and Restoration Project.
Fisher Creek No. 1 PK008469	NF	N	Y	Cooke City	9S	15E	18	CB	Part of New World Mining District Response and Restoration Project, sampled by DSL-AMRB.
Glengarry / Lizzie patented claim PK002850	MIX	Y	Y	Cooke City	9S	14E	11	ABBC	Screened out: part of the New World Mining District Response and Restoration Project.
Green Lake Prospect PK008660	NF	N	N	Cooke City	8S	15E	30	DDCD	Visited general area, unable to locate.
Henderson Group PK006382	MIX	N	N	Cooke City	9S	14E	13		Screened out: part of the New World Response and Restoration Project.
Homestake (Parkmont /Excello) PK002448	MIX	N	N	Cooke City	9S	14E	14		Screened out: part of New World Mining District Response and Restoration Project.
Lazy Beetle PK002244	NF	Y	Y	Cooke City	8S	15E	31	ABBA	One open, 20 ft adit, one 10 ft deep shaft with gentle sides.
Lost Chance PK002004	MIX	N	N	Cooke City	9S	14E	24		Screened out: part of New World Response and Restoration Project.
New Year's Gift/ McLaren PK006799	PRV	N	N	Cooke City	9S	14E	11		See McLaren Mine; private. Part of the New World Mining District Response and Reclamation Project.
Rommel Tailings PK008647	NF	N	N	Cooke City	9S	15E	19	A	Screened out: part of New World Mining District Response and Restoration Project.

Mine name MBMG ID	Owner	Visit	Hazard	24K topo	T	R	Sec	Tract	Comments
Seattle / Chicago mill site PK008649	MIX	N	N	Cooke City	9S	15E	18		Part of the New World Mining District Response and Restoration Project.
Sky Top Creek PK008691	NF	N	N	Fossil Lake	8S	15E	33		Screened out: Johnson and others, 1993; one caved adit and one trench.
Tredennick / Tredinnic PK002130	MIX	N	N	Cooke City	9S	14E	11		Part of the New World Mining District Response and Restoration Project.

2.12 McLaren Tailings

2.12.1 Site Location and Access

The McLaren tailings (figure 19) are considered to be a part of the New World mining district and plot on the Cooke City 7.5-min. quadrangle. Some Cooke City residences are within 1,000 ft of the site and most of the population of Cooke City lives within ¾-mi of the tailings. The site is easily accessible by vehicle and by hiking; it is within 500 ft south of Highway 212. The tailings are found on the Cooke City 7.5-min. quadrangle in ADCA sec. 25, T09S, R14E at an elevation of 7,640 to 7,680 ft. They are primarily on private land but extend onto GNF-administered land.

2.12.2 Site History - Geologic Features

GCM Services Inc. (Gray, 1998) conducted a historical study of the Republic Mill and the Cooke City area in general for the Montana Department of Environmental Quality in 1998. They summarized some of the history and origin of the McLaren tailings. The McLaren Gold Mines Company processed ore from the New Year's Gift Mine at the site east of Cooke City beginning in 1934. After a brief period of control from 1938 to 1940 by Newmont Mining Corporation, McLaren again produced metals from the McLaren properties until 1953. The last time the tailings dam failed was in 1950; it was reinforced in 1990 (Montana Standard, August 13, 2000).

Recorded production included 60,000 oz gold, 17,000 oz silver, and 4 million lb copper from the McLaren mine and mill. Production of the McLaren Gold Mines Company came between the years of 1940 and 1952, with the peak year being 1949 when it processed 39,139 tons of ore. One mill burned down October 28, 1942 (Parsons and others, 1962?). Another mill was closed and the equipment was liquidated in 1953.

The mill processed ore by flotation. Ore minerals (in order of their magnitude) included pyrite, chalcopyrite, covellite, bornite, and chalcocite. Chalcopyrite was of primary importance (Griswold, 1947) with non-ore minerals consisting of copper oxides, native copper, and iron oxides (including magnetite). Gangue materials included monzonite, siliceous limestone, and quartz.

2.12.3 Environmental Condition

Although the area has been partially reclaimed there are still concerns as to the stability of the impoundment.

2.12.3.1 Site Features - Sample Locations

One upstream water sample (SMTS10H) on GNF-administered land and one downstream (SMTS20H), taken within the floodplain, were collected at the site on 08/25/99. The first sample was taken upstream from any recognizable tailings and the downstream sample was taken approximately 50 ft upstream from the confluence of Miller Creek with Soda Butte Creek. More samples were not collected because of the private land position. Site features and sample locations are shown in figure 20; photographs are shown in figures 20a and 20b, and 21a and 21b.

2.12.3.2 Soil

No soil samples were taken because of the private land position. Pioneer Technical Services (1995) reported on the soil analyses at this site. They found that arsenic, copper, cadmium, and iron in the waste rock were at least three times background. Tailings had elevated levels of cadmium, iron, copper, and mercury. They estimated the volume of tailings at 370,000 cubic yards and waste at 8,000 cubic yards.

2.12.3.3 Water

The flow at the upstream site was approximately 1 cfs (448 gpm). The bed was slightly iron stained. The pH upstream of the tailings was 7.62 and the SC was 239 Fmhos. Downstream of the tailings, the pH was 7.67 and the SC was 312 Fmhos. The creek bed was bright orange, extremely iron stained at the downstream site. Most of the streambed up to the highwater mark was coated with iron oxides. The flow at the downstream site was 1.25 cfs or 561 gpm. The only exceedence was in manganese which exceeded the secondary MCL. Pioneer Technical Services (1995) noted an observed release of iron in Soda Butte Creek, but the downstream sample did not exceed any MCL's at that time.

Table 23. McLaren tailings water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	pH
SMTS10H-upstream																		
SMTS20H-downstream									S									

Exceedence codes:

S - Secondary MCL

Note: The analytical results are listed in appendix IV.

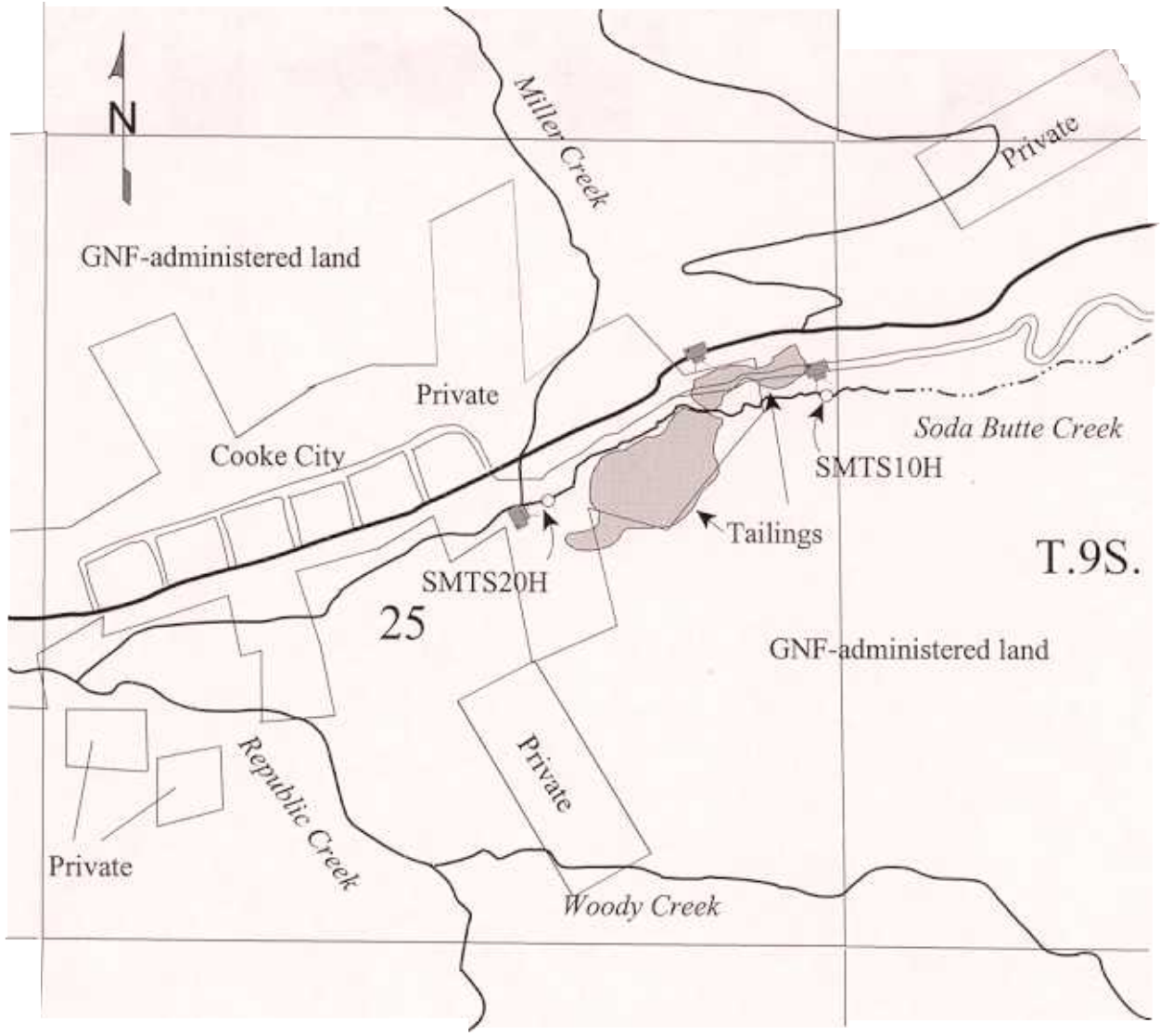


Figure 20. The McLaren tailings lie predominantly on private land but potentially influenced GNF-administered land. Schematic from the Cooke City 7.5-min. quadrangle.

Figure 20a. The upstream sample site (SMTS10H) was slightly iron stained but generally appeared healthy when sampled 08/25/99.

Figure 20b. In contrast, the downstream sample site (SMTS20H) had iron oxide coatings on the cobbles in the streambed.

Figure 21a.The runoff from the McLaren tailings eroded tailings and alluvium into Soda Butte Creek.

Figure 21b. The tailings on GNF-administered land had deep erosional channels being cut in them during recent years.

2.12.3.4 Vegetation

Sparse to moderate vegetation, mostly grasses, grew on the reclaimed tailings. The edges of some of the waste were eroding and, so, were not vegetated. The trees growing along the banks of Soda Butte Creek appeared healthy.

2.12.3.5 Summary of Environmental Conditions

The McLaren tailings have been, and continue to be, a visible source of concern considering their close proximity to Soda Butte Creek and Yellowstone National Park. They were stabilized and recontoured after the fires of 1988 (Metesh and others, 1999), some question exists of their long-term stability. They do not, however, appear to presently contribute a large amount of metals to Soda Butte Creek.

2.12.4 Structures

No structures remained at this site. The original mill has been destroyed.

2.12.5 Safety

The tailings on GNF-administered land showed evidence of being actively eroded. They had rills and deep gullies on the east side of the site. These could be hazardous to ATV's or other vehicles. Safety may be an issue because of the close proximity of these tailings to Cooke City. There was evidence of recreational use.

2.13 Summary of Mining Impacts on GNF-Administered Land.

The Gallatin River drainage administered by the Hebgen Lake and Bozeman Ranger Districts had no mines likely to impact water quality. The Johnson Canyon adits in the Gallatin drainage had only small discharges with local effects. The upper Yellowstone drainage (and the Emigrant and Mill Creek mining districts) administered by the Livingston Ranger District had three mine-related discharges, although the Galena Queen/Carmel area has natural iron-stained seeps and ferricrete deposits. The samples from this area proved to have the most exceedences. The Big Timber Ranger District has two sites that may affect GNF-administered land, although in a small way. The Gardiner Ranger District has the New World Mining District Response and Restoration Project to deal with and also the future abandonment of the TVX Gold Inc. Mineral Hill Mine to administer. These were not a part of this study and so limited the impacts considered in this inventory. They are, however, major players in the overall environmental condition of this area.

Table 24. Summary of water-quality exceedences in the Gallatin, Yellowstone Headwaters, and Upper Yellowstone River drainages.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	pH
Cooper upper adit discharge - JUNS40M																		
Cooper upper adit downstream JUNS20M																		
Cooper lower adit discharge - JUNS10M																		S*
Cooper downstream - JUNS30M																		
DUV - flowing well EWEG10M	SAC					AC	SA		S				AC					S
DUV - flowing well EWEG20H							S		S									
Allison Tunnel - adit discharge EATS10H	SAC			C		AC	SA		S				AC					S
Allison Tunnel - adit discharge EATS20H	SAC			C		AC	SA		S				AC					S
Galena Queen - seep AGQS10M																		S*
Galena Queen - adit discharge AGQS20M							SA		S									S*
Galena Queen - upstream AGQS30M																		
Galena Queen - upstream AGQS40M																		
Galena Queen - seep AGQS50M							SA		S				AC					S
Galena Queen - downstream AGQS60M																		
Carmel - seep ACAS10M							SA		S									S

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	pH
Kelly adit discharge - BKES10L																		S*
Kelly adit discharge - BKES20L																		S*
Daisy Mine - downstream BDAS10L																		S*
Gold Hill Mill - upstream PGHS20H																		
Gold Hill Mill - downstream PGHS10H																		
Surprise adit discharge - PSUS10H																		
Surprise downstream - PSUS20H																		S*
McLaren tailings upstream - SMTS10H																		
McLaren tailings downstream SMTS20H									S									

Exceedence codes:

P-Primary MCL
S-Secondary MCL
A-Aquatic Life Acute
C-Aquatic Life Chronic
S*-either field or lab pH does not meet standards

Note: The analytical results are listed in appendix IV.

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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.

Appendix II
List of Sites in the Gallatin National Forest

NAME	MBMG ID	R	T	SEC	TRACT	QUADRANGLE	CODE	OWNER
ACCIDENT	SG001904	12E	07S	22		HAYSTACK PEAK	S	MIX
ADIT CLAIM / GOLD DUST	PK006570	14E	09S	11	DDBA	COOKE CITY	V	NF
ADIT WEST OF 7562' ELEV HILL	PK009086	09E	09S	4	ADCB	ASH MOUNTAIN	V	NF
ALASKA	PK006222	08E	06S	13		EMIGRANT	S	MIX
ALICE (TUNNEL SPRINGS ADIT)	PK006306	08E	06S	22		EMIGRANT	S	PRV
ALICE C.	PK002058	09E	06S	24		KNOWLES PEAK	S	PRV
ALICE E	PK002232	14E	09S	24		COOKE CITY	S	PRV
ALLEN	PK008607	09E	07S	18	ACBD	MONITOR PEAK	V	NF
ALLISON TUNNEL	PK006290	09E	07S	6	BDAD	EMIGRANT	V	MIX
ALPHA	PK008570	08E	06S	22		EMIGRANT	S	PRV
AMIT NO. 5	PK008666	12E	07S	5		THE NEEDLES	S	MIX
ANACONDA COPPER MINES	GA009022	07E	02S	34		BOZEMAN PASS	S	PRV
ANDERSON'S SPRINGS	SG001820	13E	03S	29		MCLEOD BASIN	S	MIX
ANNIE	PK008600	09E	07S	8	BBA	MONITOR PEAK	S	NF
ANNIE NO. 2	PK008597	09E	07S	5	CDD	MONITOR PEAK	S	NF
APEX GROUP	GA008642	05E	9S	34		BIG HORN PEAK	V	NF
APEX OLE CLAIM	PK006734	09E	08S	35		ASH MOUNTAIN	V	NF
ARRASTA RIDGE AREA	PK008578	09E	07S	4		EMIGRANT	S	MIX
ARROW PEAK CLAIM	PK008674	10E	06S	5		KNOWLES PEAK	S	NF
BABOON MOUNTAIN	SG008610	12E	07S	21		HAYSTACK PEAK	V	MIX
BAILEY AND BEADLE	GA004043	06E	02S	13		KELLY CREEK	S	PRV
BALD MOUNTAIN ADITS	PK009007	09E	09S	9	DDDB	ASH MOUNTAIN	V	NF
BANK	PK008574	08E	06S	13		EMIGRANT	S	NF
BAR D	PK006574	13E	08S	8		HAYSTACK PEAK	S	MIX
BAR GROUP	PK002370	09E	07S	30		MONITOR PEAK	S	NF
BAR NO. 6	PK008594	09E	07S	7	BC	MONITOR PEAK	S	NF
BARBARA ANN MINE	PK002106	09E	06S	35	BBAA	KNOWLES PEAK	V	MIX
BASIN CREEK	PK002238	12E	07S	16	DDBC	HAYSTACK PEAK	V	NF
BEAR CREEK PLACER	PK002310	09E	09S	17		GARDINER	V	MIX
BEAR CREEK SPRINGS	PK006781	09E	09S	19		GARDINER	V	NF
BEAR TRAP CORUNDUM/SILLIMANITE	MA003927	02E	04S	6		BEAR TRAP CREEK	S	PRV
BEAR TRAP CREEK SILLIMANITE	MA000589	01E	04S	1		BEAR TRAP CREEK	S	NF
BEARS DEN LODE CLAIM	PK002208	12E	09S	1		ROUNDHEAD BUTTE	S	NF
BIG BLUE MINE	PK001986	14E	09S	26		COOKE CITY	S	PRV
BIG DADDY	PK009006	08E	07S	10	CC	MONITOR PEAK	V	NF
BIG GROUP CLAIMS	SG001862	13E	05S	3		PICKET PIN MOUNTAIN	S	NF
BIG PINE	PK008676	09E	06S	23		KNOWLES PEAK	V	NF
BLACK WARRIOR	PK002064	14E	09S	15		COOKE CITY	S	PRV
BLACKSMITH SHOP TUNNEL	PK009064	09E	09S	23	CCBB	ASH MOUNTAIN	S	PRV
BLAKELY CLIFF DEPOSIT	SG001868	13E	04S	30		CHROME MOUNTAIN	S	NF
BLUE LAKE PROSPECTS / O.K. / TOLEDO	SG008621	12E	07S	23	DDDC	HAYSTACK PEAK	V	NF
BLUE MANGANESE	PK006558	10E	03S	9		LIVINGSTON PEAK	S	NF
BOG COPPER	PK009005	14E	09S	11		COOKE CITY	S	MIX
BONANZA GROUP	SG001736	12E	04S	14		CHROME MOUNTAIN	S	MIX
BOULDER RIVER NICKEL (RIVERSIDE)	SG001934	12E	04S	23		CHROME MOUNTAIN	S	MIX
BOWERS AND JONES MINES	PK006418	08E	09S	8		ELECTRIC PEAK	S	MIX
BRIDGE PLACER	PK006634	12E	06S	28	BBAA	MOUNT DOUGLAS	V	MIX
BRIDGER CREEK	SG001940	15E	02S	25		SLIDEROCK MOUNTAIN	S	NF
BRIDGER CREEK LIMESTONE DEPOSIT	GA004178	06E	01S	34		KELLY CREEK	S	MIX
BRILLIANT	SG001238	12E	07S	23		HAYSTACK PEAK	S	MIX
BROKEN GLASSES	PK006350	09E	07S	5		EMIGRANT	S	S
BUCK CREEK	GA004153	04E	08S	4		LONE INDIAN PEAK	S	NF
BUCK CREEK PHOSPHATE	GA003908	04E	08S	5		OUSEL FALLS	S	NF
BUCKSKIN AND JOHNSON	PK002644	08E	02S	28		BOZEMAN PASS	S	PRV
BULL ELK LODE	PK006674	14E	09S	14		COOKE CITY	S	MIX

NAME	MBMG ID	R	T	SEC	TRACT	QUADRANGLE	CODE	OWNER
BULL MOOSE	PK008678	09E	06S	25		KNOWLES PEAK	V	MIX
BURNT CREEK	PK006494	09E	06S	25	CBBD	KNOWLES PEAK	V	NF
BUTTE AND BUTTE NO. 1 CLAIMS	SG001586	14E	02S	36		SLIDEROCK MOUNTAIN	S	NF
BYAM BROS.-MERGED WITH HEDGES MINE	PK006430	08E	03S	28		CHIMNEY ROCK	S	PRV
CARLTON	PK002466	14E	09S	24		COOKE CITY	S	MIX
CARMEL CLAIM	PK006262	09E	07S	4	DCAA	KNOWLES PEAK	V	NF
CARTWRIGHT CRYSTAL SPAR GROUP	SG001784	15E	02S	7	DCCB	ROSS CANYON	S	PRV
CATHY	PK006202	09E	06S	34		KNOWLES PEAK	S	MIX
CHESTNUT MINE / ROCKY CANYON	GA003853	07E	02S	20		KELLY CREEK	S	PRV
CHICO HOT SPRINGS GEOTHERMAL	PK002692	08E	06S	1		EMIGRANT	S	PRV
CHICO HOT SPRINGS TRAVERTINE	PK006314	08E	06S	12		EMIGRANT	S	MIX
CHIPMUNK CLAIM	PK002472	14E	09S	1		COOKE CITY	S	PRV
CHROMIUM OCCURRENCE	SG001874	13E	05S	3		PICKET PIN MOUNTAIN	S	NF
CHROMIUM OCCURRENCE	SG001910	13E	04S	32		CHROME MOUNTAIN	S	MIX
CINNAMON CREEK PHOSPHATE	GA004148	04E	08S	17		OUSEL FALLS	S	NF
CLARA	SG008620	12E	07S	23		HAYSTACK PEAK	V	NF
COISH	SG001946	12E	04S	25		CHROME MOUNTAIN	S	MIX
COMMANCHE	PK008580	09E	07S	4		EMIGRANT	S	MIX
COMO PIT	PK008591	14E	09S	11		COOKE CITY	S	PRV
CONNIE MO MINE	MA004162	02E	05S	7		CHERRY LAKE	S	NF
CONRAD GROUP (GUEST TUNNEL, ETC)	PK002160	09E	09S	22	DABD	ASH MOUNTAIN	V	MIX
COOPER (LOWER)	GA008534	05E	2N	1	DBAD	FLATHEAD PASS	V	NF
COOPER (UPPER)	GA008533	05E	2N	1	DBDA	FLATHEAD PASS	V	NF
COPPER PIT	GA008531	05E	2N	2		FLATHEAD PASS	S	PRV
COPPER QUEEN	PK008568	11E	07S	26		THE PYRAMID	S	NF
CORBETT	PK008602	09E	07S	8	BC	MONITOR PEAK	S	PRV
CORWIN HOT SPRINGS	PK006811	07E	08S	25		ELECTRIC PEAK	S	PRV
CORWIN SPRINGS	PK006582	08E	08S	30		ELECTRIC PEAK	S	MIX
COULSTON	GA009021	07E	02S	25		BOZEMAN PASS	S	PRV
CREVASSE CREEK / CREVICE CREEK	PK002292	09E	09S	23	DCBD	ASH MOUNTAIN	V	NF
CREVICE MOUNTAIN MINE	PK002088	09E	09S	15		ASH MOUNTAIN	S	MIX
CROW MINE	SG001814	14E	03S	2	BBBC	SLIDEROCK MOUNTAIN	V	NF
CROWN	SG008613	12E	07S	23		HAYSTACK PEAK	V	PRV
CROWN BUTTE AND MELISSA MINE	PK002274	14E	09S	10		COOKE CITY	S	MIX
CROWN POINT	PK006330	09E	06S	32		EMIGRANT	U	MIX
CROWS NEST	MA008672	02E	04S	27	ACB	WILLOW SWAMP	S	PRV
CUMBERLAND	SG008622	12E	07S	23		HAYSTACK PEAK	V	NF
DAISY /DUFFY/YAGER/TREASURE STATE	SG001850	12E	07S	15	CADD	HAYSTACK PEAK	V	MIX
DAISY/LITTLE DAISY	PK006394	14E	09S	14	ABC	COOKE CITY	V	PRV
DAVID	PK006218	09E	07S	4	ADBC	KNOWLES PEAK	V	NF
DEER CREEK	SG001838	15E	03S	6		SLIDEROCK MOUNTAIN	S	NF
DELTA	SG008617	12E	07S	23		HAYSTACK PEAK	V	PRV
DILULO	PK002632	08E	02S	31	AACA	BOZEMAN PASS	S	PRV
DISCOVERY #4 (JAR 10)	PK009082	09E	09S	4	ACDB	ASH MOUNTAIN	V	MIX
DISCOVERY (LOWER PINE CREEK)	PK009081	09E	09S	4	DBBD	ASH MOUNTAIN	V	MIX
DISCOVERY PATENTED CLAIM	PK009087	09E	09S	4	ACDA	ASH MOUNTAIN	V	PRV
DIXIE	SG008625	12E	07S	24		HAYSTACK PEAK	V	NF
DIXIE	PK006354	09E	07S	4		EMIGRANT	S	NF
DMH GROUP	PK002382	14E	09S	12		COOKE CITY	S	MIX
DRYDEN	PK002148	09E	09S	23	DCDB	ASH MOUNTAIN	V	NF
DUKE CLAIM / STREET	PK002040	14E	09S	26		COOKE CITY	S	MIX
DUV 19 GROUP / DUVAL	PK006490	09E	07S	6	DACC	EMIGRANT	V	NF
DUV MINNIE BELL NO 2	PK006450	09E	07S	6		EMIGRANT	S	MIX
EARLY DAY	PK001998	14E	09S	26		COOKE CITY	S	MIX
EAST BOULDER PLATEAU	SG001964	13E	04S	32		CHROME MOUNTAIN	S	MIX
EAST BOULDER RIVER	SG001958	13E	05S	3		PICKET PIN MOUNTAIN	S	NF

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EAST OF HORSESHOE SHAFTS (2)	PK009096	09E	08S	4	BABD	GARDINER	V	NF
EAST RIVERSIDE	MA000721	02E	02S	31	BD	BEAR TRAP CREEK	S	PRV
EAST SIDE OF HORSESHOE RIDGE	PK009095	09E	08S	33	CACD	GARDINER	V	NF
ELK CREEK DEPOSIT	GA004533	03E	03S	22	A	RUBY MOUNTAIN	S	PRV
ELK TUNNEL	PK009105	09E	09S	9	ACCA	ASH MOUNTAIN	S	PRV
ELKHORN CREEK PHOSPHATE	GA004453	04E	08S	11		LONE INDIAN PEAK	S	NF
ELVIN CLAYTON	PK006714	08E	06S	24		EMIGRANT	S	MIX
EMIGRANT GOLD MINING CO.	PK002418	08E	06S	25		EMIGRANT	S	NF
EMIGRANT GULCH MOLYBDENUM	PK002262	09E	07S	6		EMIGRANT	S	MIX
EMMA	PK008688	08E	07S	5	DB	DAILEY LAKE	S	MIX
EMPIRE HILL -MISC. MINES	PK002190	09E	09S	11	DABC	ASH MOUNTAIN	V	MIX
EMPIRE NO. 2 (MINNIE MUND NO. 2)	PK008561	12E	04S	15		CHROME MOUNTAIN	S	MIX
EMPIRE STATE / VANITY FAIR	PK006586	09E	09S	11	DABB	ASH MOUNTAIN	V	MIX
ESPERANZA	PK006270	09E	07S	6		EMIGRANT	S	MIX
EVE GROUP (MOONLIGHT)	SG008564	12E	04S	23		CHROME MOUNTAIN	S	MIX
FAIRY LAKE	GA004098	06E	02N	15		SACAGAWEA PEAK	V	NF
FEATHERSTONE MINE	PK006438	08E	03S	21		CHIMNEY ROCK	S	PRV
FIRE CLAY CLAIM	PK006590	14E	09S	22		COOKE CITY	U	MIX
FIRST CHANCE (LEWIS-MCBRIDE)	PK002142	09E	09S	22	ACDA	ASH MOUNTAIN	S	PRV
FIRST OUT	PK006775	10E	04S	8		BRISBIN	S	PRV
FISHER CREEK NO. 1	PK008469	15E	09S	18	CB	COOKE CITY	S	NF
FLOYD COUNTS CLAIM	PK006286	09E	07S	3		KNOWLES PEAK	U	NF
FORMER ARSENIC MILL	PK009107	09E	09S	9	BABB	GARDINER	S	PRV
FOSTER MINE	PK006414	07E	09S	3		ELECTRIC PEAK	S	PRV
FRANK GROUP / SPOTTED HORSE CLAIM	PK006594	09E	09S	14		ASH MOUNTAIN	V	NF
FREE SILVER	PK008604	09E	07S	8	CC	MONITOR PEAK	S	NF
FROG POND ADIT	SG001172	13E	04S	28		PICKET PIN MOUNTAIN	S	MIX
FROZEN LAKE GROUP	PK002358	10E	05S	21		MOUNT COWEN	S	NF
FROZE-TO-DEATH CREEK	PK002334	12E	04S	18		WEST BOULDER PLATEAU	S	NF
GALENA QUEEN	PK002298	09E	07S	4	DACB	KNOWLES PEAK	V	NF
GALLATIN RIVER PHOSPHATE	GA004143	04E	09S	2		SUNSHINE POINT	S	NF
GALLATIN RIVER PLACERS	GA003838	03E	07S	35		GALLATIN PEAK	S	PRV
GARDINER TRAVERTINE QUARRY	PK002802	08E	09S	14		GARDINER	V	MIX
GARDINER TRAVERTINE SAW	PK006750	08E	09S	23		GARDINER	S	MIX
GARLAND COUNTS	PK006266	09E	07S	5		EMIGRANT	S	NF
GASAWAY MINE	PK006434	08E	03S	20	DBDD	BALD KNOB	S	PRV
GISH CHROMITE CLAIMS	SG001844	12E	04S	13		CHROME MOUNTAIN	S	MIX
GISH MINE	SG001526	12E	04S	24		CHROME MOUNTAIN	S	PRV
GLENGARRY / LIZZIE PATENTED CLAIM	PK002850	14E	09S	11	ABBC	COOKE CITY	V	MIX
GOLD BUG	PK008595	08E	07S	10	ADB	MONITOR PEAK	S	NF
GOLD BUG PLACER	PK006718	08E	06S	24		EMIGRANT	S	NF
GOLD DOLLAR	PK002214	13E	08S	10		PINNACLE MOUNTAIN	S	PRV
GOLD HILL MILL	SG009002	14E	03S	1	DBDD	SLIDEROCK MOUNTAIN	V	NF
GOLD HILL MINE	SG001976	14E	03S	1	DBCB	SLIDEROCK MOUNTAIN	V	NF
GOLD KING	PK008592	12E	07S	3		THE NEEDLES	V	NF
GOLD LEAF	SG008612	12E	07S	23		HAYSTACK PEAK	V	NF
GOLD LEAF AND GOLD LEAF NO. 2	PK006258	09E	06S	31	DD	EMIGRANT	S	MIX
GRAHAM	PK009103	09E	09S	9	ABDA	ASH MOUNTAIN	S	PRV
GRAND CENTRAL CLAIM	PK002226	14E	08S	19		CUTOFF MOUNTAIN	S	NF
GRAND VIEW	PK006206	09E	07S	5		EMIGRANT	S	NF
GRAVEL PIT	GA003938	05E	03S	12		WHEELER MOUNTAIN	S	PRV
GREAT EASTERN AND GREAT WESTERN	PK006250	08E	06S	36	DAAC	EMIGRANT	V	MIX
GREAT REPUBLIC SMELTER	PK008466	14E	09S	25	CBDD	COOKE CITY	V	MIX
GREEN LAKE PROSPECT	PK008660	15E	08S	30	DDCD	COOKE CITY	S	NF
GROUSE MOUNTAIN PHOSPHATE	GA004498	04E	08S	36		SUNSHINE POINT	S	NF
HALF MOON MINE	SG001802	12E	07S	14		HAYSTACK PEAK	S	MIX

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HALF MOON MINE	PK006829	11E	03N	1	AABD	CRAZY PEAK	S	NF
HANLON HILL - EAST SIDE	PK009101	09E	09S	8	AAAD	GARDINER	V	NF
HANLON HILL WORKINGS	PK009016	09E	09S	5	DCDA	GARDINER	V	NF
HARGROVE	MA008671	01E	03S	35		BEAR TRAP CREEK	V	PRV
HARRIS-MURPHY MINE	GA004053	07E	02S	28		BOZEMAN PASS	S	PRV
HARRISON MINE	GA003958	07E	03S	2	DBAA	BALD KNOB	S	PRV
HAZEL	PK006762	09E	08S	32	DDC	GARDINER	V	NF
HELEN	PK008596	09E	07S	5		MONITOR PEAK	S	PRV
HENDERSON GROUP	PK006382	14E	09S	13		COOKE CITY	S	MIX
HENKE-BEER PLACER	PK006832	12E	07S	20		IRON MOUNTAIN	S	NF
HIDDEN TREASURE	SG001592	12E	07S	15	CACA	HAYSTACK PEAK	V	PRV
HODSON	GA003968	07E	02S	34		BOZEMAN PASS	S	PRV
HOMESTAKE (PARKMONT, EXCELLO)	PK002448	14E	09S	14		COOKE CITY	S	MIX
HONOLULU	PK008558	10E	03S	32		BRISBIN	S	PRV
HOPE GROUP	PK002388	08E	06S	36		EMIGRANT	S	
HORSESHOE	PK008635	09E	08S	33	CBAA	GARDINER	V	NF
HORSESHOE MOUNTAIN AREA	PK008627	13E	08S	10		PINNACLE MOUNTAIN	S	NF
HOT SHOT 3-5	PK006474	10E	06S	19		KNOWLES PEAK	S	NF
HUCKLEBERRY NORTH AREA	PK008599	09E	07S	6	DDD	MONITOR PEAK	S	NF
HUCKLEBERRY SOUTH AREA	PK008601	09E	07S	8	BC	MONITOR PEAK	S	PRV
IDA B	SG008623	12E	07S	23		HAYSTACK PEAK	V	NF
INDEPENDENCE "A"	SG001154	12E	07S	23		HAYSTACK PEAK	S	MIX
INDEPENDENCE MINE	SG001598	12E	07S	23	CCDC	HAYSTACK PEAK	V	MIX
INDIAN CR-TAYLOR CR SYNCLINAL AREA	GA004158	04E	09S	27		SUNSHINE POINT	S	NF
INTERMEDIATE MINE	PK006422	08E	09S	6		BOZEMAN PASS	S	PRV
IRMA-REPUBLIC	PK002010	14E	09S	36		COOKE CITY	V	MIX
IRON DIKE	SG001580	12E	04S	23		CHROME MOUNTAIN	V	MIX
IRON DUKE	PK009102	09E	09S	9	ABAB	ASH MOUNTAIN	S	PRV
IRON HILL	PK008569	08E	06S	14		EMIGRANT	S	PRV
IRON KING	PK008577	09E	07S	5		EMIGRANT	S	NF
IRON KING	PK006566	09E	09S	4	BDDC	GARDINER	V	NF
JAR 1 CLAIM	PK009084	09E	09S	4	ABAD	ASH MOUNTAIN	V	NF
JAR 22-UNNAMED ADIT	PK009089	09E	09S	4	DDAB	ASH MOUNTAIN	V	NF
JAR 245 AND 109 ADITS	PK009108	09E	09S	10	CDDD	ASH MOUNTAIN	V	NF
JAR 9 CLAIM	PK009083	09E	09S	4	ACBD	ASH MOUNTAIN	V	NF
JAY	PK008603	09E	07S	8	C	MONITOR PEAK	S	NF
JEANETTE	PK006210	09E	07S	4		EMIGRANT	S	NF
JEWELL PROPERTY	GA004493	04E	09S	7	D	LINCOLN MOUNTAIN	S	MIX
JN17 UNPATENTED CLAIM	PK009085	09E	08S	33	DDDD	ASH MOUNTAIN	V	NF
JUMBO	PK006322	11E	05S	26		THE NEEDLES	S	MIX
JUMBO PLACER	PK006722	09E	09S	8		GARDINER	V	MIX
KANGLEY MINE	PK002608	09E	02S	28		LIVINGSTON	S	PRV
KARST ASBESTOS	GA004613	04E	05S	36	CDBD	HIDDEN LAKE	S	NF
KATHY B OR EMMA	PK009100	09E	09S	15	DCDB	ASH MOUNTAIN	V	MIX
KELLY (BADGER GROUP)	SG001808	12E	03N	6	BCCC	CRAZY PEAK	V	NF
KENNEBEC CLAIM	PK006610	09E	09S	15		ASH MOUNTAIN	S	PRV
KLU KLUX CLAIM	PK006226	08E	06S	13		EMIGRANT	S	NF
KNAPP MINE	SG001574	14E	02S	36	DDDA	SLIDEROCK MOUNTAIN	S	NF
KOUNTZ MINE	PK006442	08E	03S	20	BDAB	BALD KNOB	S	PRV
KREIGER DITCH ADIT	PK002100	09E	09S	13	CCBC	ASH MOUNTAIN	V	NF
LASICH	GA004048	07E	02S	18		KELLY CREEK	S	PRV
LAST CHANCE PATENTED CLAIM	PK009088	09E	09S	4	ACDD	ASH MOUNTAIN	V	PRV
LAST CHANCE PROSPECT	GA004528	03E	06S	23		GALLATIN PEAK	S	NF
LAZY BEETLE	PK002244	15E	08S	31	ABBA	COOKE CITY	V	NF
LEA NO. 34	PK006514	09E	07S	17		MONITOR PEAK	S	NF
LILLIPUT FRACTION (221)	SG001124	12E	07S	23		HAYSTACK PEAK	S	MIX

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LIMESTONE OCCURRENCE	PK006662	09E	03S	2		BRISBIN	S	PRV
LITTLE CHIEF	PK006298	08E	06S	22		EMIGRANT	S	PRV
LITTLE FALLS CREEK (& OREGON LODE)	PK002328	11E	04S	36		WEST BOULDER PLATEAU	S	NF
LONG TOM PLACER	PK002220	14E	08S	32		CUTOFF MOUNTAIN	S	NF
LONGSTREET	PK002454	14E	09S	24		COOKE CITY	S	PRV
LORI KAY / BLACK DIAMOND /WAR EAGLE	PK006458	12E	07S	5		THE NEEDLES	S	NF
LOST CHANCE	PK002004	14E	09S	24		COOKE CITY	S	MIX
LOWER BALD MOUNTAIN ADITS	PK009014	09E	09S	9	DABA	ASH MOUNTAIN	V	NF
LOWER EAST FORK EMIGRANT CREEK	PK008572	09E	07S	6		EMIGRANT	S	NF
LOWER FALLS NO.1/ LOWER FALLS # 1	PK006470	08E	06S	24		EMIGRANT	S	PRV
LOWER PINE CREEK	PK002184	09E	09S	4	DADA	ASH MOUNTAIN	V	MIX
LUCKY ALLEN	PK006518	08E	06S	24		EMIGRANT	S	
MAGNETIC	PK008606	09E	07S	18	BCAD	MONITOR PEAK	V	NF
MAGNITITE GROUP	PK002394	08E	07S	10		MONITOR PEAK	S	NF
MAJESTIC AND FLORA B CLAIMS -MCHUGH	SG001562	12E	04S	11		MCLEOD BASIN	S	MIX
MARBLE CLAIRE	PK006294	08E	06S	28		EMIGRANT	S	PRV
MARGARET	PK006454	09E	07S	5		EMIGRANT	S	
MC ADOW NO. 2	PK006242	09E	07S	5		EMIGRANT	S	NF
MCCAULEY (& GEORGE WASHIGTON FRACT)	PK002136	09E	09S	22	ACAB	ASH MOUNTAIN	S	PRV
MCLAREN TAILINGS	PK008467	14E	19S	25	ADCA	COOKE CITY	V	MIX
MEADOW CREEK LIMESTONE DEPOSIT	GA004173	07E	02S	20		BOZEMAN PASS	S	PRV
MEADOW CREEK MINES	GA004013	07E	02S	28		BOZEMAN PASS	S	PRV
MEADOW CREEK NO. 1, 2, AND 3	PK008581	09E	07S	4		EMIGRANT	S	
MEDONA	PK002154	09E	09S	15	DDBA	ASH MOUNTAIN	S	PRV
MERRIMAN QUARRY	PK002322	08E	06S	3		EMIGRANT	S	PRV
MICA CREEK DEPOSIT	GA004503	05E	04S	31	CABA	GARNET MOUNTAIN	V	NF
MICHENER PROPERTY	GA004508	04E	06S	32		GALLATIN PEAK	S	PRV
MIDNIGHT	PK008687	09E	07S	4	DABB	KNOWLES PEAK	V	NF
MIDNIGHT BELL	SG001970	12E	07S	22		HAYSTACK PEAK	S	MIX
MILL CLAIM	PK008583	09E	07S	5		EMIGRANT	V	MIX
MILL CREEK	PK002304	11E	07S	6		THE PYRAMID	S	NF
MILL CREEK CANYON BARITE	GA004193	06E	02N	8		FLATHEAD PASS	S	NF
MILLER NOS. 1 AND 2 MINES	GA003983	07E	02S	28		BOZEMAN PASS	S	PRV
MINERAL HILL / JARDINE / TVX	PK002736	09E	09S	9	BAAC	GARDINER	S	MIX
MKB CLAIMS NO. 1 - 7	GA008535	05E	2N	1	DDBA	FLATHEAD PASS	V	NF
MOGER MICA CLAIM	MA004127	02E	05S	5		CHERRY LAKE	S	NF
MOHAWK WARRIOR / MOHAWK	PK002400	14E	09S	25	D	COOKE CITY	S	MIX
MONTANA	PK006310	11E	05S	26		THE NEEDLES	S	MIX
MONTANA QUEEN-CORBETT	PK006278	09E	07S	8	CB	MONITOR PEAK	S	PRV
MOON LAKE ASBESTOS	GA004568	04E	06S	18		GALLATIN PEAK	S	NF
MOON LAKE KYANITE	GA004598	04E	06S	18		GALLATIN PEAK	S	NF
MOONLIGHT MINE	PK006793	08E	09S	23		GARDINER	S	MIX
MORNING STAR	PK002034	14E	09S	23		COOKE CITY	S	PRV
MORNING STAR	PK006766	08E	06S	22		EMIGRANT	S	
MORTAR	PK008608	09E	07S	18		MONITOR PEAK	V	NF
MOUNTAIN CHIEF	PK009106	09E	09S	9	ADBC	ASH MOUNTAIN	S	PRV
MOUNTAIN HOUSE MINE	PK006398	08E	03S	18	DB	BALD KNOB	S	PRV
MOUNTAIN LION	PK008575	08E	06S	13		EMIGRANT	U	MIX
MOUNTAIN SIDE MINE / MOUNTAINSIDE	GA003988	07E	02S	21		BOZEMAN PASS	S	PRV
MT COWAN MOLYBDENUM / MOUNT COWEN	PK002268	10E	05S	22		MOUNT COWEN	S	NF
MT. GOAT	PK008598	09E	07S	7	AAA	MONITOR PEAK	S	NF
MUD LAKE PROSPECTS	SG008614	12E	07S	23		HAYSTACK PEAK	V	NF
NANCY	PK002112	09E	06S	24		KNOWLES PEAK	S	NF
NEBRASKA NO. 1 AND 2 PLACERS	PK006796	09E	09S	15	CCCC	ASH MOUNTAIN	S	MIX
NEW WORLD	PK002028	14E	09S	23		COOKE CITY	S	PRV
NEW YEAR'S GIFT CLAIM; SEE MCLAREN	PK006799	14E	09S	11		COOKE CITY	S	PRV

NAME	MBMG ID	R	T	SEC	TRACT	QUADRANGLE	CODE	OWNER
NEWTON MINE	PK006426	08E	09S	7		ELECTRIC PEAK	S	PRV
NICON GROUP	SG008562	12E	04S	14		CHROME MOUNTAIN	S	MIX
NORTH BANK OF PINE CREEK ADIT	PK009091	09E	09S	4	DADA	ASH MOUNTAIN	V	NF
NORTH END MT. ABUNDANCE	PK002070	14E	09S	5		CUTOFF MOUNTAIN	S	NF
NORTH STAR	SG001142	12E	07S	23		HAYSTACK PEAK	V	PRV
NORTHERN PACIFIC COAL CO. MINE	PK002656	08E	02S	24		HOPPERS	S	PRV
NUMBER THIRTY MINE	PK002626	08E	02S	30	CAB	BOZEMAN PASS	S	PRV
OLIVER	PK008547	10E	03S	3		LIVINGSTON PEAK	S	NF
OMEGA	SG008616	12E	07S	23		HAYSTACK PEAK	V	PRV
OREGON	PK008563	12E	04S	15		CHROME MOUNTAIN	S	MIX
OREGON MOUNTAIN AREA	PK008641	09E	09S	14	DDCB	ASH MOUNTAIN	V	NF
ORO CACHE / ORE CACHE /CACHE OF ORE	PK006390	15E	09S	32	B	COOKE CITY	S	PRV
ORO-Y-PLATE	PK006769	10E	03S	16		LIVINGSTON PEAK	S	NF
OVERLAP CLAIM	PK008605	09E	07S	18	BADD	MONITOR PEAK	V	NF
PALMER MOUNTAIN CREVICE MTN SADDLE	PK002178	09E	09S	14	ACCC	ASH MOUNTAIN	V	MIX
PAYNE MINE	GA008555	07E	3S	2	ABB	BALD KNOB	S	PRV
PENDELTON	GA004033	07E	02S	25		BOZEMAN PASS	S	PRV
PETER PEAR, PETE PEAR, OSSIAN	PK002406	09E	07S	31	CDAA	EMIGRANT	V	NF
PIG'S EYE PLACER	PK001992	14E	09S	7		CUTOFF MOUNTAIN	S	NF
PILGRIM-ST CROIX	PK006334	09E	06S	34		KNOWLES PEAK	S	PRV
PINE CREEK PLACER	PK009092	09E	09S	4	DBCD	ASH MOUNTAIN	V	NF
PLACER (EAST AND WEST)	SG001136	12E	07S	15		HAYSTACK PEAK	V	PRV
POOR MAN / POORMAN	SG008615	12E	07S	22	ACAB	HAYSTACK PEAK	V	MIX
POOR MAN NO. 2	SG008618	12E	07S	23		HAYSTACK PEAK	U	PRV
POP INCLINE	PK002340	09E	09S	23	ACAB	ASH MOUNTAIN	V	MIX
PORCUPINE RIDGE STONE	GA009003	04E	07S	21		LONE INDIAN PEAK	N	NF
PRATT	PK006710	09E	09S	23		ASH MOUNTAIN	N	PRV
Q AND H NOS. 1 & 2 / STINKING WATER	GA003993	07E	02S	23		BOZEMAN PASS	N	PRV
QUEEN ESTHER	PK008579	09E	07S	4		EMIGRANT	V	MIX
QUEEN VICTORY	SG008611	12E	07S	14		HAYSTACK PEAK	N	NF
RAY & AL RUDD PROPERTY	PK006802	12E	07S	21		IRON MOUNTAIN	N	MIX
RED FOX GROUP	PK002730	12E	04S	27		CHROME MOUNTAIN	N	NF
REPUBLIC MILL	PK009017	14E	09S	36	CDDD	COOKE CITY	V	NF
RIDGE PROSPECT	GA004578	03E	06S	24		GALLATIN PEAK	N	NF
ROBERT E LEE COPPER OCCURRENCE	PK006254	09E	06S	3		KNOWLES PEAK	N	PRV
ROCK CREEK PLACER	PK002046	13E	08S	23		CUTOFF MOUNTAIN	N	NF
ROMMEL TAILINGS	PK008647	15E	09S	19	A	COOKE CITY	N	NF
ROSS MINE	SG001766	15E	03S	6	AABC	SLIDEROCK MOUNTAIN	V	NF
RUDD PROPERTY OR RAYMOND RUDD NO. 2	PK006746	12E	07S	6		THE NEEDLES	N	NF
SEATTLE / CHICAGO MILL SITE	PK008649	15E	09S	18		COOKE CITY	N	MIX
SEPTEMBER MORN / PASS CREEK /	GA004618	05E	02N	1	ABCA	FLATHEAD PASS	V	NF
SHARON SUE AND CONTACT	PK006238	09E	06S	26		KNOWLES PEAK	N	NF
SHAWN MARIE	PK008593	12E	07S	3		THE NEEDLES	N	NF
SHEEP CORRAL MINE	PK002476	08E	03S	18	BCB	BALD KNOB	N	PRV
SHEILA CLAIM	PK006274	09E	07S	7	DB	MONITOR PEAK	N	NF
SHERIDAN	GA008532	05E	2N	2		FLATHEAD PASS	N	PRV
SHOO FLY	PK002250	14E	09S	23		COOKE CITY	N	MIX
SILVER KING MINE	SG001772	15E	03S	6		SLIDEROCK MOUNTAIN	V	NF
SILVER STAR	PK006302	08E	06S	22		EMIGRANT	S	MIX
SIN NOMBRE / SINOMBRE / SIN HOMBRE	PK002280	09E	09S	22	ABCD	ASH MOUNTAIN	N	MIX
SIXTY FIVE / SIXTY-FIVE	PK006698	10E	03S	32		BRISBIN	N	PRV
SKI LINE / SKILINE / MOUNTAIN VIEW	SG001826	12E	07S	10		HAYSTACK PEAK	N	NF
SKILLMAN CLAIM -MILWAUKIE & MONTANA	PK008559	12E	04S	28		WEST BOULDER PLATEAU	N	NF
SKY BABY CLAIMS	SG001778	12E	04S	25		CHROME MOUNTAIN	N	MIX
SKY TOP CREEK	PK008691	15E	08S	33		FOSSIL LAKE	N	NF
SKYLARK	SG001148	12E	07S	23		HAYSTACK PEAK	N	MIX

NAME	MBMG ID	R	T	SEC	TRACT	QUADRANGLE	CODE	OWNER
SLOUGH CREEK PLACER	PK002172	13E	09S	5		ROUNDHEAD BUTTE	N	MIX
SNOWSHOE MILL	PK009063	09E	09S	22	ABDB	ASH MOUNTAIN	V	MIX
SNOWSHOE MINE (HULSE GROUP)	PK002082	09E	09S	15	DCDD	ASH MOUNTAIN	N	PRV
SOUTHSIDE OREGON MOUNTAIN	PK009098	09E	09S	23	ACAB	ASH MOUNTAIN	V	NF
SOUTHSIDE OREGON MOUNTAIN-PROSPECT	PK009099	09E	09S	23	ACAC	ASH MOUNTAIN	V	NF
SOUTHWEST CORNER DISCOVERY CLAIM	PK009090	09E	09S	4	DBCA	ASH MOUNTAIN	V	PRV
SPANISH CREEK RES. STUDY	GA003858	04E	04S	18		BEACON POINT	N	PRV
SPRINGFIELD	SG001130	12E	07S	15		HAYSTACK PEAK	V	PRV
ST. JULIAN AREA	PK008589	09E	07S	5		EMIGRANT	V	MIX
ST. JULIAN GROUP	PK008582	09E	07S	5		EMIGRANT	V	MIX
ST. JULIAN MINE	PK006820	09E	07S	5	DCBB	EMIGRANT	V	MIX
STANDARD (DRAGO) MINE	PK008560	12E	04S	15		CHROME MOUNTAIN	N	NF
STANDARD GROUP	PK008634	09E	09S	4		GARDINER	V	NF
STEMWINDER	PK008669	11E	03N	1	DDDA	CRAZY PEAK	N	NF
STEVENSON MINE	PK002614	08E	03S	17	CCC	BALD KNOB	N	PRV
STILLWATER ANORTHOSITE	SG001532	13E	04S	25		PICKET PIN MOUNTAIN	N	NF
STUMP MINE	PK002052	14E	09S	26		COOKE CITY	N	PRV
SUNSHINE MINE	GA004608	06E	03S	31	ADDA	WHEELER MOUNTAIN	V	NF
SUNSHINE POINT PHOSPHATE	GA004463	04E	09S	12		SUNSHINE POINT	N	NF
SURPRISE MINE	SG001790	15E	03S	6	ACBA	SLIDEROCK MOUNTAIN	V	NF
TABLE MOUNTAIN PROSPECT	GA004563	04E	06S	8		GALLATIN PEAK	N	NF
TAYLOR CREEK PHOSPHATE	GA004138	03E	09S	11		LINCOLN MOUNTAIN	N	NF
TAYLOR CREEK PHOSPHORUS	MA003443	03E	09S	19	C	KOCH PEAK	N	PRV
TEPEE CREEK PHOSPHATE	GA004478	04E	09S	1		BIG HORN PEAK	N	NF
THE FOUR SEVENS / 7777	PK002022	12E	07S	20		IRON MOUNTAIN	N	NF
THOMPSON #1	GA004168	05E	04S	30		GARNET MOUNTAIN	N	NF
THUMPER LODE #1	GA004473	05E	04S	30	ADAC	GARNET MOUNTAIN	V	NF
TIMBERLINE NO. 1 AND 2	GA003808	07E	02S	24		BOZEMAN PASS	N	PRV
TIMBERLINE NO. 3 MINE	GA003998	07E	02S	23		BOZEMAN PASS	N	PRV
TIMBERLINE NO. 4	GA004038	07E	02S	25		BOZEMAN PASS	N	PRV
TIMBERLINE NO. 5 MINE /FIVE MINE	GA003848	07E	02S	24		BOZEMAN PASS	N	PRV
TINY JACK	PK002094	09E	09S	14	DDAB	ASH MOUNTAIN	V	NF
TIP TOP	PK009104	09E	09S	9	AACC	ASH MOUNTAIN	N	PRV
TOWER GROVE (AND PRATT)	PK006706	09E	09S	23	BCDA	ASH MOUNTAIN	N	PRV
TREDENNICK / TREDINNIC	PK002130	14E	09S	11		COOKE CITY	N	MIX
UNAMED N FK BEAR CR ADIT	PK009076	09E	09S	5	ADBA	GARDINER	V	NF
UNNAMED CALCITE	PK006542	08E	01S	2		GOBBLERS KNOB	N	PRV
UNNAMED CALCITE	PK006554	08E	01S	2		GOBBLERS KNOB	N	PRV
UNNAMED CALCIUM	PK006646	10E	01S	7		GOBBLERS KNOB	N	PRV
UNNAMED CALCIUM	PK006530	08E	01S	11		GOBBLERS KNOB	N	PRV
UNNAMED CALCIUM	PK006626	08E	01S	12		GOBBLERS KNOB	N	PRV
UNNAMED COPPER MINE - SQUAW PEAK	SG001610	13E	03S	10		SQUAW PEAK	N	PRV
UNNAMED GOLD PRIZE CREEK PROSPECTS	PK009013	08E	07S	4	BBB	DAILEY LAKE	V	NF
UNNAMED LOCATION	GA004003	04E	06S	27		GALLATIN PEAK	S	NF
UNNAMED LOCATION - FLATHEAD PASS	GA009001	06E	02N	30		FLATHEAD PASS	S	NF
UNNAMED LOCATION - MISER CREEK	GA009000	06E	01S	8		MISER CREEK	S	PRV
UNNAMED LOCATION, NEW WORLD GULCH	GA004518	06E	03S	12		MOUNT ELLIS	S	S
UNNAMED MINE	PK006790	08E	06S	24		EMIGRANT	S	MIX
UNNAMED MINERAL HILL ADIT	PK009015	09E	09S	9	ADAA	ASH MOUNTAIN	V	NF
UNNAMED N FK BEAR CR ADIT	PK009073	09E	08S	32	DCAD	GARDINER	V	NF
UNNAMED N FK BEAR CR ADIT	PK009069	09E	08S	32	DACC	GARDINER	V	NF
UNNAMED N FK BEAR CR ADIT	PK009070	09E	08S	32	DBAD	GARDINER	V	NF
UNNAMED N FK BEAR CR ADIT	PK009079	09E	09S	4	CCAB	GARDINER	V	NF
UNNAMED N FK BEAR CR ADIT	PK009074	09E	09S	5	AACD	GARDINER	V	NF
UNNAMED N FK BEAR CR ADIT	PK009075	09E	09S	5	ADBA	GARDINER	V	NF
UNNAMED N FK BEAR CR ADIT	PK009077	09E	09S	4	CCAB	GARDINER	V	NF

NAME	MBMG ID	R	T	SEC	TRACT	QUADRANGLE	CODE	OWNER
UNNAMED N FK BEAR CR ADITS	PK009067	09E	09S	5	ADDD	GARDINER	V	NF
UNNAMED N FK BEAR CR ADITS	PK009071	09E	08S	32	ACBB	GARDINER	V	NF
UNNAMED N FK BEAR CR ADITS	PK009068	09E	08S	32	DDC	GARDINER	S	NF
UNNAMED N FK BEAR CR PIT	PK009078	09E	09S	4	CCAB	GARDINER	V	NF
UNNAMED N FK BEAR CR PROSPECT PIT	PK009072	09E	08S	32	ACDC	GARDINER	V	NF
UNNAMED PROSPECT	PK006738	13E	08S	10		PINNACLE MOUNTAIN	S	NF
UNNAMED PROSPECT PIT	PK006730	09E	09S	3	C	ASH MOUNTAIN	S	MIX
UNNAMED PROSPECT WEDOW'S 14-16	PK008626	13E	08S	11		PINNACLE MOUNTAIN	S	NF
UNNAMED PROSPECTS	PK006726	09E	09S	4		ASH MOUNTAIN	S	MIX
UNNAMED PROSPECTS-WEDOW'S 1-8	PK006702	13E	08S	10		PINNACLE MOUNTAIN	S	NF
UNNAMED PUMICITE DEPOSIT	GA004128	05E	03S	12		WHEELER MOUNTAIN	S	PRV
UNNAMED RARE EARTH DEPOSIT	MA003205	02E	04S	30		CHERRY LAKE	S	NF
UNNMAMED SEC 18 9S 9E	PK009080	09E	09S	18	DACC	GARDINER	V	NF
UPPER HELLROARING -REGINA/RED CHIEF	PK002196	11E	07S	16	D	IRON MOUNTAIN	S	NF
UPPER PINE CREEK AREA	PK008640	09E	09S	11	DBBB	ASH MOUNTAIN	V	MIX
UPPER ROSS MINE / ROSS MINE	GA003803	07E	02S	24		BOZEMAN PASS	S	PRV
VINDICATOR	PK002346	09E	09S	22	BBCA	ASH MOUNTAIN	S	NF
W. FK GALLATIN RIVER SYNCLINAL AREA	GA004203	04E	08S	6		OUSEL FALLS	S	NF
W. FORK-GALLATIN RIVER PHOSPHATE	GA004163	04E	06S	32		GALLATIN PEAK	S	NF
W. M. CLAYTON PLACER	PK006823	09E	06S	29		EMIGRANT	S	MIX
WALTON PROSPECT	GA004423	04E	08S	22		SUNSHINE POINT	S	NF
WATSON GROUP -CROSSCUT & RIO GRANDE	PK002166	09E	09S	22	ABBA	ASH MOUNTAIN	S	NF
WEST FORK GALLATIN RIVER PLACERS	GA003833	04E	07S	5		GALLATIN PEAK	S	PRV
WEST OF BEAR CREEK	PK009097	09E	09S	4	BCCD	GARDINER	V	NF
WHEELON	SG008624	12E	07S	23		HAYSTACK PEAK	V	NF
WHITEWOOD GIRL	PK002202	10E	09S	1		SPECIMEN CREEK	S	NF
WILSON CREEK ASBESTOS	GA004198	05E	04S	18		GARNET MOUNTAIN	S	NF
WINONA F	PK006462	09E	07S	8		EMIGRANT	S	MIX
WISCONSIN	PK006366	08E	06S	13		EMIGRANT	S	MIX
WOODLAND MINE	GA003953	07E	02S	24		BOZEMAN PASS	S	PRV
YELLOW JACKET N0. 2	SG008619	12E	07S	22		HAYSTACK PEAK	V	PRV
YELLOWSTONE RIVER	PK002286	08E	05S	27		EMIGRANT	S	PRV

S-SCREENED OUT
V-VISITED
U-UNABLE TO LOCATE

Appendix III
Description of Mines and Mill Sites
Gallatin National Forest

Alice C
PK002058

The Alice C is a patented claim on Bulldozer Creek. It was not visited because it is private and there appeared to be no access. Stotelmeyer and others (1983) stated that there was one open and one caved adit, and one open shaft at the Alice C during the time of their investigation. Ore minerals include galena, pyrite, sphalerite and chalcopyrite in quartz vein/fracture filling and as replacements in the schist. There is no recorded production for the Alice C.

Allison Tunnel
PK006290

One adit here was discharging water but the water never reaches the active drainage. It was sampled at the source at the adit's portal.

Amit No. 5 Claim
PK008666

This site was located on the east side of the Boulder River and it consisted of two open adits when inspected by Stotelmeyer and others (1983). The mine explored the contact between schist and granitic intrusive. The adits were driven 28 feet and 16 feet, respectively. The adits were considered to be still open because of Stotelmeyer's findings. It was not visited because of the small nature of the workings.

Anderson's Spring
SG001820

These springs are used for bathing (Waring, 1965). The temperature is 70EF and the flow is 90 gpm. The surrounding rock is Cretaceous limestone. The site was screened out because it is probably on private land and is unlikely to affect GNF-administered land (geothermal).

Apex Ole Claim
PK006734

The area in sec. 35 as described in Wedow and others (1975) was visited but the bulldozer trench described was not located. The site has little or no effects on GNF-administered land.

Arrow Peak Claim
PK008674

Stotelmeyer and others (1983) described this occurrence as a 40-ft adit driven N.70EE. on a Precambrian gneiss/schist contact. The site was not visited because of limited time in the area. It was open at the time of the USGS North Absaroka study (USGS Bulletin 1505).

Bailey and Beadle
GA004043

This site was screened out because it plotted on private land. It plots on the Kelly Creek 7.5-min. quadrangle near Moffit Canyon, over 1 mile downstream from GNF-administered land. The reference for it is Johnson and others (1993) where they described it as a 450-ft-long underground mine with two other adits totaling 300 ft that were driven along the Cokedale bed. It was mined in the early 1900's.

Bald Mountain Adits
PK009007

These mine workings were investigated because of the adit symbols plotted on the Ash Mountain 7.5-min. topographic map; they were not listed in the MILS database. They consist of several short caved adits (each originally driven less than 50 ft and probably even less than 15 ft) and prospects. One adit did have a 3-ft overhang but was not considered a hazard. No sulfides or water were noted.

Bald Mountain Adit-lower
PK009014

This adit's location is shown by an adit symbol on the Ash Mountain 7.5-min. quadrangle in the SE¼ NE¼ section 9, T9S, R9E. It is open for at least 20 ft, has a 3-ft by 3-ft opening at the partially collapsed portal, and is dry. A collapsed log cabin lies to the west, closer to the road. The adit trends S55EE.

Barbara Ann
PK002106

This mine is associated with the Pilgrim and St. Croix patented claims but overlaps onto GNF-administered land. The actual workings are on public land as is the well built cabin. The two adits are still open and equipment is still present at the site. The second adit is not mentioned in Stotelmeyer and others (1983) and may postdate that study (the field work was done in 1973 and 1974). A bulldozer and two compressors (although not in working order) were abandoned. A shaft is partially caved. No environmental concerns were noted. Very few sulfides are present on the waste dumps. The mine explored a quartz-sulfide replacement vein along a brecciated shear zone in basalt (Stotelmeyer and others, 1983).

Bear Creek Placer
PK002310

The placer here was described in Lyden (1948) and he shows it stretching from Jardine down to the confluence of Bear Creek and the Yellowstone River. It was worked in the 1800's and little work has been done since. It was technically screened out, but the general area was visited and no adverse effects were noted. Most evidence of the placering has been removed by the action of the stream.

Bear Creek Springs
PK006781

These springs were described in Waring (1965) in "Thermal springs and wells in the United States". They are found in Quaternary lava overlying Precambrian rocks. The area was visited in 1999 during a study of the Yellowstone controlled groundwater area. Springs issue from the banks of Bear Creek near its mouth and travertine deposits are found along Bear Creek also. The springs were not sampled but the water was sampled at the mouth of Bear Creek.

Big Pine
PK008676

This site was visited on 11/18/99. An adit trending N30EE at the base of a talus slope and an incline driven on the same trend at the base of an outcrop 50 to 100 feet upslope were caved. Stotelmeyer and others (1983) described an open inclined shaft, one prospect and an open adit on the property in 1973-74.

The workings explored a northeast-trending, northwest-dipping shear zone in biotite schist. The ore minerals included quartz, pyrite and galena. It is on the Knowles Peak 7.5 min. quadrangle in sec.23, T6S, R9E.

Blue Lake Prospects
SG008621

These trenches and prospects are found immediately north of Blue Lake in the Independence mining district. Workings were all caved although one adit did have vertical 10-ft high walls. All were dry.

Bowers and Jones Mines
PK006418

These mines were screened out because they were coal deposits. Johnson and others (1993) briefly describe the deposit as consisting of 2–3-ft seams. The workings were mined intermittently from 1889 to1890. The Bowers was a 175-ft inclined shaft (at 40E to 60E). The Jones Mine was not described except for the fact that it produced coal for local use.

Bridge Placer
PK006634

No mention of this placer was found in Lyden (1948) but it was listed in the USBM MILS database. The area was visited because of other abandoned mines inventory, and some placer workings were noted in the general area. No environmental problems were noted.

Bridger Creek
GA004178

MINOBRAS (1975) and Johnson and others (1993) gave sketchy details for this occurrence. MINOBRAS (1975) listed it as a limestone-dolomite occurrence in the Lodgepole Member of the Madison Limestone. The site was screened out for these reasons: private, inaccurate location (+/- 1 mi), and limestone only.

Buck Creek

GA004153

This prospect was screened out because it is a phosphate prospect with no workings or production (Condit and others, 1927).

Buckskin and Johnson
PK008546

The Buckskin and Johnson was screened out because it plotted on private land outside the GNF-administered land boundary. The Buckskin mine produced coal in 1888 and a second mine, the Johnson, produced coal in 1906. The south-trending adits were driven along the Cokedale bed (Johnson and others, 1993).

Bull Moose
PK008678

One 7-ft adit explored a chlorite-bearing area in schist (Stotelmeyer and others, 1983). The site was screened out because of the small nature of the workings.

Burnt Creek
PK006494

An open adit was found to the west of the West Fork of Mill Creek. It appeared to be approximately 20 feet in original length. It is visible from the West Fork road. No aplite as described in Stotelmeyer and others (1983) was found, only a gray schist was on the waste dump.

Butte and Butte No 1 Claims
SG001586

These are probably unpatented mining claims in the vicinity of the Knapp Mine. No references were found for the location. They plotted on a dry ridgetop.

Byam Brothers
PK006430

This mine was described in Johnson and others (1993) as a coal mine with a horizontal, 170-ft adit. It was developed in1884–1885 and was worked intermittently from 1887 to 1897. It was on private land and so was screened out in the office.

Cartwright Calcite (Crystal Spar Group)
SG001784

Cartwright Calcite was screened out because it was located on private land, downstream from GNF-administered land. The commodity was calcite. Johnson and others (1993) described this property as a strong N 52EW, near vertical calcite vein in Late Cretaceous volcanics.

Cathy
PK006202

The Cathy and Spring claims lie to the southwest of the patented St. Croix and Pilgrim claims on the Knowles Peak 7.5-min quadrangle. Stotelmeyer and others (1983) showed the adit at the Cathy as open on their map but the text describes the workings as consisting of prospect pits only. The site was screened out because of the inaccessibility of the location and the inaccuracy of the description.

Chestnut (Rocky Canyon) Mine
GA003853

This mine was screened out because it was located on private land downstream from GNF-administered land. The commodity was coal. Johnson and others (1993) described 600 ft of workings including 400 ft of drifts and 200 ft of raises but then went on to say the main adit extended 10,000 ft and the No. 2 adit 4,500 ft.

Cinnamon Creek
GA004148

This prospect was screened out because it is a phosphate prospect with no workings or production (Condit and others, 1927).

Conrad Group
PK002160

This group includes the patented claims of Highland Placer, Highland Chief, Crevasse Fraction, Consolidated Mizpah, Summit, and Granite (Seager, 1944). Workings named the Blacksmith Shop tunnel, the "M" tunnel, the "J" tunnel, Conrad incline, and the Guest tunnel are included in the group. Most, if not all, of the workings are on private land. The area is also a part of the currently permitted TVX Mineral Hill project. It was briefly visited and no negative environmental impacts to GNF-administered land were noted. Two adits to the east of the Consolidated Mizpah may lie on GNF-administered land but, with the exception of some rusting iron scrap, no environmental problems were noted. The only open adits were on private land.

Cooper (upper and lower)
GA008533 / GA008534

It is unclear where these adits are located. They are in the Gallatin Range north of Bozeman in the Pass Creek mining district.

Copper Idol
PK008656

This site consists of a small caved adit with very slight discharge (less than ½-gallon per minute) and with a waste dump near the east edge of Goose Lake. This adit trends S.50EE. There is another caved adit higher on the hillside. Simon and others (1979) described the mineralization here as a 6-ft thick, east-trending shear zone with fine grained sulfide minerals. They defined it as having 2 caved adits and 5 trenches.

Copper King
PK002430

The shaft here is caved and flooded; it is on private land. The site was sampled upstream and downstream on public land. It appeared to have recent exploration, and a trailer house ruin was present.

Copper Pit
GA008531

This site was screened out because it was plotted on private land, and Johnson and others (1993) described it as an eastward trending caved adit (100 ft). The mineralization was hosted by LaHood arkose with traces of copper oxides and chalcopyrite.

Copper Queen
PK008568

This mine lies to the east of Anderson Creek (Stotelmeyer and others, 1983) and the two adits, pit and trench were badly sloughed. The mineralized structure was along a contact between limestone/shale and a porphyritic andesite. The primary ore mineral was chalcocite with a gangue of siderite and calcite coatings on fractures. The site was screened out because of the small nature of the deposit and the sloughed nature of the workings as described in Stotelmeyer and others (1983).

Corwin Hot Springs
PK006811

This spring was screened out because it was located on private land and it was a geothermal occurrence.

Corwin Springs
PK006582

This site was screened out because it was listed in MILS as a uranium occurrence and it had no references except for CRIB. The ownership was unknown.

Coulston
GA009021

This mine is located on the Bozeman Pass 7.5-min. quadrangle and is on private land. It was screened out.

Crevasse Creek
PK002292

This placer gold occurrence was noted in Lyden (1948) who stated that it was discovered in 1863 and that the production was never large. The location was inaccurate; only that placers were worked intermittently on Crevasse Creek.

Crow Mine
SG001814

This small adit lies to the east of Box Canyon Creek. It was visited on 07/21/99 by hiking down a steep hill from the gravel road and then following the creek. A log cabin in poor condition lay

to the north. The small adit was located but did not have a discharge, was totally caved and the waste was not in contact with the creek. It appeared that the rocks at the adit portal had been recently sampled (in 1999). Pete Northcutt, a small miner, was doing exploration in the area and reported finding the adit, also. The adit was sampled in 1991 by USBM and the results are in Johnson and others (1993).

David
PK006218

The David was described and its location shown in Stotelmeyer and others (1983). The David adit was still open when visited in October of 1999 but the portal was partly sloughed. Although technically the waste was in contact with the drainage, negative effects of this mine were determined to be unlikely because of its size and because most of the waste was blocky. Stotelmeyer and others (1983) said that the adit length totaled only 15 ft. They sampled the more limonite stained material and found it to contain 0.35 opt Au, 1.3 opt Ag and 0.85 % Bi.

Deer Creek
SG001838

Three adits were described at the Deer Creek occurrence in a U.S. Bureau of Mines mineral property file. This is an iron deposit consisting of magnetite lenses exposed along the ridge. This was considered an iron deposit and it was estimated that a resource of 20,000 to 50,000 tons at 65.2 percent iron, 1.12 percent aluminum and 5.12 percent silica was present (Johnson and others, 1993). The site was screened out because of the ridgetop location, inaccurate location, and the lack of access.

Dryden
PK002148

The Dryden mine is described in Reed (1950) as “a series of narrow and discontinuous lenses of glassy quartz ... exposed by this adit over a strike length of 300 feet.” He did not note any sulfides although some iron staining was present. The host rock is quartz-biotite schist. The mine lies just less than ⅛-mile from the YNP boundary to the northeast of Crevice Station and is shown by an adit symbol on the Ash Mountain 7.5 min. quadrangle map. Two caved adits were located. One trending N05EW was largely caved with a 2-ft hole remaining and with a small waste dump (probably less than 30 ft, total length). The other appeared to be a start of an adit trending S.35EE. on the southeast side of the creek. A quartz pod in schist was exposed in the face.

Elkhorn Creek
GA004453

This prospect was screened out because it is a thin bedded (8 inches) phosphate prospect (USGS Bull 795-6, 1920) with no workings or production (Condit and others, 1927).

Empire Hill PK002190
Empire State / Vanity Fair PK006586
Upper Pine Creek Area PK008640

These are two patented claims at the base of "Empire Hill" approximately ½-mile north/northeast of Palmer Mountain in section 11. Two adits and two shafts were all inaccessible in 1944 (Seager, 1944). The host rock was a biotite schist with possibly some association with a quartz latite porphyry extrusive on Palmer Mountain. The ore was found in lenticular quartz bodies with some arsenopyrite (Seager, 1944). This site also coincides with the "upper Pine Creek area" of Wedow and others, 1975. They describe an open shaft, timbered with water within 12 ft of the land surface on USFS-administered land to the south of Empire Hill. This shaft was not located in 2000. One open adit lies adjacent to the Palmer Mountain trail near a switchback. The adit is on GNF-administered land.

Fairy Lake
GA004098

The Fairy Lake site was visited but only three small prospects were found on the ridgetop about 1 mile north of Fairy Lake. The 20-ft deep shaft mentioned in Johnson and others (1993) was not located. One caved mine working was located adjacent to the trail. The location was inaccurate as described in Johnson and others (the prospect pits are 1,200 feet due north of the shaft).

Featherstone
PK006438

This mine was screened out because it was a coal mine that reportedly only produced for one year in the yearly 1900's. It was located on private land. The location came from Johnson and others (1993), who described it as a 55-ft inclined shaft developed on the Big Dirty coal bed.

First Chance (Lewis-McBride)
PK002142

The First Chance mine consists of five patented claims: the Columbus, First Chance, Homestead, Topeka, and Delaware (Seager, 1944). This group occurs near the center of section 22, to the west edge of the patented claims in this area. No workings were noted on public land.

The mine explores quartz veins (some up to 30 feet thick) in schists. Ore minerals include arsenopyrite, pyrite and galena (Seager, 1944). Main workings at the first chance include an adit and an inclined shaft (all on private land).

First Out
PK006775

The First Out mine's location plotted on private land. According to Johnson and others (1993), the mine is hosted by an orthoclase-gneissic schist striking north and dipping 90E. One caved adit was driven south (50 ft long).

Floyd Counts
PK006286

The Floyd Counts prospect was not found even though it was searched for. Stotelmeyer and others (1983) showed the location on a map but after examination of the area, no workings were found. Talus covers much of the slope and may have covered the workings. The slope was

walked and then later examined with binoculars to try and spot the workings. An open adit and a trench were described in Stotelmeyer and others (1983).

Foster
PK006414

This deposit was screened out because it plotted on private land and the commodity was coal. Johnson and others (1993) stated that it produced 75 tons of coal per day from 1907 to 1910 from an 800-ft inclined adit. No other data was given.

Gardiner Travertine Quarry
PK002802

This site is still partially active on a small scale. It is described in Reed (1950). The general area was visited but no adverse effects were noted.

Gardiner Travertine Saw
PK006750

The commodity here is dimension stone (travertine) and the location is inaccurate. The site was screened out.

Glengarry
PK002850

The Glengarry mine is one of the major producers of the New World mining district. It is part of the New World Mining District Response and Restoration Project. It was excluded from the inventory because it was being included as a part of the larger study. It is one of the major discharges in the district.

Gold Dust
PK006570

The Gold Dust also had a discharging adit, eroding waste, and a hazardous structure but was considered to be part of the New World Mining District Response and Restoration Project and so was not evaluated for this project.

Gold Hill Mine
SG001976

The Gold Hill mine was visited 07/20/99. The adit was completely caved, and the waste was not in contact with the active drainage. A mill was found down from the mine and is described separately. Johnson and others (1993) sampled the mine in 1991 and found no significant assays. The area was claimed in 1999 by Pete Northcutt (a small miner, actively exploring in the area in 1999) as the Lodestar claims. Johnson and others (1993) estimated the adit at 175 ft in length; no production was noted. They described the host rock as a strongly altered quartz latite.

Gold Hill Mill
SG009002

This mill site is in total ruins and the small pile of tailings is in the floodplain. The building is represented by concrete foundation footings and a pile of boards. Most of the building is gone. Pete Northcutt, a mining engineer who had claims in the area, reported that this mill was a mercury amalgamation facility.

Gold King
PK008592

This mine is briefly described in Stotelmeyer and others (1983) as having one open adit and a caved shaft. The workings explored a quartz fissure filling in a biotite schist. The quartz contained a about 5 percent pyrite and 10 percent limonite. The general area was visited but no adit or shaft was found in the area. Two cabins and a prospect were found in the general vicinity.

Gold Leaf and Gold Leaf No 2
PK006258 and

The Gold Leaf and Gold Leaf No. 2 were described in Elliot and others (1977) as consisting of a patented claim and the northward extension of it. The Gold Leaf had a 110-ft adit which was caved in 1977, and No. 2 had a 20-ft caved shaft. These sites were screened out because it is a patented claim and because of the inaccessible terraine. The general area was visited and no discharging adits were noted. The site plots on the Emigrant 7.5-min quadrangle.

Great Eastern and Great Western
PK006250

These two patented claims and associated unpatented claims have been almost totally obliterated by snowslides and recent exploration activities. A sign marking the patented claims was found just before the creek crossing. No open adits were noted and no environmental concerns were noted. The area was visited 08/26/99.

Green Lake Prospect
PK008660

This site is described in Simons and others (1979) as consisting of one caved adit exploring a shear zone striking N.85EW. and dipping 40ESE. It is shown as being due east of the Lazy Beetle. It is in a major joint in a mica schist. The area was visited in 1999 but the prospect was not located.

Half Moon Mine
PK006829

The Half Moon mine was viewed from the Forest Service trail and no discharge was noted. The adit was caved. Johnson and others (1993) recently sampled the deposit and have a photo of it in their report. The deposit was mined in the 1950's by the Half Moon Mining Company and was later explored by Viking Exploration, Inc. Some high-grade ore was shipped from the area via tram from tunnels on the northeast end of Granite Creek. These mines all explore shear zones in the Big Timber igneous complex diorite. A sulfide zone was mined. The mine was isolated; access was by improved gravel road (Forest Route 197) and then by trail (Forest Trail 119).

Hanlon Hill Workings
PK009016

It was unclear if these workings were considered to be part of the Standard Group or the Hazel, so a separate entry was made for them. The prospects, trenches and adits were all dry and caved. Some of the adits had caved to the surface but were not considered dangerous. There were at least five caved adits. The workings are in dark gray schist with brick red iron staining, with dark gray to clear quartz veins.

Hodson
GA008540

This site was screened out because it was on private land and probably had little or no impact to GNF-administered land. The property consisted of an inclined shaft and a 650-ft adit (Johnson and others, 1993). This coal mine operated from 1883 to 1910.

Honolulu
PK008558

The Honolulu is plotted on private land outside the Forest boundary. It consisted of one caved adit (Johnson and others, 1993) 50 ft long. The host rock was schist with a shear zone containing quartz mica schist, limonite, quartz vugs and chalcopyrite. It was screened out because it was on private land.

Horseshoe
PK008635

Reference to this site was found in Stotelmeyer and others (1983) who described the workings as consisting of two 8-ft shafts and five pits. The geology consists of quartz veins in schist, quartzite, quartz amphibolite and gneissic granite. It was screened out because of the small nature of the workings and the location on a dry ridge.

Hot Shot
PK006474

This site was screened out because it was a travertine deposit. One adit in the gulch bottom was described in Johnson and others (1993) and is presumed to be open.

Intermediate
PK008541

This site was screened out because it was on private land and probably had little or no impact to GNF-administered land. The inclined shaft was at 24E and was driven 275 ft (Johnson and others, 1993); it was a coal mine.

Iron King
PK006566

One adit, as described in Stotelmeyer and others (1983) as being 153-ft long – including drifts, was found approximately 25 feet downhill from the Bear Creek trail. It trends N37EW, and the portal opening was 4 ft by 6 ft high. The portal was partially caved but still accessible. The trail

above is used by recreationalists (horses and hikers). There is a small storage area to the left just inside the adit.

The quartz/arsenopyrite veins are 0.2 ft wide and are hosted by pervasively limonite-stained folded and sheared quartz-cummingtonite schist (Stotelmeyer and others, 1983).

Jewel Property
GA004493

A total of about 2000 cubic yards of material was handled (placer production records, confidential U.S. Bureau of Mines files). This property was screened out because of low production and because it is a placer deposit located on private and NF land (Lyden, 1948) which will likely have little impact on GNF-administered land.

Jumbo Placer
PK006722

This mine was described in MBMG Memoir 20 as the placer and nine unpatented claims near Jardine. It employed seven men during the summer of 1939 and was worked by several tunnels, 50- to 100-ft long. No other mention of it was found in literature. It is probably the same as the more general Bear Creek Placer described in Lyden (1948). The general area was visited but no visible adverse effects were noted. Most evidence of placering have been washed away by the creek.

Kangley
PK002608

This site was screened out because it was private and was unlikely to affect GNF-administered land. It was a coal mine (Johnson and others, 1993).

Kelly (Badger Group)
SG001808

One adit, discharging water, was found to the north of Granite Lake on a small saddle. This mine was held at one time by Belle Mining Co., of Butte, MT. It was discovered in 1900 and was last explored in 1929 according to Reed (1951). Only oxides were found the waste rock dump, mined from a NW-trending fracture zone in diorite (Reed, 1951). The adit was supposedly 467-ft long (Johnson and others, 1993) and was partially open when visited in 1999. The adit discharge infiltrated into the waste dump and re-emerged at a steep rock face to the east and then trickled down to the twin, unnamed lakes to the north. See the write up in the main section of this report for this mine.

Knapp Mine
SG001574

This iron occurrence was screened out and not visited because of the ridgetop location and because Pete Northcutt reported that the adit was caved and dry; Northcutt had active mining claims in the area and had visited many of the mines. Johnson and others (1993) described two

open cuts and the USBM resampled the location in 1991. Tertiary quartz diorite and Cretaceous limestone and shale hosts the iron-copper mineralization (Johnson and others, 1993).

Kreiger Ditch Adit
PK002100

This short adit was described in Wedow and others (1975) as exploring quartz zones in a "fissile and contorted schist". It is open its entire length of approximately 30 ft. It was visited in August, 2000. There was no discharge and no erosion. It was in schist.

Lasich
GA004048

This coal mine was screened out because it occurred on private land with little or no chance of impacting GNF-administered land. It plots over a mile downstream of the Gallatin National Forest boundary on Moffit Canyon on the Kelly Creek 7.5-min. quadrangle. It is described in Johnson and others (1993) as consisting of a 682-ft adit, two other adits of unknown length and a shaft.

Lazy Beetle
PK002244

These prospects are east of the road to Goose Lake and the lower prospect is visible from the road. One open adit is on the north side of an east-west trending mafic dike. The site is by the Wilderness boundary sign and is open at least 20 ft. A 10-ft-deep shaft there has gentle sides and is not a hazard. The adit trends N60EE and follows a 37E dipping quartz-pyrite vein. Sample results from this area and a short description are in Simons and others (1979).

Limestone occurrence - Brisbin Quad
PK006662

This site was screened out because it is a limestone occurrence with no references. It is also private.

Longstreet
PK002454

The Longstreet is included in the New World Mining District Response and Restoration Project. It is described as a contact-metamorphic deposit in Gros Ventre limestone (Lovering, 1929). Minerals associated with the site include magnetite, chlorite, garnet, hematite, and tremolite. It was screened out in the office.

Lori Kay / Black Diamond / War Eagle
PK006458

This mine was originally plotted on the northeast side of War Eagle Mountain approximately at 8,000 ft to 8,500 ft elevation. Workings include 5 adits and 2 caved shafts (Stotelmeyer and others, 1983). The mine is hosted by Precambrian gneisses, Paleozoic limestone, and Tertiary intrusives and extrusives (Stotelmeyer and others, 1983). The mine is located on a remote slope and is difficult to find. The USGS report lists at least two open adits.

Lorraine
PK008655

This prospect or short adit is located on a talus of granite but was driven in a gabbro (?) dike. Mineralization includes magnetite, chalcopyrite, and malachite. There are a few rotten timbers on the dump and the adit has a slight overhang but no safety hazards were noted. The start of the adit trends S38EE (but the compass direction may be skewed because of the magnetite on the dump).

Majestic and Flora B. Claims (McHugh)
SG001562

These are two patented claims; Thomas McHugh was the original claimant. Johnson and others (1993) quoted a U.S. Bureau of Mines mineral property file that there were two "hand-work" adits located on the claims. They were only 25 and 63 ft long. The mines were driven in anorthosite, exploring scattered sulfide mineralization in small irregular patches and along fractures. These mines were screened out because development work was most likely on the patented land.

McCauley
PK002136

This site consists of two patented claims: the McCauley and the George Washington fraction (Seager, 1944). It was not visited because the workings are entirely on patented land as plotted. It was listed in Reed (1950) as a gold and scheelite property.

Meadow Creek
GA004173

The Meadow Creek site was screened out because it was located on private land. Secondly, it was alternately described as a limestone or dolomite deposit (MINOBRAS, 1975) or a coal deposit (Johnson and others, 1993). The coal mine was started in 1884 and was operated at least until 1922.

Mica Creek Deposit
GA004503

This occurrence was visited 08/10/99 and was accessible only by foot. It lies on the north side of Mica Creek and is marked by a prospect symbol of the Garnet Mountain 7.5-min. quadrangle. It is a large (20- to 30-ft high) outcrop and a shallow prospect in a coarse-grained mica-rich gneiss. The mica did not react like vermiculite when tested. No further investigation into the exact kind of mica was done. The bouldery waste was technically in contact with Mica Creek but no effects were discerned.

Midnight
PK008687

This iron-manganese occurrence lies in the Arrastra Creek drainage in the same general area as the Galena Queen and the David mines. No hazards were noted. It consists of iron and

manganese bog deposits and cemented alluvium and colluvium. The occurrence is associated with the present-day springs in the area. Stotelmeyer and others (1983) sampled the deposit.

Mill Creek
PK002304

This deposit was screened out because it was a small placer occurrence. The description in Lyden (1948) inferred that while a few placers were worked in the 1930's, there was little interest in the possibilities of placering in this area.

Mill Creek Canyon Barite
GA004193

This site was screened out because it was a barite occurrence as described in MINOBRAS (1975) and in Johnson and others (1993). No other information was found.

Miller Mine (Nos. 1 and 2)
GA003983

Johnson and others (1993) had no data on this mine except that it was a coal deposit. It was screened out because it plotted on private land with unlikely or minimal impacts to GNF-administered land.

Mineral Hill Adit
PK009015

This adit lies north of the unimproved road FS6945 just west of the section line between secs.9 and 10. The adit is totally collapsed but trends under the road (S30EE). It has a fairly large waste dump (>200 ton).

MKB No. 7
GA008535

This site was visited on 07/21/99 and three trenches were found, one with a dangerous highwall. This is a group of claims numbered at least 1 through 7. The 3-ft by 5-ft and 100-ft to 150-ft long adit described in Johnson and others (1993) was not located. The caved inclined shaft was not located either. The workings were on a high and dry ridge and there was no water component. Johnson and others (1993) stated that the occurrence was hosted by a heavily silicified LaHood Formation arkose and black shale with mineralization including galena, covellite, chalcopyrite, pyrite, barite, and calcite.

Moger Mica Mine
MA004127

This mine was screened out because it was a mica mine and Johnson and others (1993) stated that the workings consisted of a shallow cut. The deposit was described as a pegmatite chimney in the Madison Range (Johnson and others, 1993).

Moonlight
PK006793

This site screened out because it had no references except for CRIB and the location was inaccurate. It plotted in sec. 23 near the town of Gardiner. The commodities were listed as gold, silver and copper in MILS.

Mountainside Mine
GA003988

This coal mine consisted of 3,000 ft of drifting along the Cokedale bed (Johnson and others, 1993) but it was screened out because it occurred on private land. It plots on the Bozeman Pass 7.5-min. quadrangle and is over a mile outside of and downstream of the Gallatin National Forest boundary to the east of Meadow Creek. It is associated with the Rocky Canyon (Chestnut) mine. Additional workings were driven after the two mines were connected.

Mount Cowen Molybdenum
PK002268

Also known as the Mount Cowen Area or Frozen Lake Group, this occurrence was explored as a molybdenite and a uranium prospect. Reed (1950) described the workings as consisting of shallow prospects only; Stotelmeyer and others (1983) found no workings at all. The site was screened out because of the small nature of the workings.

Murphy Mine
GA003579

This mine was screened out because it had no references and because it plotted on private land. The only details were found in the MILS database.

Nancy
PK002112

The Nancy is described in Reed (1950) as having a 30-ft adit and a few prospects in quartz/pegmatite bearing schists and quartzites. It is unlikely to have an effect on GNF-administered land. The location is described as “a few feet above the stream level” on the West Fork of Mill Creek in section 24. It was not located and was screened out. It was not mentioned in Stotelmeyer and others (1983).

Newton
PK006426

This site was screened out because it was located on private land. It is a coal mine developed on the No. 2 and No. 3 coal beds. According to Johnson and others (1993), it was one of two chief bituminous coking coal mines in the eastern portion of the Electric coal field for 14 years. It was mines by a 1,000 ft inclined shaft with a 20-bucket aerial tram transporting the coal to the tipple.

New World
PK002028

The New World is a patented mining claim as well as the name of the mining district and the recent project by Noranda.

Northern Pacific Coal Company
PK002656

This entry is actually a group of mines around Cokedale, west of Livingston. It is totally private so no further work was done on it for the AIM program. Johnson and others (1993) briefly described it.

Number Thirty
PK008544

The Number Thirty was screened out because it was on private land and probably had no impact on GNF-administered land. It was a coal mine (Johnson and others, 1993) that operated from 1932 to 1934 (and maybe other years). Coal was mined from the Cokedale bed by a 500-ft adit and a later 600-ft adit.

Ore Cache / Cache of Ore
PK006390

These are two patented claims in sec. 32, T9S, R15E, to the southeast of most of the patented claims in the New World area. Johnson and others (1993) describe the workings as two caved shafts and two other workings that may have been shafts or pits. There is no known production for this mine. It is hosted by manganese-stained Pilgrim Limestone.

Oregon Mountain Area
PK008641

The Oregon Mountain area is a general description of the prospects in the vicinity of Oregon Mountain by Wedow and others (1975). It includes the Kreiger and the Tiny Jack as well as other unnamed prospects in the area. It was visited in August 2000. The only open adit was at the Kreiger.

Pendleton
GA008543

This mine was screened out because it was on private land; unlikely or minimal impacts to GNF-administered land were expected from this site. Johnson and others (1993) described it as a 390-ft adit driven on the Cokedale coal bed that produced from 1943 to 1947.

Pete Pear/Peter Peyer
PK002406

This group of closely spaced adits was visited 08/26/99 but no open adits were found. The site is in an avalanche chute, and talus had covered many of the mine workings. Elliot and others (1977) and Stotelmeyer and others (1983) described the workings and at that time, many of the adits were open.

Pilgrim and St. Croix
PK006334

The Pilgrim and St. Croix are two patented claims south and west of the Barbara Ann mine. Stotelmeyer and others (1983) described two caved adits and some prospect pits here. The site was screened out because it was private.

Poor Man
SG008615

Johnson and others (1993) cited Moyle and others (1989) in describing this mine as consisting of 1 open adit, 2 open shafts, 1 caved adit, 2 caved shafts, 1 trench, and 7 pits. The area was walked in September 1999 and no open adits were noted. Moyle and others (1989) described the geology explored by the workings as diorite with several near-vertical, northwest-trending shear zones.

Porcupine Ridge Stone
GA009003

This site was screened out because the commodity was listed as stone in the MILS database and the accuracy was +/- 1 km.

Regina / Red Cliff / Upper Hellroaring
PK002196

These two claims are mentioned in Wedow and others (1975) but are not accurately located in the text of the report. The location is described as “west of Elk Creek” but the only prospects in the area were found near the junction of the main stem of the West Fork of Hellroaring Creek and the East Fork of the West Fork. Only two prospects were found by the USGS and the claim was originally located in the late-1800's; no further development work is documented. The site was screened out in the office.

Republic Mill
PK009017

The Republic mill lies in sec. 36, T9S, R14E near the end of the road along Republic Creek. The buildings are completely collapsed and various mining/milling debris remains at the site. There are at least 15 empty 55-gallon drums, an old Schram compressor, and rusting metal. A tailings pond was well vegetated and dry; it appeared to be intact. A small patch of tailings (sulfide slimes) were found next to a collapsed building (mill?).

Robert E. Lee Copper Occurrence
PK006254

This site was screened out because it plotted on private land downstream from GNF-administered land. Stotelmeyer and others (1983) shows two open adits at this site but their existence was not confirmed.

Ross Mine
GA003803

This site was screened out because it was located on private land. It was mined from 1934 to 1941 from two levels of an inclined shaft (Johnson and others, 1993).

Rudd Property
PK006746

The Rudd property and the Raymond Rudd No. 2 are probably the same site. It was described as a uranium prospect along the contact of schist and granite. The workings were prospects only (Stotelmeyer and others, 1983).

Ross Mine
SG001766

The one adit, partially open, lies on the west side of Placer Gulch. The waste dump was close to the drainage but was not in contact with the creek when it was visited 07/20/99.

Sharon Sue and Contact
PK006238

These two claims are described in Stotelmeyer and others (1983). The Sharon Sue consisted of two caved adits in Cambrian sandstone associated with a contact with volcanics. They were screened out as having negative environmental impacts because of the small nature of the workings.

Shawn Marie
PK008593

This mine was described as a caved, 10-ft shaft that explored a contact between a metasedimentary rock and a mafic dike (Stotelmeyer and others, 1983). The general area was visited during this study and no workings were noted. The shaft may lie uphill and to the west of the Gold King claim.

Silver King Mine
SG001772

The area in which this mine was plotted was walked but no workings were found. Pete Northcutt, a small miner with active claims in the area, also confirmed that he was unable to locate the workings as plotted on the map. Gilbert (1935) reported 15 unpatented claims in the area staked by the Silver King Mining Company. He described open cuts and pits exposing a 20 ft wide vein. Gilbert listed this mine as being last worked in 1933. The area was sampled by Johnson and others (1993) with the results reported as the Iron Mountain/Gold Hill area.

September Morn
GA004618

The September Morn was visited by MBMG staff 07/23/99. It is also known as Pass Creek or Johnson and is located on the Flathead Pass 7.5-min. quadrangle. A lower adit and upper open cut were located and were dry. The adits are driven in coarse grained arkose and shale beds. The lower adit trends S. 38EE. and has a steep, but not vertical, highwall. The waste rock consisted of blocks of arkose, fragments of shale, and vein of quartz, galena, and a blueish, metallic mineral. The upper working, accessed by a very steep 4-wheel drive road, appeared to be an open cut. It also explored veins in the arkose and shale. There were several other small beginnings of adits

and prospect pits in the immediate area. Reed (1951) stated the workings totaled 750 ft and explored a narrow vein in dacite. This does not exactly fit the location described as visited. Johnson and others (1993) also described the area and their description fit more closely. The area is accessible by a 4-wheel drive road. This road was supposedly built by the government in 1944. Berg (pers. communication, 1999) said that there was a small barite operation at the mine in the recent past.

Sheridan
GA008532

This site was screened out because it consisted of one caved shaft on private land according to Johnson and others (1993). It plotted close to the Copper Pit as described earlier.

Sixty-five
PK006698

This site is referenced in Johnson and others (1993) as having biotite-amphibolite schist host rock striking N.07EE. and dipping 40ENE. It consists of one caved adit trending N. 35EW. and 200 ft long. It was sampled in 1991 by the USBM.

Skytop Creek
PK008691

This occurrence was screened out because it was described in Simons and others (1979) as consisting of one trench and one caved adit. The 4-ft thick mineralized sulfide-bearing zone was described as being in granitic rock. The location was inaccurate.

Standard Group
PK008634

Visited in August 2000, this group consisted of several dry workings.

Stemwinder
PK008669

This prospect reportedly had a small shipment of ore in 1929. It was discovered around the turn of the century (Johnson and others, 1993). The general area was visited and no effects to GNF-administered land were noted.

Stinking Water Mine (Q & H - Nos. 1 & 2)
GA003993

This mine plotted on private land and no references were found for it except for the basic information from the MILS database and so it was screened out.

St. Julian Mine/Group
PK006820

The St. Julian was the target of recent exploration by Duval Corporation. The workings are primarily on patented claims with additional adits and small pits on National Forest land. One adit on the knob to the south of the adits (Bottler shaft of Elliot and others, 1977) was considered

open and hazardous. It was only accessible by 4-wheel drive vehicle or by hiking. No environmental factors were noted at the St. Julian.

Surprise Mine
SG001790

The mine represented by the adit symbol on the map could not be found but another adit on the southeast side of the drainage was included as the Surprise mine. It had an adit discharge and was sampled. Pete Northcutt, a mining engineer with claims in the area, also stated that he could not find the adit represented by the symbol on the map.

Taylor Creek
GA004138

This phosphate prospect was screened out because of poor location and lack of data suggesting that it was not worked.

Taylor Creek Phosphorous
MA003443

This prospect was screened out because the location lies on private land and has minimal likelihood of impacting GNF-administered land.

Thompson #1
GA004168

This site was screened out because it had an inaccurate location (+/-1 km) and it was classified as a mica deposit in MINOBRAS (1975).

Thumper Lode
GA004473

This mica deposit had one open adit (at least 40 ft long) and highwalls when visited 08/10/99. The timber and lagging were buckling and splintering. The adit was caved from above at the 40-ft length. It was dry. Four lengths of 18-in. diameter plastic culvert were on the ground in front of the adit and a pickup truck was parked nearby. There were two open cuts on the hillside above with 10–20 ft slopes. Mica (muscovite?) was abundant on the dump and the host rock was gneiss, silty quartzite, graphic granite, and amphibolite. It was mined in 1954 and 1956 through 1962 (McMannis and Chadwick, 1964).

Timberline Nos. 1 and 2
GA008542

These mines were screened out because they lie on private land and had no or minimal likelihood of impacting GNF-administered land. They are coal mines.

Timberline No. 3
GA003998

This site was screened out because it plotted on private land and no references were found for it except for the basic information from the MILS database.

Timberline No. 4
GA008545

Johnson and others (1993) described this mine as an 850-ft adit that served as a haulageway from the Timberline No. 1. It plotted on private land on the Bozeman Pass 7.5-min. quadrangle, with unlikely or minimal impacts to GNF-administered land. It lies over 3 miles from and downstream of the Gallatin National Forest boundary.

Timberline No. 5
GA003848

No references were listed for this mine and it plotted on private land. It was therefore screened out from further consideration.

Tiny Jack
PK002094

This location is described as a tungsten prospect (Wedow and others, 1975) with only prospect pits and some open cuts. It is located along the Krieger Ditch inside the Absaroka-Beartooth Wilderness. It was visited August 2000. All workings were dry. No verified adits were found, only some shallow workings with small waste dumps. A small cabin in good condition was still present at the site. It is accessible only by foot and is located by walking the Kreiger ditch.

Unnamed Calcite - Gobblers Knob
PK006530

This site was screened out. It is on private land and is a calcite occurrence. No references except for MILS were found for it.

Unnamed Calcite - Gobblers Knob
PK006542

This site was screened out. It is on private land and is a calcite occurrence. No references except for MILS and USGS Bulletin 1042-M, plate 23, location # 15, were found for it.

Unnamed Calcite - Gobblers Knob
PK006554

This site was screened out. It is on private land and is a calcite occurrence. No references except for MILS and USGS Bulletin 1042-M, plate 23, location # 46, were found for it.

Unnamed Calcite - Gobblers Knob
PK006626

This site was screened out. It is on private land and is a calcite occurrence. No references except for MILS were found for it.

Unnamed Calcite - Gobblers Knob

PK006646

This site was screened out. It is on private land and is a calcite occurrence. No references except for MILS were found for it.

Unnamed Copper Mine - Squaw Peak Quad

SG001610

This site was considered but was screened out because it lies outside the Forest boundary and is unlikely to impact GNF-administered land. There were no references to it in MILS. The commodity was listed as copper.

Unnamed Location - Miser Creek Quad

GA009000

This location was screened out because it is on private land and it is an unnamed location with an accuracy of +/- 1 km. It is unlikely to affect GNF-administered land.

Unnamed location - Flathead Pass Quad

GA009001

This site was screened out because it is a phosphate prospect with no references and the accuracy is +/- 1 km.

Unnamed open adit

PK008653

This adit is located due east of the north end of Goose Lake and north of the Lorraine mine. The adit trends N10EE and is open for at least 15 ft but probably less than 20 ft. It is driven in granite and is dry. The opening is 3 ft by 18 in.

Unnamed Prospects on Ash Mountain Quadrangle

PK006726, 6730 etc.

These were screened out because the locations were inaccurate, there were no references, and they may be the same as lower Pine Creek area as described in Wedow and others (1975).

Unnamed Rare Earth Deposit

MA003205

This site was screened out because it is an unnamed rare earth deposit with an accuracy of +/- 1 km, and no references were listed in the MILS data base.

Upper Ross Mine

GA003803

Screened out because the site is on private land, this mine is a part of the Ross Mine. It is a coal mine. It is referenced in Johnson and others (1993).

US Mint and US Treasury

PK002256

The US Mint unpatented claim and US Treasury patented claim are north of Lulu Pass near an unnamed lake in the New World mining district. A cabin in poor condition lies on the property. The adits, prospects and shaft lie along a contact between granite/gneisses and a maroon red shaley rock. Adits are not extensive but many were started. No hazards were noted.

Vindicator
PK002346

A 415-ft adit was driven N.76EE. and is located approximately 2,100 ft northwest from the First Chance adit. The adit encountered orthoclase basalt porphyry, diorite, quartz stringers, granite pegmatite, and schist (Seager, 1944). It was screened out because it was in the active area for the TVX Gold, Inc.- Mineral Hill Mine.

West Fork Gallatin River Syncline Area
GA004203

This prospect was screened out because it is a phosphate prospect with no workings or production (Swanson, 1970).

West of Como Trench (possibly Agnes M unpatented claim)
PK009019

Prospects shown west of the Lulu Pass road where it splits were examined on 08/25/99. The workings consisted of small prospects and a trench that follows the drainage. No problems were noted although the drainage had less than 1 gpm discharge. The area is defined as “west of Como” trench on the New World Mining District Response and Restoration Project map.

Whitewood Girl
PK002202

The Whitewood Girl consists of prospects only. They explored an iron-stained quartz vein associated with a shear zone in Precambrian schist (Wedow and others, 1975). The site was screened out but was visited in conjunction with another project and no workings were noted.

Wilson Creek Deposit
GA004198

This deposit was screened out because it had an inaccurate location. The only data for it was from MINOBRAS (1975) which stated the occurrence consisted of tremolite-anthoplyllite veinlets in serpentine. It is tentatively located in T4S, R5E in section 18 on the Garnet Mountain 7.5 min. quadrangle.

Woodland Mine
GA003953

No references were found for this site. It plotted on private land and so was screened out from further study.

Appendix IV
Soil and Water Analytical Results
Gallatin National Forest

Appendix IV. Soil sample results.

Mine and Sample	Lab ID	Ag	C	Q	As	C	Q	Ba	C	Q	Cd	C	Q	Cr	C	Q	Cu	C	Q	Ni	C	Q	Pb	C	Q	Zn	C	Q	Hg
		mg/Kg			mg/Kg			mg/Kg			mg/Kg			mg/Kg			mg/Kg			mg/Kg			mg/Kg			mg/Kg			ug/g
Galena Queen																													
AGQD10H	2001S0003	<3.3	U		42.2			586			3.98			<6.7	U		17.7			13.8			158			3450			<1.0
Gold Hill Mill																													
PGHD10H	2000S0060	<1.2	U		350			224			<2.5	U		<2.5	U		44.1		N	3.62			146			127			<1.0
Johnson Canyon adits																													
JUND10H	2000S0061	<1.1	U		5.04			30.1	B		8.14			106			71.9		N	43.9			8270			4910			<1.0
JUND20H	2000S0062	<1.1	U		3.93			10.7	B		7.35			72.4			66.7		N	36.8			572			3090			2.9

B - Detected but below method detection limit.
U - Analyzed for but below instrument detection limit.
N - Spike sample recovery not within control limits.
* - Duplicate sample not within control limits.
CP - Outside of calibrated range of ICP

Appendix IV. Water-quality chemistry.

Bottle Number		Al ug/L	As ug/L	Ba ug/L	Cd ug/L	Cr ug/L	Cu ug/L	Fe mg/L	Pb ug/L	Mn mg/L	Hg ug/L	Ni ug/L	Ag ug/L	Zn ug/L	Cl mg/L	F mg/L	NO3_n mg/L	SO4 mg/L	SiO2 mg/L	field_ph	field_sc umhos/cm	lab_sc umhos/cm	lab_ph	Disch. gpm
Johnson Creek Adits - sample date 07/23/99																								
JUNS40M	upper adit	<30	<1	15.7	<2	<2	<2	<.005	2.9	0.013	<1	<2	<1	32.5	0.51	0.1	0.16	6.42	7.34	6.98	139	134	7.66	3
JUNS20M	upstream	<30	<1	13	<2	<2	<2	<.005	<2	<.001	<1	<2	<1	40.8	0.46	0.1	<.05	6.93	6.19	6.53	160	154	7.77	3
JUNS10M	lower adit discharge	<30	<1	9.83	<2	<2	<2	<.005	<2	<.001	<1	<2	<1	43.8	0.68	0.1	0.21	12.82	8.05	5.98 S	167	173	7.66	1
JUNS30M	downstream	<30	<1	14.6	<2	<2	<2	<.005	<2	<.001	<1	<2	<1	76.3	0.44	0.1	<.05	9.22	8.36	6.57	173	157	7.75	3
DUV (Duval) - sample date 08/26/99																								
EWEG10M	flowing well	1600 S A C	<1	11.1	<2	<2	28.7	A C 7.9 S A	2.5	0.64 S	<1	5.17	<1	231	A C 0.63	0.2	<.05	83.95	45.8	5.31 S	179	182	4.97 S	1.8
EWEG20H	flowing well	<30	6.14	28.3	<2	<2	<2	0.39 S	<2	0.299 S	<1	3.32	<1	28.1	0.46	0.5	<.05	57.91	18.5	7.33	237	284	7.18	2.1
Allison Tunnel - sample date 08/27/99																								
EATS10H	adit discharge	3540 S A C	<2	17.1	2.97	C <2	162	A C 12.2 S A	<2	1.08 S	<1	7.35	<1	1140	A C 0.63	0.2	<.05	97.3	47.5	3.31 S	247	314	3.34 S	25
EATS20H	duplicate	3530 S A C	<1	11	2.91	C <2	153	A C 12.3 S A	<2	1.09 S	<1	6.98	<1	1140	A C 0.63	0.2	<.05	99.2	48	3.31 S	247	348	3.36 S	25
Galena Queen - sample date 10/12/99																								
AGQS10M	seep	<60	<1	10.2	<2	<2	<2	0.07	<2	0.035	<1	<2	<1	67.1	0.48	0.1	<.05	41.54	23.1	5.83 S	142	125	7.16	6
AGQS20M	adit discharge	<60	1.14	19.6	<2	<2	<2	3.75 S A	<2	0.506 S	<1	2.05	<1	112	0.74	0.2	0.11	41.72	27.2	6.38 S	166	144	6.69	8
AGQS30M	upstream-tributary	<60	<1	109	<2	<2	<2	<.01	<2	0.005	<1	<2	<1	18.3	0.43	0.1	0.08	19.06	10.8	5.55 S	132	125	7.55	45
AGQS40M	upstream-Arrastra	<60	<1	10.8	<2	<2	<2	<.01	<2	<.002	<1	<2	<1	7.07	0.43	0.1	0.06	17.71	10.8	6.24 S	195	193	8.09	40
AGQS50M	seep	<60	2	20	<2	<2	<2	8.79 S A	<2	0.729 S	<1	2.21	<1	199	A C 0.46	0.1	<.05	42.52	29	6.19 S	154	145	6.31 S	2
AGQS60M	downstream	<60	<1	87.3	<2	<2	<2	0.01	<2	0.004	<1	<2	<1	29.2	0.47	0.1	<.05	21.99	13.4	7.44	158	132	7.64	300
ACAS10M	Carmel Mine seep	<60	1.07	17.8	<2	<2	<2	8.46 S A	<2	0.842 S	<1	4.28	<1	187	0.53	0.1	<.05	46.98	29.8	6.25 S	176	132	6.27 S	5
Kelly Adit - sample date 07/22/99																								
BKES10L	adit discharge	<30	<1	12.2	<2	<2	<2	<.005	<2	0.002	<1	<2	<1	2.09	0.34	<.05	0.13	3.12	5.89	6.1 S	54	52	7.1	2 to 3
BKES20L	duplicate	<30	<1	11.5	<2	<2	<2	<.005	<2	0.001	<1	<2	<1	<2	0.34	<.05	0.13	3.24	5.96	6.1 S	54	50	7.3	2 to 3
Daisy Mine - sample date 09/29/99																								
BDAS10L	downstream	<30	<1	38	<2	<2	3.07	0.02	<2	0.002	<1	<2	<1	9.9	0.38	<.05	<.05	12.29	8.29	5.35 S	52	56	7.28	224
Gold Hill Mill - sample date 07/20/99																								
PGHS20H	upstream	<30	<1	120	<2	<2	<2	<.01	<2	<.002	<1	<2	<1	7.68	0.43	0.1	0.15	30.3	16.2	7.85	374	358	7.95	1
PGHS10H	downstream	<30	<1	139	<2	<2	<2	<.01	<2	0.002	<1	<2	<1	8.39	0.34	0.1	<.05	40	15.4	7.46	386	367	8.16	75
Surprise Mine - sample date 07/20/99																								
PSUS10H	adit discharge	<30	1.74	116	<2	<2	<2	<.01	<2	<.002	<1	<2	<1	7.09	0.72	0.2	0.13	64.33	12.2	6.2 S	489	445	7.72	1
PSUS20H	downstream	<30	<1	147	<2	<2	<2	<.01	<2	<.002	<1	<2	<1	3.36	0.45	0.1	0.06	39.02	16.2	7.93	389	373	8.21	300
McClaren Tailings - sampled date 08/25/99																								
SMTS10H	upstream	<30	<1	59.4	<2	<2	<2	0.01	<2	0.002	<1	2.04	<1	5.11	0.32	<.05	<.05	6.2	8.34	7.62	239	224	7.72	448
SMTS20H	downstream	<30	<1	53.6	<2	<2	<2	0.19	<2	0.064 S	<1	3.16	<1	2.01	0.33	0.1	<.05	34.57	7.94	7.67	312	301	7.67	561

[UG/L = micrograms/liter; MG/L = milligrams/liter; < = below method detection limit; P = primary drinking water standard exceeded;
S = secondary drinking water standard exceeded; A = acute aquatic standard exceeded; C = chronic aquatic standard exceeded
SC = specific conductance in micromhos/centimeter; Temp = temperature in degrees Celcius; GPM = gallons/minute]
– = analyte not reported; not analyzed for by laboratory.