Minnie Moore Gulch Mine(s)

aka

Minnie Moore Mine, Minnie Moore Shaft, Silver Star-Queens Mine, Queen of the Hills Mine, Lusk Tunnel, Moulton Tunnel, Rockwell Shaft, Michigan Shaft, Allen Shaft, Relief Shaft, Penobscot Tunnel,

aka

Maggie, Relief, Hope, Mascot, Chili Fraction, Old Telegraph, Minnie Moore, Erie, Defiance, Badger, U S, Grey Copper, Alta, Broadford, Michigan, River View, Penobscot, Penobscot Fraction, San Jose, Con Virginia, Overland, Little Giant, Queen of the Hills patented mining claims.

Preliminary Assessment Report

Blaine County
State of Idaho

Department of Environmental Quality

November 2008

Submitted to:
U. S. Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, WA 98101

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

1410 North Hilton • Boise, Idaho 83706 • (208) 373-0502

C.L. "Butch" Otter, Governor
Toni Hardesty, Director

December 20, 2008

Marcia Penny
2547 Dorn Drive
Twin Falls, Idaho 83301

RE: Site Assessment of the Minnie Moore Gulch Mines, containing the Con Virginia patented claim and mine and workings.

Dear Mrs Penny:

The Idaho Department of Environmental Quality (IDEQ) has completed the Preliminary Assessment report for the Minnie Moore Gulch mines (attached). Subsequent to a in depth historical review, IDEQ conducted a site visit of the Minnie Moore Gulch mines and associated claims. During the site visit, mining facilities were mapped and sampled to complete the Preliminary Assessment (PA).

Based on existing conditions and current uses, historic information, background and mine waste samples were collected during the site visit. Subsequent to our analysis of the **Con Virginia** patented mining claim and workings, IDEQ has determined that there may be some potential risks to human health and the environment. Currently potential risks at the site are minimal because site access via the Minnie Moore Gulch Road is greatly restricted by the Minnie Moore Mining Company that has its offices at the mouth of the gulch. However, IDEQ has determined that heavy metals concentrations in mine wastes on the Con Virginia pose a health risk to those on-site personnel who have or are currently conducting earth moving activities on the claim. Furthermore, the concentrations of heavy metals in the mine wastes would pose a human health risk if the site was developed for residential purposes. This risk to residents could be managed or eliminated by routine reclamation practices such as capping and covering the wastes with top soils and vegetation.

IDEQ noted one dangerous open or other physical hazard on the Con Virginia, which we believe should be closed. Furthermore subsidence of abandoned underground workings may threaten new construction at the site, if any.

Attached is the Preliminary Assessment Report of the property and mine facilities. The report contains a brief mine history, limited geologic information, maps and additional discussion of observations made at the property. There are also photos of the mine facilities.

IDEQ very much appreciates your cooperation and approval for our access, and looks forward to addressing any questions you may have regarding our findings. Please call me at 208-373-0554 if you have any comments, questions, or I may be of any other assistance.

Sincerely,

Bruce A. Schuld
Mine Waste Projects Coordinator
Waste Management and Remediation Division

Attachments

cc: Steve Moore – U.S. Bureau of Land Management
file

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

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C.L. "Butch" Otter, Governor
Toni Hardesty, Director

December 20, 2008

Halverson Living Trust
c/o Bessie Y. Halverson
25 W 300 N
Rupert, Idaho 83350

Dan Halverson
1715 Shannon Valley Drive
Houston, Texas 77077

RE: Site Assessment of the Minnie Moore Gulch Mines, containing the Overland and Little Giant patented mining claims and workings.

Dear Mr. and Mrs Halverson.:

The Idaho Department of Environmental Quality (IDEQ) has completed the Preliminary Assessment report for the Minnie Moore Gulch mines. Because of its size, and IDEQ's discussions with Mr. Halverson, one (1) copy of the report is being sent to him. Subsequent to a in depth historical review, IDEQ conducted a site visit of the Minnie Moore Gulch mines and associated claims. During the site visit, mining facilities were mapped and sampled to complete the Preliminary Assessment (PA).

Based on existing conditions and uses, historic information, background, mine waste and adit discharge samples were not collected during the site visit. Subsequent to our analysis of the **Overland** and **Little Giant** patented mining claims and workings, IDEQ has determined that No Remedial Action is Planned (NRAP) for this property. However, based on the historical information regarding mine development and production, and observations made during our visit IDEQ recommends that if you decide to develop these properties, you should conduct more detailed site investigations, and if necessary, based on those investigations, you should incorporate risk management provisions in development plans, particularly if the development involves residential construction.

IDEQ did not note any dangerous openings or other physical hazards on the Overland and Little Giant, but subsidence of abandoned underground workings may threaten new construction at the site, if any.

Attached is the Preliminary Assessment Report of the property and mine facilities. The report contains a brief mine history, limited geologic information, maps and additional discussion of observations made at the property. There are also photos of the mine facilities.

IDEQ very much appreciates your cooperation and approval for our access, and looks forward to addressing any questions you may have regarding our findings. Please call me at 208-373-0554 if you have any comments, questions, or I may be of any other assistance.

Sincerely,

Bruce A. Schuld
Mine Waste Projects Coordinator
Waste Management and Remediation Division

Attachments

cc: Steve Moore – U.S. Bureau of Land Management
file

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

1410 North Hilton • Boise, Idaho 83706 • (208) 373-0502

C.L. "Butch" Otter, Governor
Toni Hardesty, Director

December 20, 2008

Carl Johnston
Minnie Moore Mining Company
350 Broadford
Bellevue, Idaho 83313

James Bilbray
3154 Sorrel Street
Las Vegas, Nevada 89146-6549

RE: Preliminary Assessment Report – Minnie Moore Gulch Mines.

Gentlemen:

The Idaho Department of Environmental Quality (IDEQ) has completed the Preliminary Assessment Report for Minnie Moore Gulch Mines. (attached). We thank you for your assistance with respect to access privileges on this project and hope that the attached report is of assistance to you.

You will notice in the Report that IDEQ focused attention on the historic workings in the gulch on the Relief, Old telegraph, Minnie Moore, Badger, Grey Copper, Alta, and Chief of the Hills. IDEQ did not assess properties that extended over the ridge into Lee's Gulch including the Maggie, Mascot, Sunrise, Defiance, U.S., and San Jose claims. Generally speaking IDEQ did not observe substantial enough development in Lees Gulch to warrant field work in 2007. With your permission, however, we would like to complete assessments on these claims during the 2009 field season.

Regarding the areas assessed, the report explains that there may be potentially significant risks to human health from tailings and spoils and physical hazards for both site workers and potential residents due to mine safety issues. Some of these risks are, of course, dependent on whether or not you or successive property owner(s) develop the gulch for residential uses. IDEQ would be very pleased to discuss questions you may have relative to these risks and potential risk management tools you might apply towards minimizing these risks.

IDEQ also has concerns regarding the use of aggregate and top soil products you are generating in your active operations. IDEQ's characterization of the mine wastes and tailings in Minnie Moore Gulch indicates that high concentrations of metals in these materials could pose a human health risk. If your products, in whole or part, contain similarly high concentrations of heavy

metals, you should restrict exportation of contaminated materials because they should not be used in a residential setting. IDEQ suggests that you sample and characterize these products or the source areas prior to further export. Please understand, IDEQ is not suggesting that you stop all aggregate and top soils production and sale. Rather, IDEQ is interested in ensuring that there are no human health risks generated as a result of this operation. It is in your interest to do so to avoid prospective liability you might have should any of these materials later be determined to require removal. IDEQ can, at your convenience, discuss the potential risks and assist you with characterizing both your sources and stockpiles to more accurately qualify risks, if any. If you would like to discuss this further, please call me at 208-373-0554.

Again, IDEQ very much appreciates your cooperation and approval for our access, and looks forward to addressing any questions you may have regarding our findings. We hope to continue, what we believe has been a very working relationship with your company..

Sincerely,

Bruce A. Schuld
Mine Waste Projects Coordinator
Waste Management and Remediation Division

Attachments

cc: Steve Moore – U.S. Bureau of Land Management
Eric Wilson – Idaho department of Lands
file

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Section 1 Introduction

The Idaho Department of Environmental Quality (IDEQ) was contracted by Region 10 of the United States Environmental Protection Agency (EPA) to provide technical support for completion of preliminary assessments at various mines within the Mineral Hill Mining District in Blaine County, Idaho.

IDEQ often receives complaints or information about sites that may be contaminated with hazardous waste. These sites can include abandoned mines, rural airfields that have served as bases for aerial spraying, old landfills, illegal dumps, and abandoned industrial facilities that have known or suspected releases.

In February 2002, IDEQ initiated a Preliminary Assessment Program to evaluate and prioritize assessment of potentially contaminated sites. Due to accessibility and funding considerations, priority is given to sites where potential contamination poses the most substantial threat to human health or the environment.

For additional information about the Preliminary Assessment Program, see the following:

http://www.deq.idaho.gov/waste/prog_issues/mining/pa_program.cfm

This document presents the results of the preliminary assessment (PA) of the various mining properties located within and adjacent to the Minnie Moore Gulch watershed. The Minnie Moore, the Queen of the Hills (Silver Star) and the Golden Bell mines have historical references, while many of the lesser workings do not. This assessment does discuss human health and ecological risks associated with the active mining operations for aggregate and top soil at the site. IDEQ also discusses possible risks that may be the result of active operations and future residential development, and IDEQ makes recommendations regarding the need for more thorough risk assessment and management presented by these scenarios.

Risks relative to the numerous mine openings were not quantitatively calculated. It is intuitive, however, that these opening represent extremely dangerous physical hazards that should be actively managed either by very aggressive site restrictions or physical closures.

Access to the Con Virginia patent, the Overland and Little Giant patented claims and the patented claims around the Minnie Moore mine was given by Marcia Penny, Dan Halverson and Carl Johnston, respectively, in 2007. Although some observations have been made about the Queen of the Hills patent (aka Silver-Star Mine), no samples were collected from the Queen of the Hills and the site has not been assessed relative to human health and ecological risks.

The Golden Bell mine is located near the head of Minnie Moore Gulch on public lands administered by the U.S. Department of Interior - Bureau of Land Management (BLM). IDEQ did not assess the Golden Bell mine site. Public access and use of the area is restricted by way of the Minnie Moore Gulch road, which is controlled by Mr. Johnston.

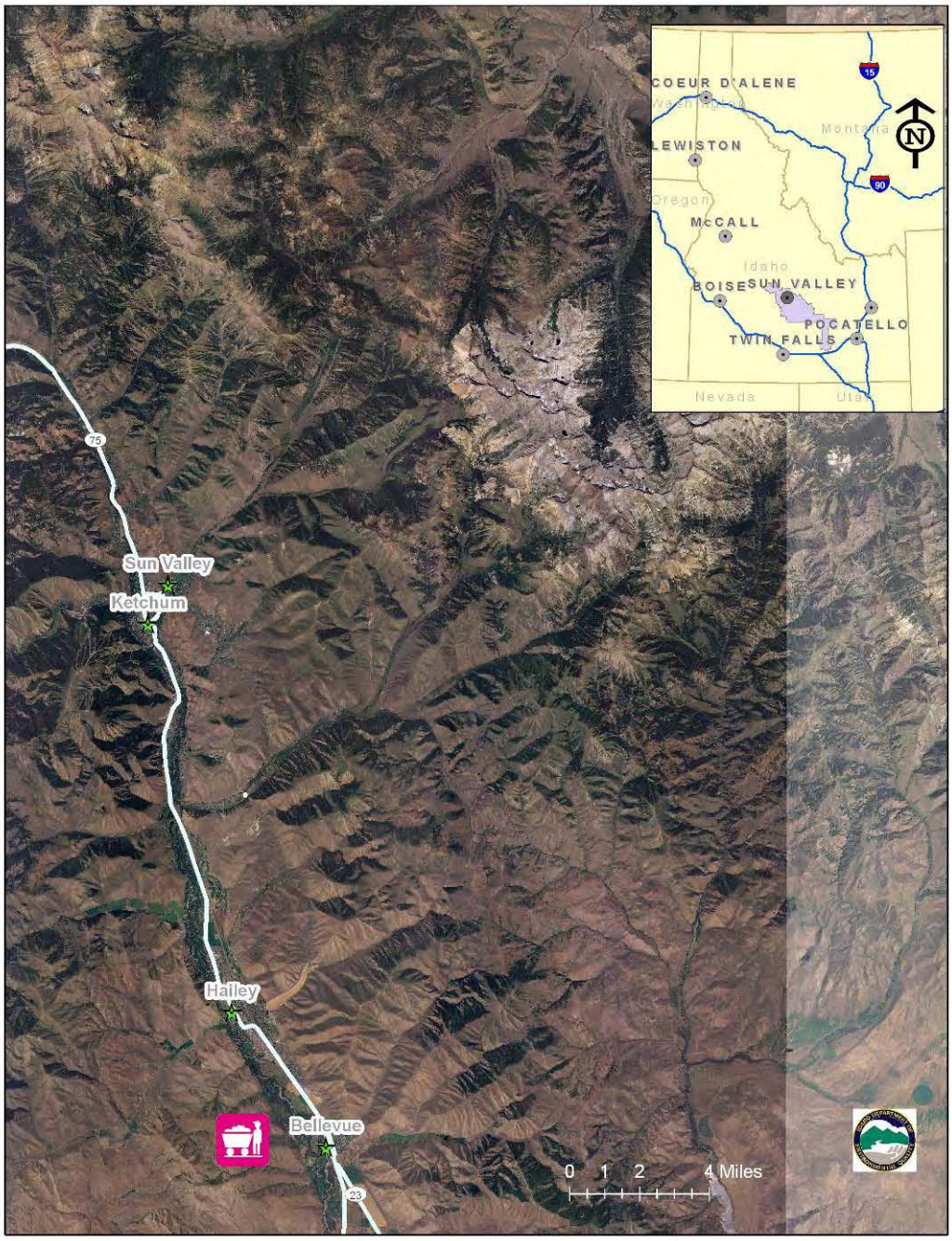


Figure 1
Location of the Minnie Moore Gulch within the State of Idaho

Section 2 Ownership

IDEQ does not warrant the ownership research or location of property boundaries contained in this report. The information regarding ownership and property boundaries was obtained from the Blaine County Tax Assessor's Office in Hailey, Idaho. Although numerous mining claims are frequently listed by a single Parcel Number in the Blaine County Assessor's Office tax rolls, IDEQ discusses individual claims as distinctive properties because this is how they are referenced in the numerous inactive and abandoned mined lands data bases and historical references.

In the following list of properties ad owners, IDEQ has presented a **"Partial Determination"** that is meant to convey a very brief summary of IDEQ's assessment of individual claims and parcels relative to human health and ecological risk factors associated with toxicological responses to mine wastes. These "**Partial Determinations"** are recommendations by IDEQ to EPA to consider in their evaluation of our report. These partial determinations with be entered into IDEQ's Wastesite Data Inventory as our determined status for these properties.

A determination of No Remedial Action Planned or "**NRAP**" means that based on current conditions at the site IDEQ did not find any significant evidence that would indicate the potential of adverse effects to human or ecological receptors on the parcel of land. This determination says nothing about risks associated with physical hazards such as open adits, open shafts, high walls, or unstable ground. "**Partial Determination"** of "**calculate HRS**" indicates that IDEQ has determined that there is sufficient evidence to warrant calculation of a Hazard Ranking Score (HRS) by EPA's contractors. It also indicates that IDEQ has come to the conclusion that additional site assessment and/or remedial actions may be necessary to prevent adverse affects to human or ecological receptors. These conclusions and recommendations are contained in the final section of this report.

Owner	**Workings**	**Partial Determination**
Carl B. Johnston Minnie Moore Mining Co. 350 Broadford Bellevue, ID 83313		
Claim/Parcel **RP1M0000001860**		
Relief	Relief Shaft, Allen Shaft Minor Adit and Dumps	Calculate HRS
Chili Fraction	Major Shaft, Minor Adit and Dumps	NRAP
Old Telegraph	Minnie Moore Waste Dump And jig tailings	Calculate HRS
Maggie	Not in Minnie Moore Gulch	Not Assessed
Mascot	No Plat or Location Found	Not Assessed
Sunrise	No Plat or Location Found	Not Assessed
Minnie Moore	Minnie Moore Shaft, Minor Adit and Dumps	Calculate HRS

Erie	Minor Explorations	NRAP
Defiance	Not in Minnie Moore Gulch	Not Assessed
Badger	Minor Workings	Calculate HRS, Likely NRAP
U S	Not in Minnie Moore Gulch	Not Assessed
Grey Copper	Major Adits and Dumps	Calculate HRS

RP1M0000001870

Alta	Caved Shaft and Waste Dumps	Calculate HRS, likely NRAP
Broadford	Minor Workings	NRAP
Michigan	Michigan Shaft, Minor Adit and Dumps	NRAP
Riverview	Major Milling Wastes and Dumps	Needs Additional Assessment As step in closure of EPA CERCLA 106 Removal Project
Penobscot	Penobscot Tunnel, Min. Adit and Dumps	NRAP
Penobscot Fraction	Minor Explorations	NRAP
San Jose	Not in Minnie Moore Gulch	Not Assessed
Chief of the Hills	Rockwell Shaft, Minor Adit and Dumps	Needs Risk Mgmt and HRS

Owner | **Workings** | **Partial Determination**

Marcia Penny (rep)
Jane Andrews Estate
2547 Dorn Drive
Twin Falls, ID 83301

Claims/Parcel
RP1M0000000060

Con Virginia	Minor Workings (Open Adit)	Calculate HRS, likely NRAP

Owner | **Workings** | **Partial Determination**

Halverson Living Trust
Bessie Halverson, Trustee
c/o Dan Halverson
1715 Shannon Valley Drive
Houston, Texas 77077

Claims/Parcel
RP1M0000000800

Little Giant	Minor Workings (Open Adit)	NRAP
Overland	Minor Workings/Explorations	NRAP

Owner	**Workings**	**Partial Determination**
Maloney Living Trust 1006 N. Arista Lane Fountain Hills, AZ 85268-0000		No Response to Request for Access
Claims/Parcel **RP1M0000015000** Queen of the Hills Aka Silver-Star	Moulton Tunnel, Lusk Tunnel And other Mine Workings and Waste Dumps	Needs Assessment

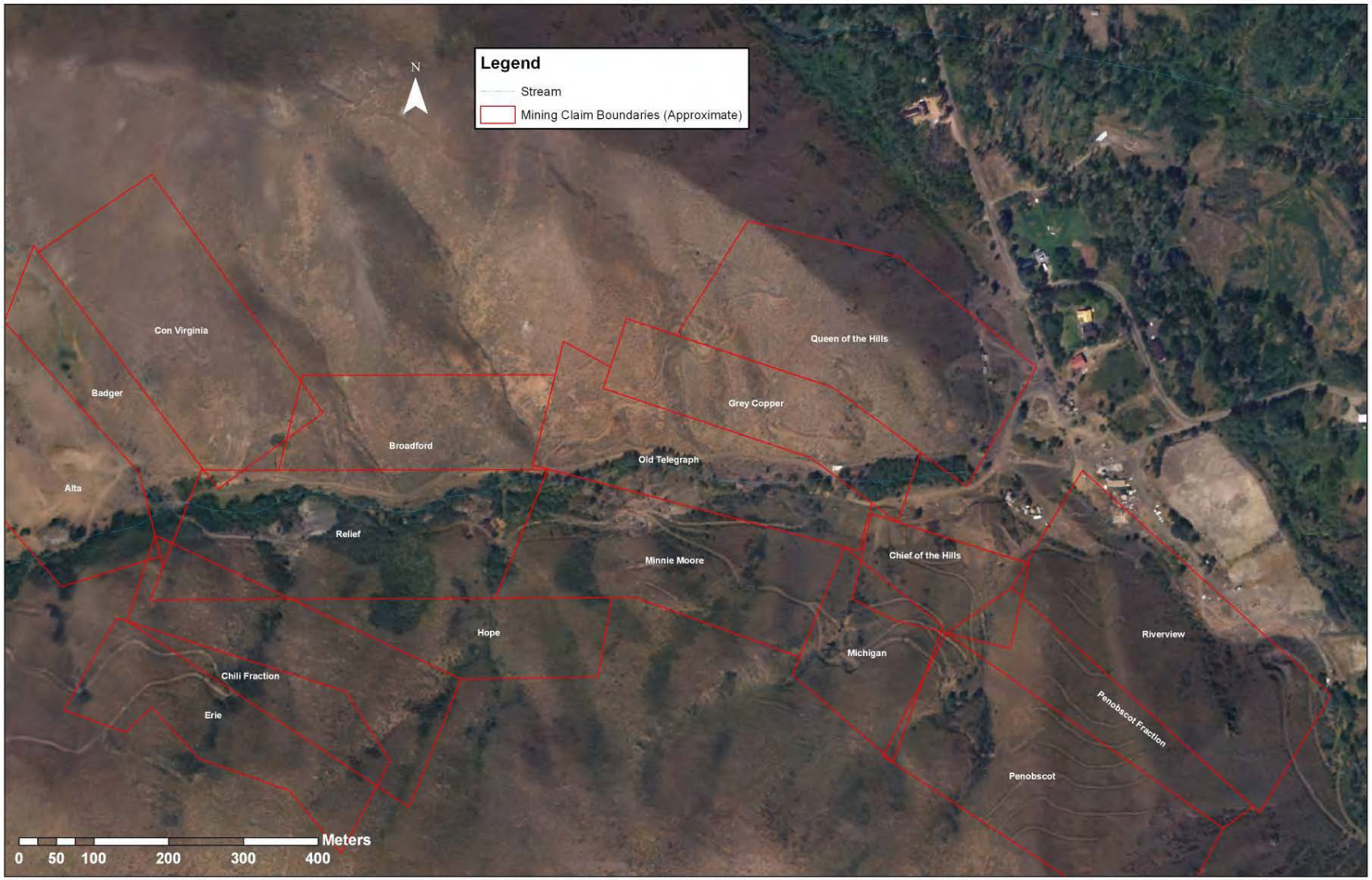


Figure 2
Approximate Mining Claim Boundaries within Minnie Moore Gulch

Section 3 Overview

Numerous patented claims are located within Minnie Moore Gulch. The two principal mines were the Minnie Moore and the Queen of the Hills (formerly known as the Silver Star-Queens). Ore-processing mills were located at each mine, but the Minnie Moore's operated for a longer period of time and generated a much greater volume of tailings.

The Minnie Moore Mine is located near the mouth of Minnie Moore Gulch (formerly known as Galena Gulch), an ephemeral sub-drainage, approximately one mile west of Bellevue, Idaho, in Sections 34 & 35 of Township 2 North, Range 18 East of the Boise Meridian, at Latitude 43º 28' 03"N, and Longitude 114º 17' 21"W (see Figure 1). The mine encompasses numerous workings, primarily along the southern portion of the gulch. The Queen of the Hills Mine is located on the north side of the gulch in Section 27 of Township 2 North, Range 18 East of the Boise Meridian, at Latitude 43º 28' 16"N, and Longitude 114º 17' 22"W. Both mine sites are located on private land, but lie adjacent to public lands administered by the BLM.

The most direct route to Minnie Moore Gulch is obtained by driving west on the Broadford Road from Highway 75 in Bellevue. After crossing the Big Wood River, one continues for approximately 0.75 miles until the road sharply curves to the north (right). Here, the access road/driveway continues straight into the Johnston property at the base of the mining properties.

The climate in Bellevue, Idaho, is mild and arid with annual precipitation in the area averaging 15.89 inches a year, mostly in the form of snow and winter precipitation. Winters in Bellevue are cold and wet, while summers are dry and warm. The average temperature in Bellevue ranges from an average low of 7.8 degrees Fahrenheit (°F) in January to an average high of 84.8 °F in July. (WRCC, 2005). Local waters are dominated by surface water and near surface ground water which is recharged by seasonal precipitation. Annual precipitation for Hailey, Idaho, located approximately five miles to the east, is 16 inches, predominately during the winter months, with an average annual snowfall of 81 inches (WRCC, 2006).

Dry-season rainfall occurs almost exclusively in relatively short bursts, usually related to thunderstorm activity. It is expected that except for rare flash flood-type events, almost all dry-season rainfall events would be completely absorbed by the soils and plants, without much, if any, contribution to the ground water.

Section 4 Historical Perspective

The Minnie Moore was the largest and most famous mine in the Mineral Hill mining district. Discovered in 1880, activity on the Minnie Moore and the adjacent Silver Star-Queens (formerly known as the Queen of the Hills) property continued for more than a century. D. F. Hewett conducted underground geologic investigations and surface mapping of the Minnie Moore and surrounding mines in 1910, 1913 and 1926. Hewett's report includes details of the mine development, mineralization and production. A. L. Anderson (1950) described exploration and development work at the Minnie Moore during the intervening years as well detailing the Silver Star-Queens mine. Mitchell (2000) compiled the extensive development, ownership and ore

production history of the Minnie Moore and its latter-year association with the Silver Star-Queens mine.

Minnie Moore Mine

Discovery of the Minnie Moore was credited to J. W. Moore in 1880 when galena ore was found in waste allegedly from a badger hole. The area was trenched and revealed a 35 foot long by 2.5 foot thick zone of ore. By 1881, a shaft had been sunk to a depth of 45 feet throughout which the galena continued. 1881 records indicate 217 tons of ore averaging 101.62 ounces of silver and 67 percent of lead were shipped (Hewett, 1930).

Excerpts from the D.F. Hewett report are as follows:

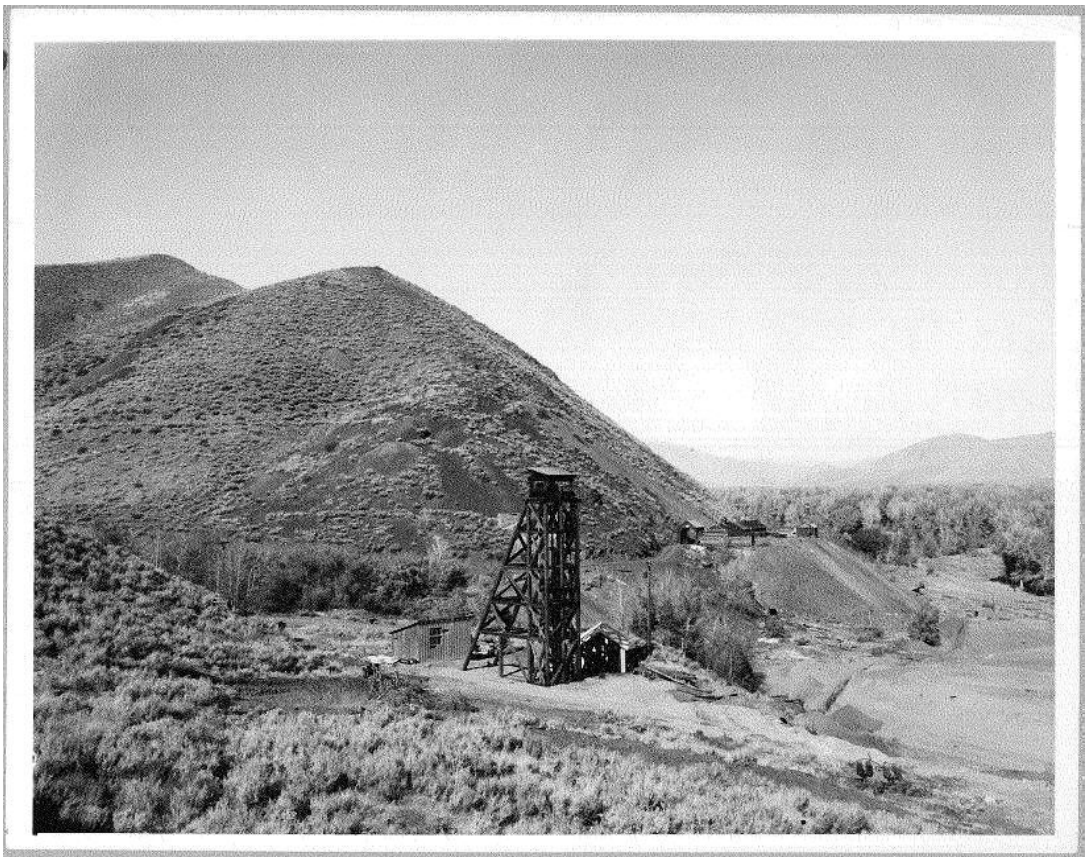
> *"The history of the mine is roughly separable into four periods. The first period extends from the discovery of the deposit in 1880 to the sale of the mine to Dent, Palmer & Co., of London, in 1884; the second period from 1884 to the cessation of work by that company in 1889; the third period, from 1900, when the mine was pumped out, to 1906, when it was again closed down; and the fourth period, from 1909, when it was pumped clear of water, until 1927, when it was again allowed to fill. The main shaft was pumped clear of water to the 1,000-foot level in 1909 and kept open during prospecting in the footwall until 1913, when it began to cave seriously and was abandoned. In 1923 the mine was leased to the Federal Mining & Smelting Co., which pumped out the Minnie Moore shaft and sank the Allen shaft 300 feet deeper"* (pp. 219-220).
>
> *On the date of the sale to Dent, Palmer & Co., February 25, 1884, the principal workings consisted of the main inclined shaft, 160 feet deep, two levels eastward to a maximum distance of 205 feet, and three levels westward to a maximum distance of 80 feet...In an area 125 feet long and 100 feet wide the vein was estimated to contain 3,699 tons of ore averaging 100 ounces of silver to the ton and 68 per cent of lead...There is an accurate record of the value of the output for the period 1886 to 1889 but not for 1884 and 1885. The net smelter return for these four years was $1,433,306.13...the apparent profit for the period was $625,865.76* (p. 220).
>
> *The mine filled with water and lay idle from 1889 to November 1900, when I. E. Rockwell, C. R. Carpenter, and others, having purchased the property for $30,000, began to pump out the workings. Ore was struck in a raise from the south crosscut on the old 900-foot level in June, 1902, and from that time the lower part of the mine was vigorously explored. The Minnie fault was struck on the west end of the 900-foot level in November, 1903, and later in successively lower beds...It was operated under lease until two men were accidentally killed in the Singleterry raise in March, 1906. The mine was then allowed to fill with water. Most of the explorations beyond the Minnie fault, as we as the footwall crosscut on the 1,000-foot level, were made between July, 1904, and March, 1906.*
>
> *During the period 1902 to 1906 mining operations below the old 900-foot level yielded about $1,100,000, net smelter returns. A small stope on the Singleterry vein above the 1,000-foot level yielded $31,000, net smelter returns.*

> *In October, 1907, new pumps were installed, and by December 1, 1909, the 1,000-foot level was clear. Explorations during 1910 were confined to the Singleterry vein in the footwall. The Minnie Moore shaft began to cave in 1913 and soon thereafter was abandoned. During 1911 and 1912 crosscuts and drifts were opened on the 380 and 470-foot levels from the Allen shaft, and in 1923 that shaft was sunk to the 800-foot level. Three groups of operators made successive efforts to recover the ore shoot below the Minnie fault by exploring eastward on the 800, 900, 1,000, and 1,100-foot levels of the Allen shaft, but as these failed the mine was abandoned in May, 1927" (pp. 221-222).*

On the nearby Consolidated Virginia claim the Alturas Mining Company sank a vertical, two-compartment shaft, hoping to intersect the Minnie Moore vein at depth. Unable to solve structural complexities, this operation was abandoned (Mitchell, 2000). No additional information was provided regarding the dates of operation or the extent of the workings, however.

According to Anderson (1950), mining activities in the gulch resumed, but with emphasis on the adjacent claims.

> *In 1931, the Federal Mining and Smelting Co. sank the Rockwell shaft near the mouth of Galena Gulch to explore the extension of the Queen of the Hills vein on Minnie Moore ground. This work was later abandoned but three years later a crosscut was started by the Minnie Moore Mines Development Company on the 450 level of the Rockwell shaft to explore the area southeast of the old workings in the hope of finding the faulted extension of the Minnie Moore ore body...In 1949 the Silver Star-Queens Mines Company began to rehabilitate the Rockwell shaft in order to gain entrance to the deeper levels of the Old Queen of the Hills mine. During the summer a new headframe was raised to replace the old one which had collapsed into the shaft and by the end of the year pumps were at work dewatering the shaft and the old workings of the Minnie Moore* (Anderson, 1950, p. 14).



View to NNW: Rockwell shaft head frame, Silver Star-Queens mine buildings on hill beyond at right; (Courtesy of Idaho State Historical Society)

View to E: Double drum hoist - Rockwell shaft

Mitchell (2000) noted:

> *"During 1950, Silver Star-Queens acquired the Minnie Moore property under lease and bond...On October 16, 1951, Silver Star-Queens began work under Defense Minerals Administration (DMA; later Defense Minerals Exploration Administration, or DMEA)...In 1952, the company explored below the 450 level of the Rockwell shaft, with the results of this work reported as "now down 50 feet in ore" in February 1953. Forty-two railroad cars and one truckload of ore were shipped from the property during the last half of 1952; presumably this included ore from both the Minnie Moore and Queen of the Hills workings....During 1953, the company connected the Hershey crosscut with the 1000 level of the old Minnie Moore workings. The old tunnels were caved...Forty-eight railroad cars and one truckload or ore were shipped...Work continued on the property for several years. A second DMEA contract was awarded in 1955. Most of the work on this project was apparently directed toward exploring the Queen of the Hills veins, although the work was probably conducted through the Rockwell shaft. Large shipments of ore were made from the property every year between 1956 and 1959...Some prospecting was done at the Minnie Moore in 1960. In 1961, drifting and diamond drilling were carried out from the 450 level of the Rockwell shaft....Federal Resources did diamond drilling and drifting on the property in 1961 and early 1962, but most of this work may have been on the Queen of the Hills. In April 1964, Federal Resources completed construction of a 250 tpd* (tons per day) *flotation mill. Tailings from the Minnie Moore were processed at the mill during both 1964 and 1965. Federal Resources continued to operate the Silver Star-Queens property until 1971...In 1978, Carl Johnston purchased the Minnie Moore for $250,000"* (pp. 33-35).

In 1983, a zone of high-grade silver ore was discovered, but there were no records of any development or production from this orebody found. Between 1984 and 1986, Exxon Minerals obtained an interest in the property and conducted exploration activities (Mitchell, 2000). During the past 30 years, the Minnie Moore property has been a source of top soil, gravel and sand for landscaping, construction and riprap. As of July 2008, Carl Johnston has listed the Minnie Moore and adjacent property, totaling 217 acres, for sale.

> *"Total recorded production from the Minnie Moore between 1881 and 1947 was 96,197 tons of ore and 41,499 tons of reprocessed tailings. This material yielded 139 ounces of gold, 2,580,974 ounces of silver, 23,495 pounds of copper, 31,250,301 pounds of lead, and 640,410 pounds of zinc. These numbers must be considered a minimum. No accurate information is available prior to 1886...no production was recorded for the Minnie Moore during the period after 1950...no information is available on the metals obtained from the tailings shipped from the property in 1980"* (Mitchell, 2000, p. 35).

Silver Star-Queens Mine

> *"Whether the mine was founded before or after ore was discovered at the Minnie Moore was not learned, but records show that by 1881 ore shipments were being made and that by 1884 the mine contained 3,000 feet or tunnels and drifts. By 1890 development work extended to the fifth level of an inclined shaft which had been sunk from the Lusk tunnel level. Work was suspended in 1892 and the workings were allowed to fill with water.*

> *Some work was carried on in 1903 and 1904 along the Lusk tunnel but on ore was mined. In 1907 a new mill replaced the old one below the portal of the Lusk tunnel and was used to treat the tailings dump. In 1913 the mine was reopened and two years later unwatered. After that the mine was generally idle until acquired by the Silver Star Queens Mines Company several years ago. This company reopened and rehabilitated the Lusk tunnel level and started to reopen the inclined shaft. After sinking the shaft to a depth of 60 feet or so beyond the old face, work was suspended and attention turned to reopening the Rockwell shaft"* (Anderson, 1950, p 18).
>
> *"Records of production are incomplete but Blake has given figures of 11,377 tons or ore for the years 1884 to 1890 inclusive with a gross value of $1,265,608 or $916,145 net. Walker has estimated the total production at $2,500,000"* (Anderson, 1950, p. 18).

The production of post-1950 development has not been learned, but Mitchell (2000) noted that 90 railroad carloads and two truckloads of ore were shipped. The reprocessing of old tailings and dump material is suspected to constitute a portion of this total.

Section 5 Current Site Conditions

Currently, Minnie Moore Gulch has both active and inactive mining facilities. IDEQ did not evaluate or assess the active aggregate and top soil operations in the or adjacent to the Gulch. IDEQ focused on historic mine facilities where massive sulfide and heavy metals were likely to be found in volumes and concentrations that pose a threat to human health or the environment.

During the visitation of the Minnie Moore Gulch mines IDEQ staff identified mapped as many of the historic mine facilities discussed in historical references. However, many explorations, shallow adits and open stopes which dot Minnie Moore Gulch were designated with numbers in the order in which they were encountered. Field note descriptions and sample markings were designated as "Unkown (UK)" for workings that were not referred to in historical records, "Minnie Moore (MM)", "Allen shaft (AL)", "Relief shaft (RF)", and "Michigan shaft (MS)". Workings on Queen of the Hills property were also included on maps to provide for continuity. The multiple adits, shafts and prospect explorations mapped throughout the gulch are presented on two separate site maps of Minnie Moore Gulch to provide for greater detail.

Figure 3 illustrates the workings and sample locations within the eastern portion of the gulch, including the workings and waste dumps of the Silver Star-Queens mine, Grey Copper and part of the Minnie Moore mine. Figure 4 illustrates the workings and sample locations within the western portion of the gulch, including the Con Virginia claim, the Allen and Relief shafts and adjacent mine locations. Figure 5 shows the locations of these workings relative to the patent boundaries. Figure 6 illustrates the Rockwell Shaft, and Minnie Moore (s) Millsite.

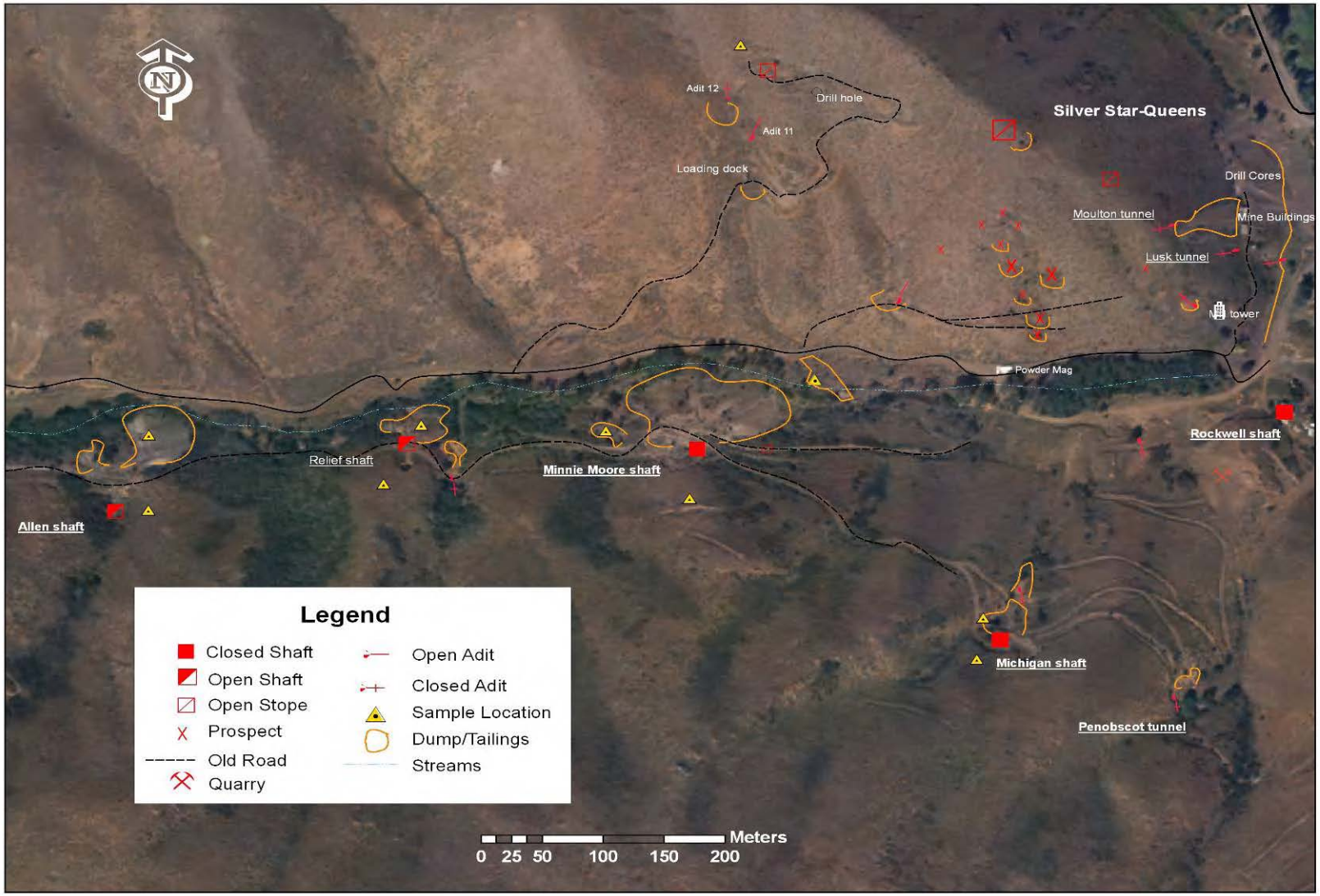


Figure 3 Eastern Minnie Moore Gulch Mine Workings

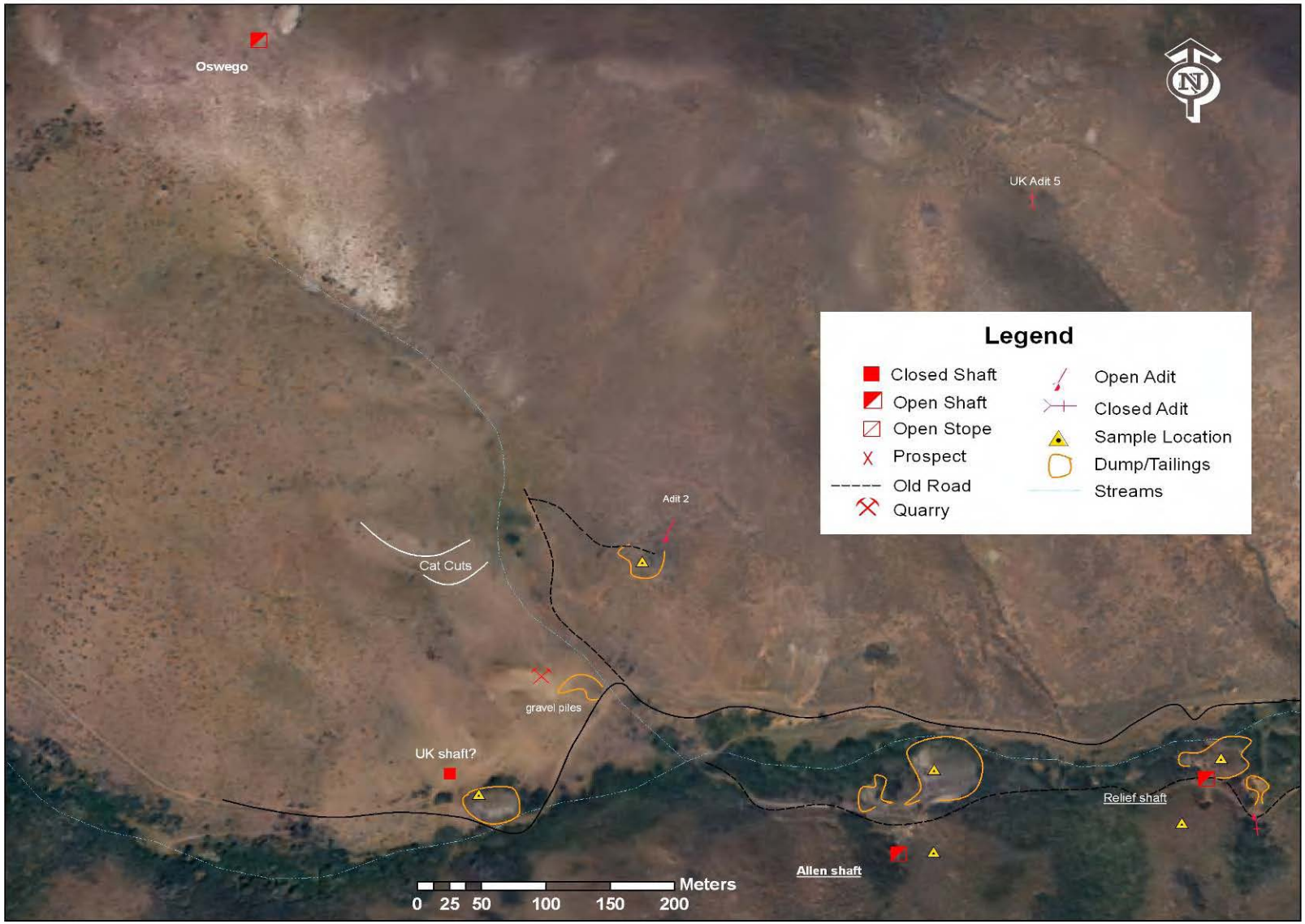


Figure 4 Western Minnie Moore Gulch Workings

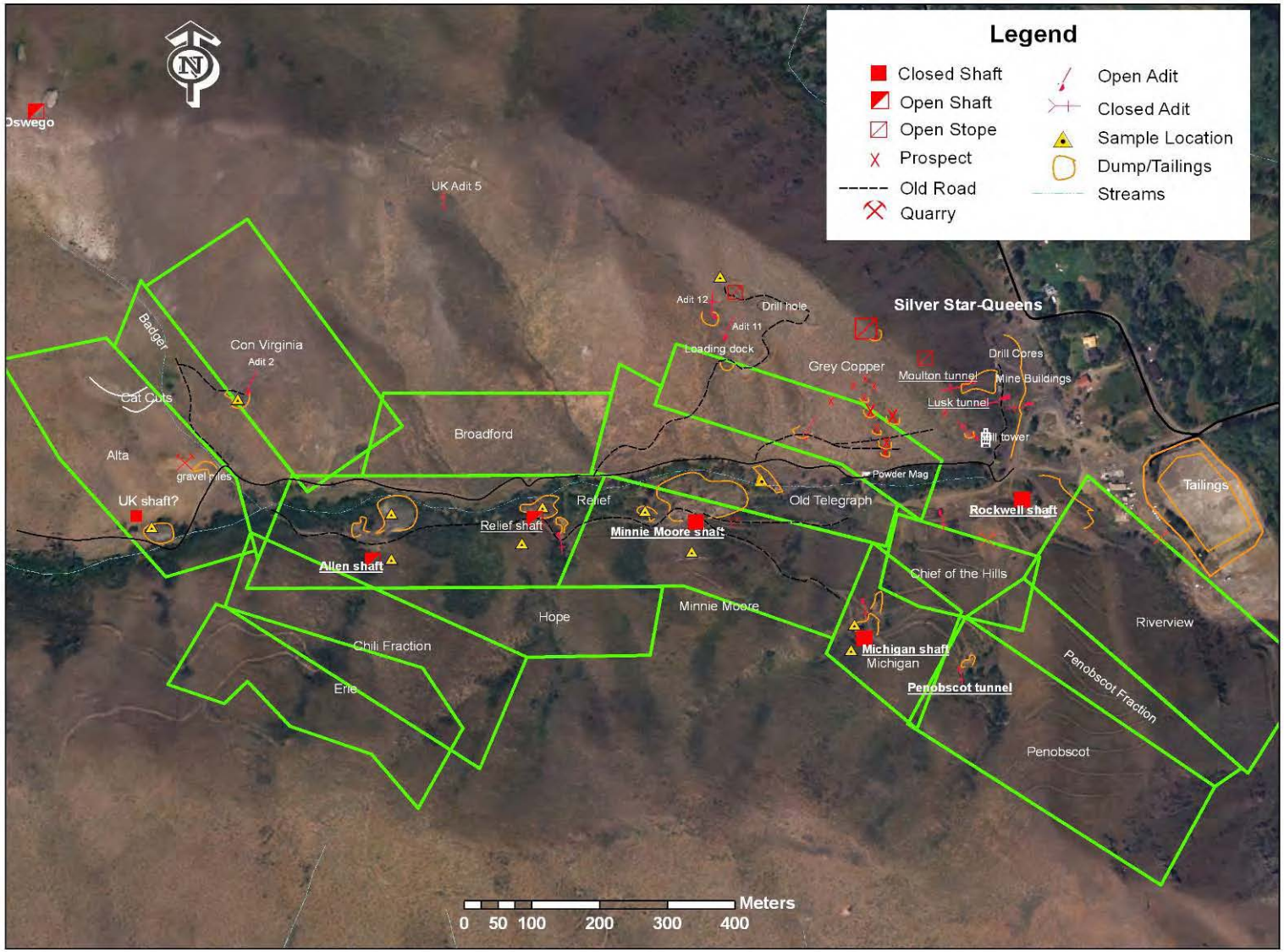


Figure 5. Locations of Mine Workings and Patents

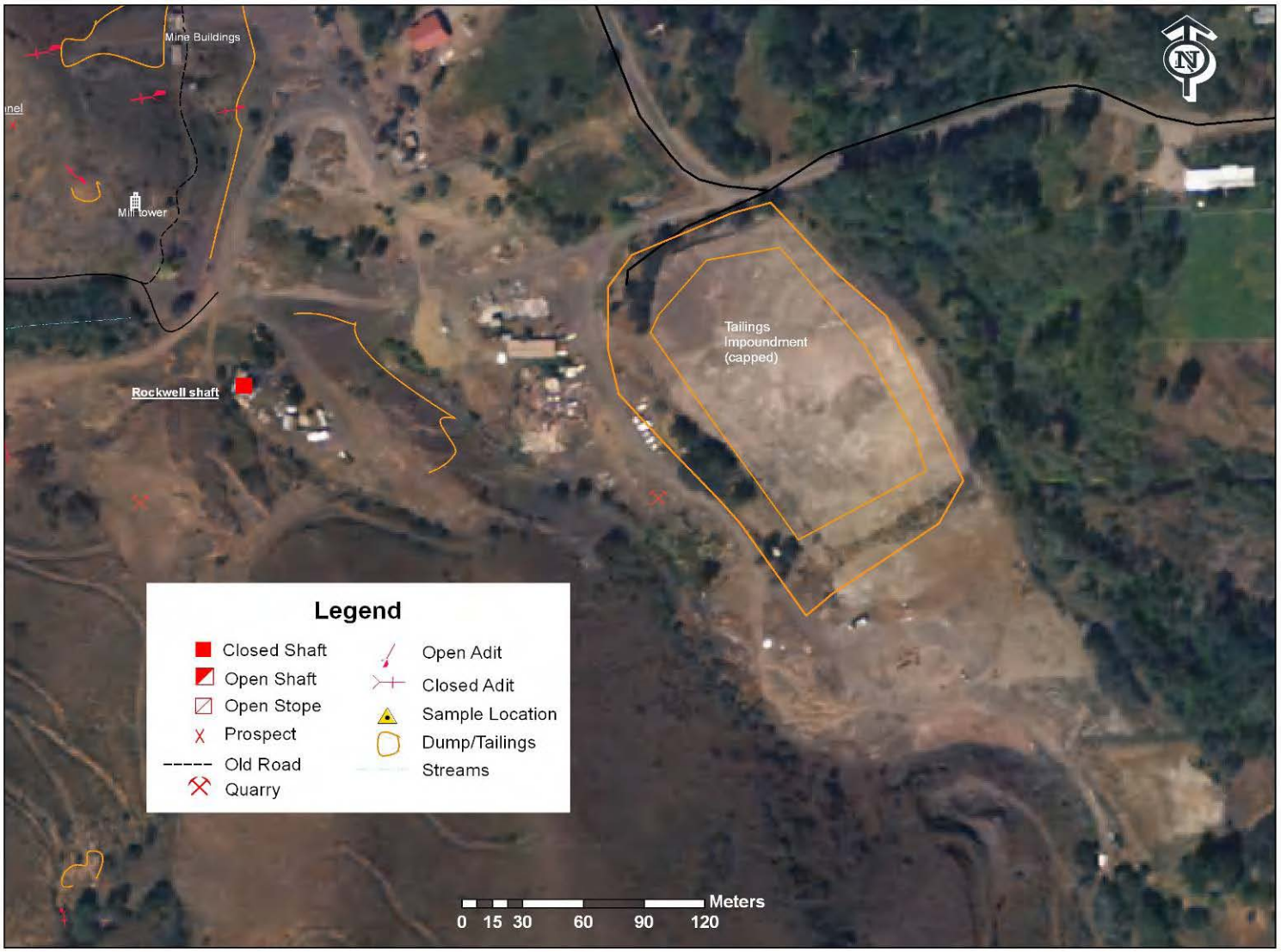
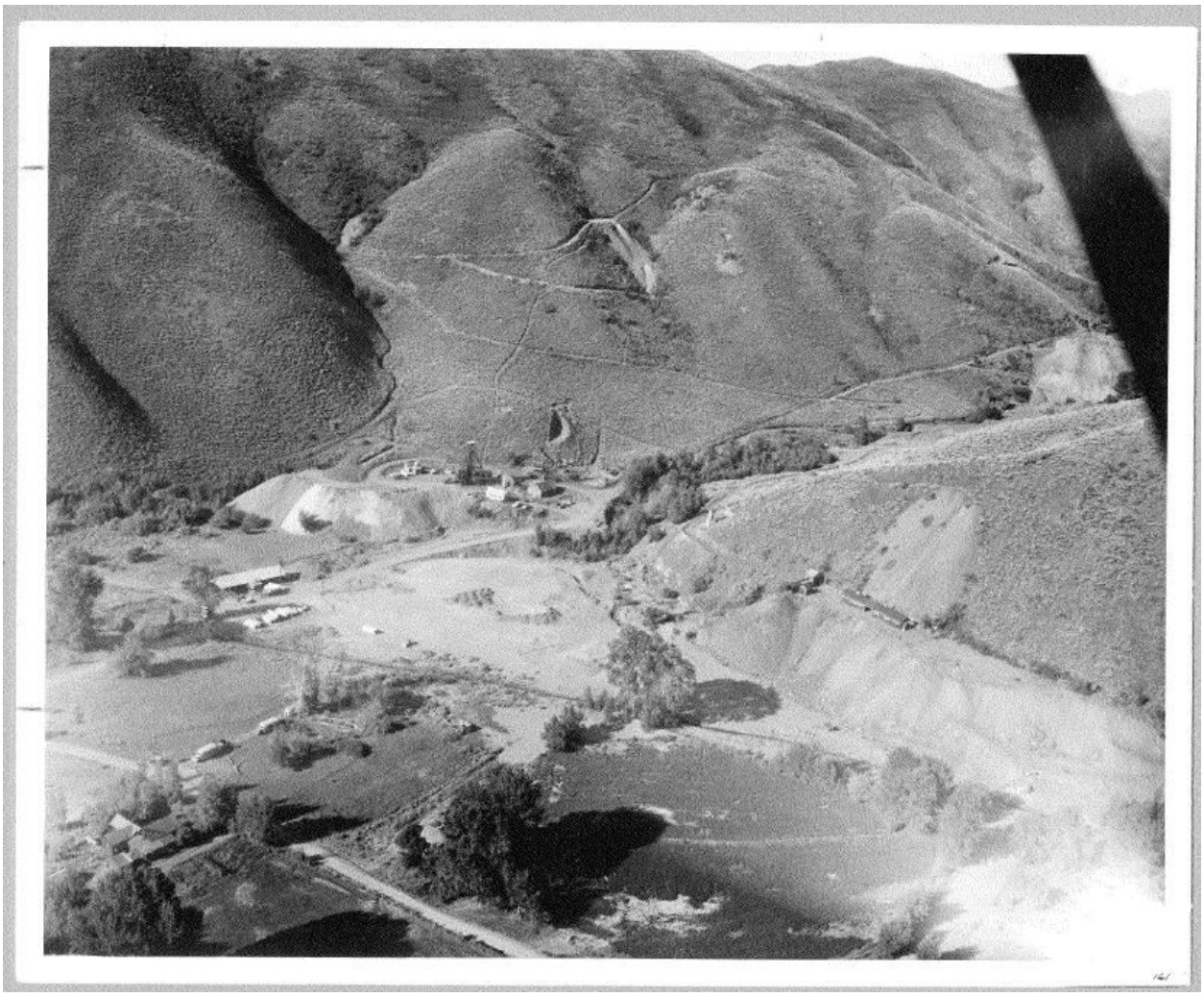


Figure 6 Rockwell Shaft and Minnie Moore Mill



View to SW: Minnie Moore and Silver Star-Queens mines. Former mill site(s) at center; Rockwell shaft head frame; Penobscot tunnel above the Rockwell in gully; Michigan shaft at upper center; Minnie Moore dump at upper right; Silver Star-Queens mine buildings and waste dumps on hill at right; (Courtesy of Idaho State Historical Society)

Section 6 Mine Workings

Penobscot and Penobscot Fraction Claims

According to Link and Worl (2001), the main tunnel on the Penobscot claim was driven 565-feet, while a second tunnel was 200-foot long tunnel. Records indicate that a total of 1005.6 ounces of silver and 17,000 pounds of lead were produced during 1883, 1887 and 1900.

> *A N. 9° W. -trending shear zone that dips 60° SW. in shale and argillite contains some pods and stringers of quartz and calcite, and in places galena, arsenopyrite, stibnite, and sphalerite. In one location siderite, sphalerite, and pyrite are present as replacement of shale. (ibid, p. 10)*

The Penobscot claim, contains remnants of the caved main tunnel, one (1) caved adit and associated dumps. The waste dump is estimated to contain less than 250 cubic yards of material, though additional volume of waste appeared to fill the draw below the site. A soil sample was not collected from the dump. Thick vegetation at the portal was supported by low-flow drainage from beneath the collapse. The discharge quickly disappeared into the waste dump and was not observed any where else the lower slope. A water sample was not collected.

View to SE; Penobscot tunnel (collapsed); healthy vegetation supported by minor seepage from adit, water ponds at the portal and infiltrates the adjacent landing area (not pictured)

Michigan Claim

The Michigan contains one (1) open shaft, one (1) caved adit, and associated waste dumps. The shaft's waste dump is estimated to contain less than 500 cubic yards of material while the adit dump contains less than 150. Both of these workings were dry. **The open shaft is a dangerous opening that should be closed.** Soil and background samples were collected, the results of which indicate that remedial actions or risk management may be necessary if the Michigan claim is developed for residential purposes.

View to S: argillite and limestone headwall of Michigan shaft (closed)

Close-up view: subsidence of waste rock above Michigan shaft, depth unknown.

View to S. Caved adit approximately 50 vertical feet below Michigan shaft

Minnie Moore and Old Telegraph Claims

The Minnie Moore and Old telegraph claims contain one (1) collapsed shaft and concrete foundations, one (1) open shaft and associated waste dumps. Jig mill ruins and tails lie on the Old Telegraph below dump to the southeast on both sides of the dry creek bed. Jig tails were also noted approximately 50 feet west of the dump, along the old road and beneath a loading ramp.

The specific outline of the main shaft is difficult to locate because the area has been bulldozed. An approximate location, situated near the hoist house, was mapped. The waste dump is primarily composed of limestone with some argillite and is estimated to contain approximately 20,000 cubic yards of material. The dump is moderately vegetated with cheat grass and sagebrush and is deeply gullied into multiple lobes. Soil and background samples were collected. The waste dump is located on the border between the Minnie Moore Claim and the old Telegraph Claim (according to Blaine County P&Z data base).

An open shaft with a 12-foot high wall lies approximately 150 feet east from the center of the waste dump. **This is a dangerous opening that should be permanently closed**. Hewett (1930) noted that the vein was originally worked along a trench and later by a shallow shaft. This opening may be the remnant of this working.

Jig tails were observed (and sampled) on the Old Telegraph claim at the east end of the dump and jig mill remains were noted below the dump near the bottom of the gulch. The total volume of tails from both locations is estimated to be less than 1,000 cubic yards of material, but may have been transported down the ephemeral drain during seasonal runoff.

Soil samples from the Minnie Moore waste dump and Old Telegraph jig tailings indicate significant risks. The results of soil sample analysis may be found in Table 1 and the detailed risk analysis is discussed in Appendix A.

View to the SE. Open shaft, measured – 8 x 8 feet, 12-foot high wall and depth undetermined

View to SE. Jig mill remnants, located near base of gulch below Minnie Moore dump

Relief Claim

The Relief Claim contains of one (2) open shafts (Allen and Relief) and one (1) caved adit.

The Relief Shaft was driven at an angle of about 20-25º to southwest in competent rock. **This opening is extremely dangerous, especially when approached from up hill. Safeguards such as high fencing and signage should alert unwary recreationists to the hazard**. This shaft is readily accessible and inviting to the casual explorer. The main dump is moderately oxidized, lightly vegetated and gullied. Pyrite casts were noted in the waste rock. It is estimated that 5,500 cubic yards of material comprise the dump.

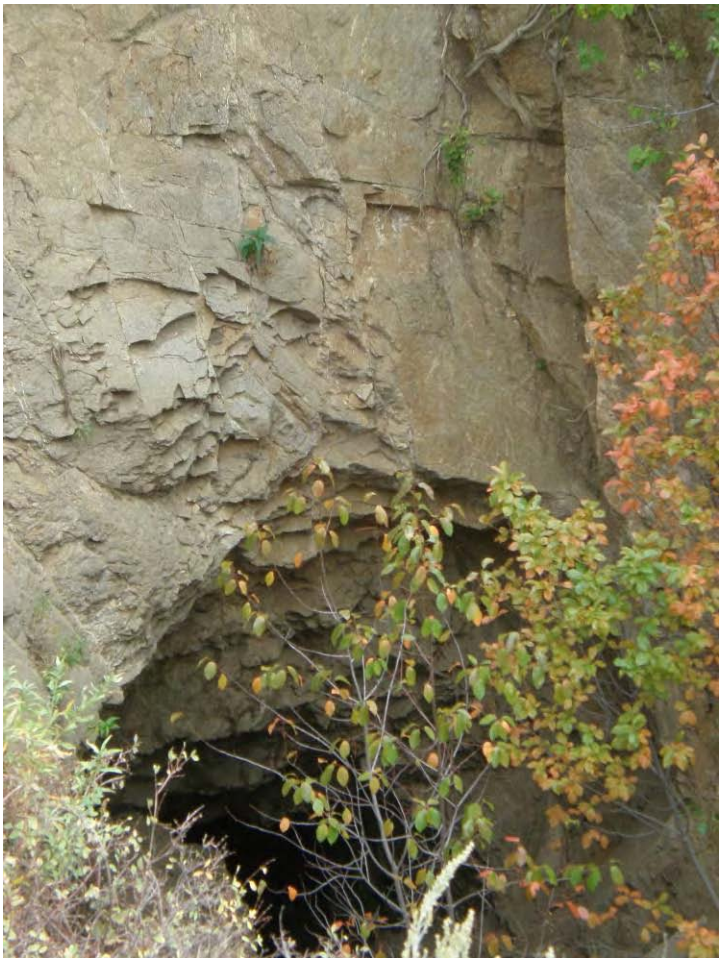
One caved adit lies to the east of the Relief shaft. Its waste dump is oxidized and sulfurous odors are prevalent. The dump is estimated to contain 500 cubic yards of material waste. Minor sulfide minerals were noted including pyrite, galena and sphalerite. A soil and background samples were collected.

View –looking down to S. Relief decline below collar, oxidation on limestone walls. The shaft is open to a depth of at least 100 feet.

The Allen Shaft is open. The shaft declines steeply below a vertical to overhanging headwall. Sloughing along its perimeter has increased the extent of the opening, resulting in a "glory hole" appearance. **This opening is extremely dangerous, especially when approached from up hill. Safeguards such as high fencing and signage should alert unwary recreationists to the hazard**. Owing to the dimensions of the shaft area (>50 feet diameter) closure or grating of the opening may be difficult (Gillerman & Griggs, 2005).

It is estimated that 22,500 cubic yards of material are on the Allen Shaft waste dump. The majority of the waste rock appears to consist of gray limestone and weather oxidized

diorite. Minor sulfide minerals were noted on the dump. Vegetation is moderately established on the top of the dump, but the steep slopes appear to support little if any, vegetative growth. Soil and background samples were collected.



View to SW. Looking into the open Allen Shaft decline; overhanging headwall and steep sidewalls. This is a very dangerous opening.

Alta Claim

An undocumented caved shaft on the Alta claim (designated as Unknown Shaft) exists northwest of the open Allen shaft. At this location a circular waste exists that appears to have formed by vertical hoisting and wasting. The waste dump was estimated to contain less than 1,500 cubic yards of material; principally diorite and argillite. Close examination of the immediate area detected the possible remnants of a collapsed shaft which is illustrated in Figure 5, as "UK shaft". Waste dump and background samples were collected on the Alta.

Badger Claim

Several short cat cuts and "dog holes" were observed on the north side of the gulch, primarily located on the Alta and Badger patented claims. The recent cuts seemed oriented in a general east-west orientation, exposing diorite. Sulfide mineralization was not readily apparent.

Quarrying of the diorite was evident as piles of this source material were noted near the gulch road.

Three small prospects were noted across the hillside above UK Adit 2. All of the dumps were of a very small volume where discernable the dump material seemed little more than a veneer covering the slope, below. No soils samples were collected.

Con Virginia

Minor workings including one recently opened (Unknown Adit#2) were observed on the Con Virginia patented claim. An old road traces to the entrance of an adit, designated by DEQ as UK Adit 2. Though the associated waste dump is small (<500 cubic yards), a soil sample was collected. Recent excavation of the portal, possibly with a backhoe is evident. The relative representation of patent boundaries suggests that the open adit lies within the Con Virginia while portions of the waste dump may lie on the adjacent Badger patented claim. **This opening may be considered hazardous, and safeguards such as high fencing and signage should alert unwary recreationists to the hazard**. Historically, the Con Virginia was noted to have been developed through a two compartment shaft, but lesser workings, such as encountered at UK Adit 2, were not mentioned in historic references. These openings were not definitively identified during the site assessment.

Grey Copper Claim

The Grey Copper consists of several prospects and at least one adit. The workings lie on the north side of the gulch, opposite the Minnie Moore. Two workings, designated by DEQ as Adit 11 and Adit 12, were initially included as Grey Copper workings though they may actually be located on the Queen of the Hills patent claim or on public land administered by the BLM.

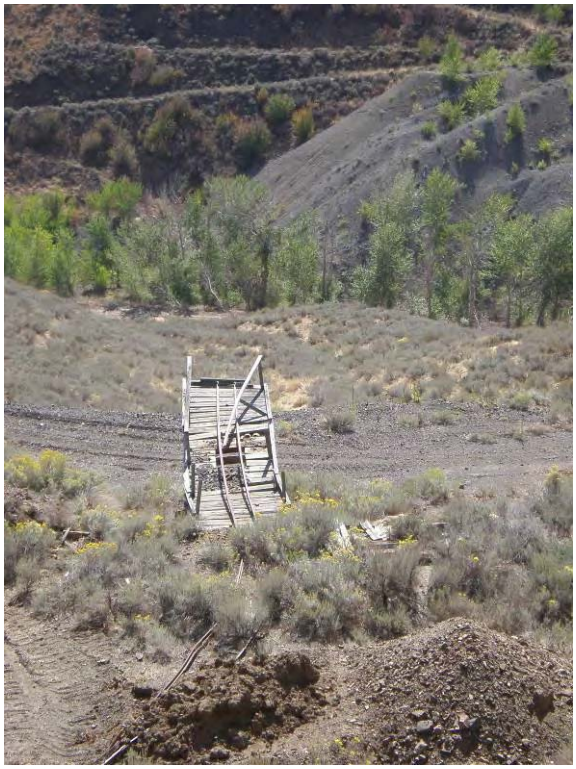
A background soil sample [UKBGSS-1] was collected above the Grey Copper claim near the ridge separating Minnie Moore Gulch (formerly known as Galena Gulch) from Mammoth Gulch. This sample was deemed applicable for screening level comparisons to the lower elevation facilities. Additional background samples were collected adjacent to major workings of the Minnie Moore mine. No samples were collected from any of the workings within the Queen of the Hills claim since the property owner's did not respond to IDEQ's requests for access.

A narrow old road winds up the hill to the north where it crosses the waste dump of Adit 11 before traversing back towards the northwest to Mammoth Gulch. A loading dock, in fair condition, lies along the road, below Adit 11 and waste dump 12. Remnant rails protrude from the portal area across the dock. The Adit 11 portal has been excavated, revealing cribbing across the back of the tunnel. The open length of the tunnel was not determined. The adits appear to have been driven N 10º E, possibly intersecting with the Lusk tunnel. **This opening is extremely dangerous, especially when approached from up hill. Safeguards such as high fencing and signage should alert unwary recreationists to the hazard**.

View to N: Unknown Adit 2, excavator marks on headwall, partially open adit, length unknown

View to N. Loading dock below Adit 11 (right); WD 11 (below); WD 12 (upper left)

View to N. Adit 11: portal excavated to tunnel, siliceous argillite host rock.



View to S. Taken from WD 12; track leading from Adit 11 to loading dock; road below dock crosses WD 11; Minnie Moore WD at upper right

View to N. Collapsed portal of Adit 12

Adit 12 waste dump was estimated to contain less than 1,250 cubic yards of material. No sulfides were evident, and a soil sample was not collected. Additional workings were noted above Adit 12. These include one shallow prospect as indicated by a very minor waste dump (not mineralized) and an open shaft. The shaft appears to have followed veining in a Gossan outcrop. Less than 50 cubic yards of material were noted on the waste dump below the shaft. The shaft measured 10 feet by 20 feet though its depth was determined. **This opening is very dangerous owing to steep and unstable walls. Perimeter fencing and signs are recommended to prevent accidents.** An exploration drill hole was observed along the road below the shaft.

View to SE. Looking down into shaft on Grey Copper Claim

Close-up view: Drill hole casing

Field notes incorrectly identify Adit 13 as the Lusk tunnel. The Adit 13 lies southeast of Adit 11, approximately 100 vertical feet above the road. The portal had been partially excavated, exposing a tunnel at least 50 feet long, bearing N 30º E. Dump material was scattered, but estimated to be less than 250 cubic yards. At least two prospects to the east may be located on the Grey Copper, as well. **This opening is dangerous, especially when approached from up hill. Safeguards such as high fencing and signage should alert unwary recreationists to the hazard**.

Mine waste located around open and caved workings on the Grey Copper are not voluminous, but residual jig tailings from the Minnie Moore Jig Mill are likely to be found on the Grey Copper claim.

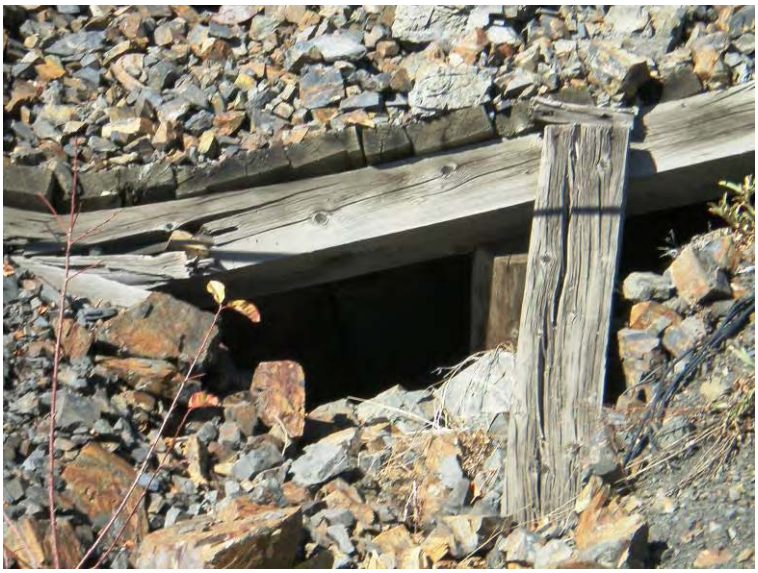
View to NNE. Adit 13; partially caved, opens beyond to a length/depth >50 feet

Queen of the Hills Claim

The Queen of the Hills mine/claim also know as the Silver Star-Queens Mine contains two main tunnels, the Moulton and the Lusk; two shafts (not including the one previously attributed to the Grey Copper); at least four lesser adits; and multiple prospect “dog holes” and a multiple buildings and foundations for a mill. All of the adits and Moulton tunnel were caved, while the Lusk’s portal was mostly collapsed. It was not determined whether the Lusk tunnel remained open beyond the portal. Both of the shafts are open and present serious safety issues to the unwary recreationist. The uppermost shaft is surrounded by a short fence, but the fence may not be an adequate deterrent. **Proper closure or high fencing and signage are recommended to prevent accidents.**

East of the Grey Copper, several shallow workings trace outcrops upslope. The largest of these waste dumps was estimated to contain less than 250 cubic yards of material. Adits 2 and 3, located northwest of a 50-foot mill support contained small waste dumps. Iron-stained black shale, quartz and minor sphalerite were noted on the dumps. Adit 4 was noted approximately 25 feet below compressor shed, near the Lusk tunnel. No dump was observed.

The Moulton tunnel waste dump was estimated to contain less than 750 cubic yards of material. The Lusk tunnel waste dump was not easily discerned. Much of the dump appears to have been removed for reprocessing or quarried. Several structures remain from the former mine including the storage building, compressor shed, mill (collapsed), office and drill core storage area.



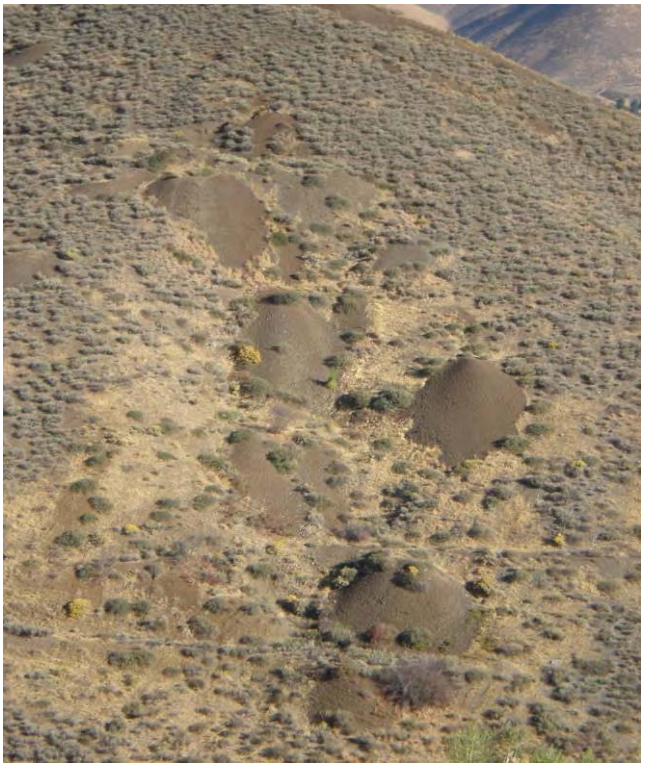
View to W. Lusk tunnel; collapsed portal

View to S. Mine office (?); Penobscot claim on far hill (upper left)

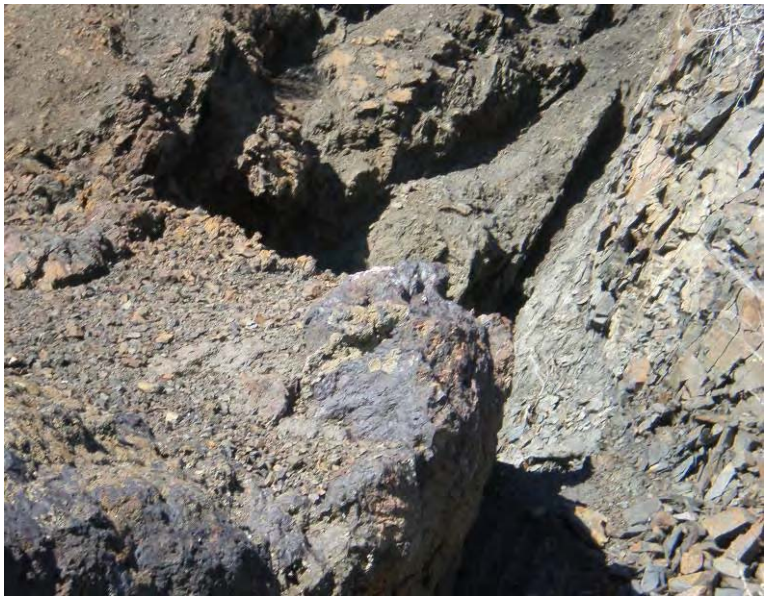
View to W. Collapsed mill building (foreground); Moulton tunnel waste dump beyond

View to N. Storage building (left), collapsed mill beyond at right

View to NE. Shallow adits & prospects; mill tower (right)



View to NE. Shallow adits & prospects, probably on the Queen of the Hills claim just east of the Grey Copper claim



View to NNW. Gossan outcrop, and open shaft on the Queen of the Hills Claim

View to SW. Open shaft on Queen of the Hills claim, vertical walls

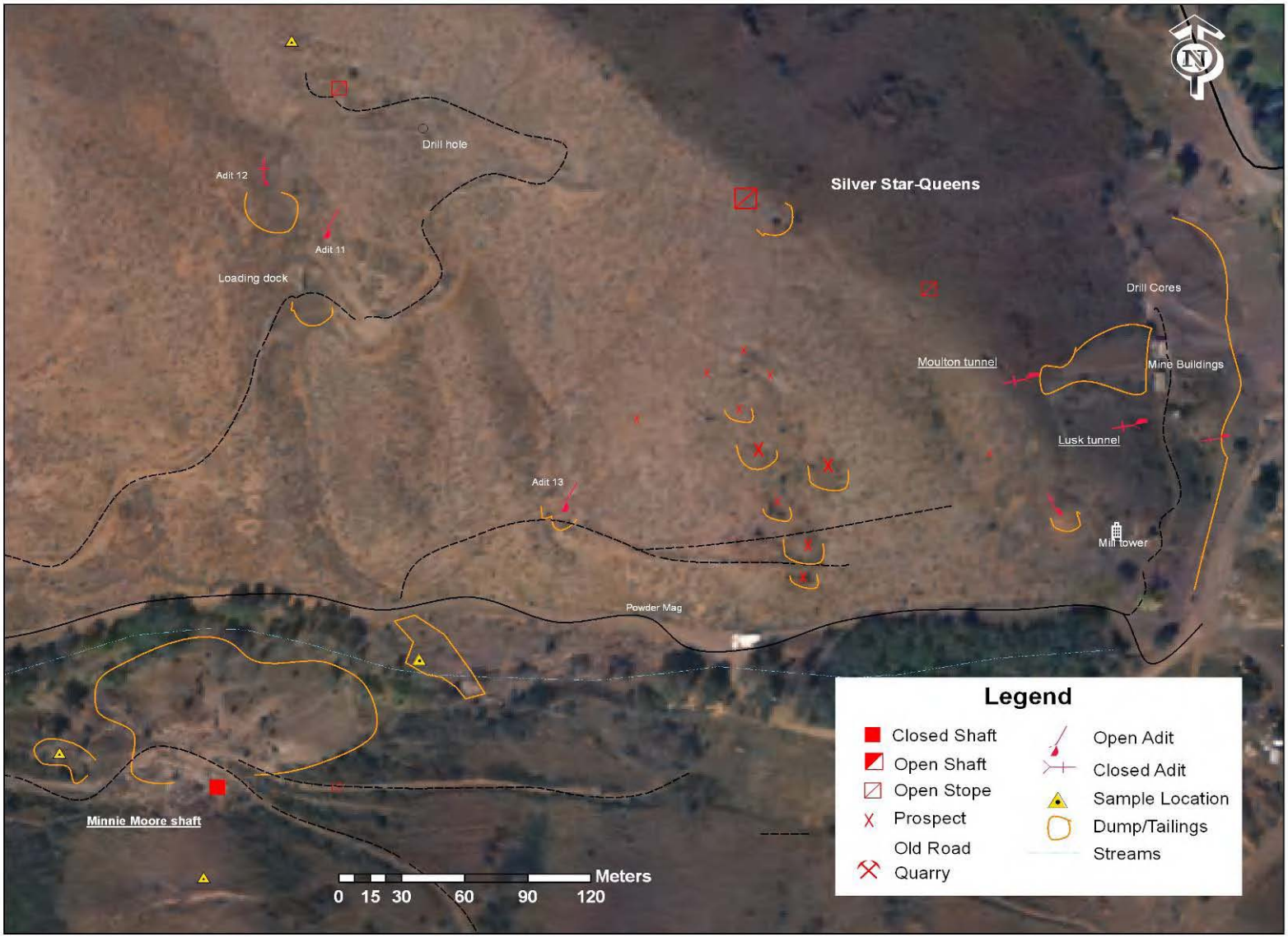


Figure 7 Grey Copper and Queen of the Hills Workings

Section 7 Geology

Numerous previous studies of the geology and mineral resources of the Wood River and adjacent areas have been made. Geologic studies have been conducted to investigate mineral deposits (Lindgren, 1900 & 1933; Umpleby et al, 1930; Anderson and Wagner, 1946; Anderson et al, 1950; Hall et al, 1978; Wavra and Hall, 1989; Link and Worl, 2001; Worl and Lewis, 2001); individual formations and units (Hall et al, 1974; Sandberg et al, 1975; Wavra and Hall, 1986; Worl and Johnson, 1995); quadrangles (Batchelder and Hall, 1978; Mitchell et al, 1991; Kiislgaard et al, 2001) and to compile regional information (Rember and Bennett, 1979). Preliminary and environmental assessment investigations have been conducted to assess current and potential impacts from historic mining in the region (Gillerman and Griggs, 2005; IDEQ, 2002 & 2006; IDEQ & USEPA, 2006 & 2007). Link and Worl (2001) reviewed previous geologic and historic information relating to stratigraphy and mineralization relationships in the Mineral Hill district, including Minnie Moore Gulch.

Figure 8 illustrates the lithology and structural geology in the Minnie Moore Gulch and surrounding area. Excerpts from A. L. Anderson's 1950 report describing the geology and workings of the Minnie Moore Mine are as follows:

> *"The Hailey-Bellevue mineral belt is underlain by a varied assemblage of sedimentary and igneous rocks, which, except for volcanics of mid-Tertiary age and some still younger unconsolidated sedimentary rocks, are all older than the ore deposits. The earlier rocks include fairly wide exposures of the Milligen and Wood River formations-the host of so many of the ore deposits in the Wood River region-and also rather large intrusive bodies of diorite and quartz monzonitic rock which are regarded as outliers of the Idaho batholith. There is also a younger group of intrusive rocks which are of more pertinent interest because of their close association with the mineralization.…In addition to the Milligen formation (Mississippian age) and the Wood River formation (Pennsylvanian age), the area contains some strata in and beneath a series of Tertiary volcanics (Oligocene) and much poorly consolidated and unconsolidated slope wash, terrace gravels, and stream alluvium of Quaternary age"*. (p. 2)
>
> *"The Minnie Moore vein is in argillitic rocks of the Milligen formation close to several limestone members a short distance under the sill-like body of diorite...These beds strike generally northwest and dip southwest at about 30º, with two notable exceptions. One of these is between the Minnie Moore and Relief shafts, where the strike changes to west-southwest for 200 to 300 feet and then resumes its northwest direction. The change produces a shallow synclinal trough of southerly pitch which coincides with the middle of the Minnie Moore ore body. The other exception is near the 1,000-foot level of the Minnie Moore shaft. There the beds flatten and locally dip slightly to the northeast for some 200 to 300 feet before resuming their normal 30º southwest dip.*
>
> *The diorite body conforms roughly to the northwesterly strike and southwesterly dip of the Milligen beds, although the contact is quite irregular. Both the diorite and sedimentary beds are cut by a few dikes and sills.*
>
> *The Minnie Moore is only one of a series of roughly parallel fissure veins of northwesterly strike and southwesterly dip. The other veins are the Bergman and McIrvin, which are believed to be southeasterly extensions of the Minnie Moore, and the Singleterry, Gray Copper, Old Telegraph, Queen of the Hills, and Queen of the Hills Footwall vein, which are referred to as the "Footwall", because they lie beneath or in the footwall of the Minnie Moore vein...*

> *The Minnie Moore ore body is a gently inclined, blanket-like body, continuous and unbroken down dip, except where offset by post-mineral faults and cut by post-mineral dikes. The ore body has varied considerably in thickness and grade from place to place and the thicker and richer parts may be deduced by referring to the stoped areas...The individual stopes represent flattened and somewhat irregular lenses of ire with lengths and widths up to 400 feet and thicknesses up to 18 feet. The full length of the ore zone is 1,200 feet.*
>
> *The ore consists, in order of abundance, of galena, pyrite, sphalerite, gray copper, chalcopyrite, and arsenopyrite in a gangue of siderite, quartz, calcite, and crushed country rock. Siderite is the most abundant of the vein minerals and occurs along parts of the vein in massive extensive sheets up to 10 feet thick. Pyrite, sphalerite, chalcopyrite, and arsenopyrite are present in relatively small amounts. The ore contains an average of $1^{1/2}$ to 2 ounces of silver to each per cent of lead...*
>
> *Of the ore mined, 90 per cent is said to have been milling ore averaging 10 per cent lead and 20 ounces of silver to the ton, The remainder, direct shipping ore, contained about 60 per cent lead and 100 ounces of silver to the ton. The direct shipping ore is reported to have formed bands and lenses of solid galena a few inches to 10 feet thick either as a complete vein filling or with milling ore.*
>
> *The Minnie Moore ore body has been mined for a distance of 1,400 feet down dip with no observable change in character, grade, or abundance of the ore. In this distance the ore body has been interrupted by four post-mineral faults; namely, the Upper and Lower Relief faults (small with little displacement), the Rockwell flat fault (200-foot displacement), and the Minnie fault zone beyond which the ore body has not been recovered although three separate segments have been found along the fault zone. Where cut off by the Minnie fault between the 900 and 1,100 levels, the ore body occurred as three lenses. The more westerly lens was about 60 feet wide, up to 18 feet thick, and contained galena and gray copper in massive siderite. The ore averaged 8 per cent lead and 16 ounces of silver per ton. The middle lens, which was 60 feet to the east, measured 65 feet wide and up to 10 feet thick. It contained both milling and direct shipping ore in non-siderite gangue. The third lens, 60 feet beyond the second, measured 75 feet wide and contained up to 6 feet of massive galena in a non-siderite gangue"* (pp. 15-16).

Link and Worl (2001) summarized the geology of the Silver Star-Queens mine as follows:

> *Two parallel vein systems are about 100 ft apart; the Hangingwall vein strikes N. 70º W. and dips 60º-65º SW. and the footwall vein is a splay of the Hangingwall vein. The main orebody had a stope length of 500 ft and was made up of sulfide lenses, including dark-brown sphalerite, 2-6 ft thick. Ore is present as a fracture filling of open space and as a replacement of wallrock. Marcasite present as a film coating on the other sulfide minerals suggests that the calcite and marcasite may have been deposited at a later time. Host rocks of black siliceous argillite strike N. 40º-50º W. and dip 25º-35º SW. and are folded* (p. 11).

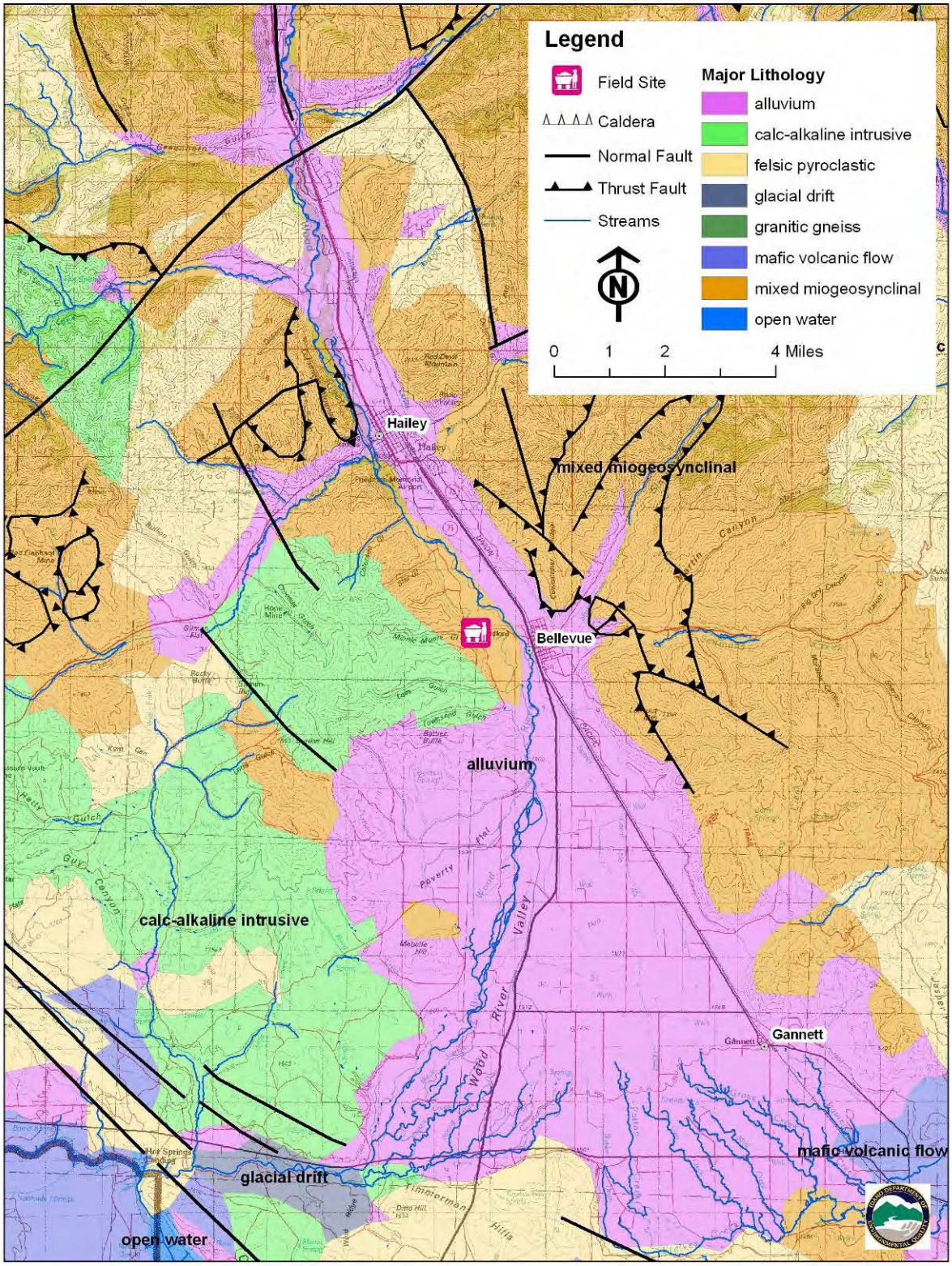


Figure 8
Geology of the Minnie Moore Gulch area

Section 8 Current and Potential Future Land Uses

Current land uses in the area include surface mining of topsoil and aggregate for commercial sale, off-road vehicle (ORV) use, hunting and hiking. The Johnston family controls access to the Minnie Moore Gulch road, but trails from adjacent gulches may permit access. As detailed in the Section 3 of this report, the most direct route approaches the gulch from the Broadford Road. A steep, narrow road from Lees Gulch winds passed the Modoc mine before crossing the ridge into Minnie Moore Gulch. However, the lowest portion of this road has been excavated and blocked to deter access. Considering the interest in developable properties and land values, it is likely that residential and commercial development of the patented mining claims in Minnie Moore Gulch either has been or will be a consideration in the future. IDEQ is, therefore evaluating these claims with that assumption in mind.

Section 9 Waste Sampling and Characterization

Sample Collection

At the time of the site visits, there was only one observation of surface waters (Penobscot Tunnel). However, there was not direct link to perennial streams, and therefore a water sample was not collected.

Numerous background soil, mine waste and tailings samples were collected in Minnie Moore Gulch. Each soil sample collected was, initially approximately ten (10) pounds in size. Each sample location was excavated several inches with the material discarded. Then the sample hole was excavated approximately 6” more to extract a sample. Waste dumps and tailings had at least three locations within a few square yards sampled and composited. Samples were placed in a large sterile plastic bowl from which coarse (+1") rock and woody debris were hand picked and disposed. The samples were then screened over a 10-mesh sieve and placed in a sterile plastic zip lock bag. The bag was appropriately marked with the sample identification, location description, date, and sampler name. It was then placed in a cloth sample bag, identically labeled. Sample descriptions were entered into field logbooks. The samples were logged on a standard chain-of custody lab submittal form. Once samples were taken to IDEQ’s field office at the end of the day they were placed in secure storage to await shipping.

Soil/waste samples were collected from waste dumps at the Minnie Moore shaft (MMWDSS-01), at the Allen shaft (ALWDSS-01), at the Relief shaft (RFWDSS-01), at the Michigan shaft (MSWDSS-01), and from jig mill tailings (MMWDSS-02), located below the Minnie Moore. Additional soil/waste samples were collected from two unnamed waste dumps. One of the waste dumps (UKWDSS-01) appeared to be isolated from any recognizable working, although its relative dimensions seem to indicate it was generated from shaft operations. The second unnamed waste dump (UKWD2SS-01) corresponded to a shallow adit across the gulch to the north. Background soils samples were collected for analysis above the Minnie Moore shaft (MMBGSS-01), the Allen shaft (ALBGSS-01), the Relief shaft (RFBGSS-01), the Michigan shaft (MSBGSS-01), and on the north ridge of Minnie Moore Gulch, above the Grey Copper and Queen of the Hills claims (UKBGSS-01).

Sample Description

Sample MMWDSS-01 was collected to the west slope of the main Minnie Moore Waste Dump, beneath a loading ramp. The sample location was excavated approximately 6 more inches in coarse rock and soil. The yellow to brown colored sample was a composite of jig-like tails and oxidized soil. Approximately 80% of the sample passed the 10 mesh sieve, less than 10% organic material was included.

Sample MMWDSS-02 was a composite sample collected from jig tailings adjacent to the road beneath the Minnie Moore waste dump. The sample location was excavated approximately 6 more inches in coarse rock and soil. The yellow to brown colored sample was a composite of jig-like tails and oxidized soil. Approximately 80% of the sample passed the 10 mesh sieve, less than 10% organic material was included.

Sample MSWDSS-01 was a composite sample collected from waste rock material from the crown of the Michigan Shaft Waste Dump. The sample contained some coarse fragments greater than 2". After hand sorting to dispose of the plus 1" material, approximately <50% passed the 10 mesh screen. The sample was generally brown to buff or gray colored.

Sample RFWDSS-01 was a composite sample collected from waste rock material from the east portion of the Relief Shaft Waste Dump. Here the dump emitted a strong sulfurous odor and abundant pyrite, minor galena and siderite sulfides were noted. The sample contained some coarse fragments greater than 2". After hand sorting to dispose of the plus 1" material, approximately <75% passed the 10 mesh screen. The sample was generally orange-yellow to brown.

Sample ALWDSS-01 was a composite sample collected from waste rock material from the north side of the Allen Shaft Waste Dump. Approximately 80% of the sample passed the 10 mesh sieve, less than 10% organic material was included. The sample contained some coarse fragments greater than 3". After hand sorting to dispose of the plus 1" material, approximately <75% passed the 10 mesh screen. The sample was generally orange-yellow to brown, minor sulfides were noted.

Sample UKWD1SS-01 was a composite sample collected from waste rock material from the Unknown Shaft Waste Dump on the Alta claim. The sample contained some coarse fragments greater than 2". After hand sorting to dispose of the plus 1" material, approximately <50% passed the 10 mesh screen. The sample was generally brown to black with minor quartz. No sulfides were noted.

Sample UKWD2SS-01 was a composite sample collected from waste rock material from the Unknown Waste Dump located on the Con Virginia claim. The sample contained some coarse fragments greater than 2". After hand sorting to dispose of the plus 1" material, approximately <50% passed the 10 mesh screen. The sample was generally buff-brown or gray, sphalerite and calcite.

Background soil samples were collected above: the Minnie Moore Shaft (MMBGSS-1); the Allen Shaft (ALBGSS-1); the Relief Shaft (RFBGSS-1); the Michigan Shaft (MSBGSS-1), and

on the south-facing slope above the Queen of the Hills claims (UKBGSS-01). Generally speaking all of the background samples appeared to be decomposed quartz diorite with minor alteration (iron) minerals. They were buff or brown in color, contained less than 10% organic materials. Approximately 30-50% passed the 10 mesh screen.

Sample Analysis

IDEQ Sample Analysis of waste dump, tailings and background soils are presented in Table 1 and Table 2. Samples were analyzed for Total Recoverable Metals (Totals), but subsequent TCLP analyses were not performed. In addition to IDTLs, the sample results were compared with the EPA Region 6 Human Health Medium-Specific Screening Levels (HHSL). Although HHSL values are not regulatory, they are derived from EPA guidance equations and commonly used defaults (EPA, 2007).

Analysis of background soil samples MMBGSS-1, ALBGSS-1, RFBGSS-1, MSBGSS-1, and UKBGSS-01 indicate that background metals concentrations are fairly consistent in top soils around the mines in Minnie Moore Gulch. None of the background samples contains total concentrations of Antimony, Selenium, or Silver above detection limits. Background soil samples collected above the Minnie Moore Shaft and Relief Shaft had concentrations of Mercury slightly above the method detection limits, but were still below EPA Region 6's Human Health Screening Criteria. Ranges for concentrations of total Arsenic (5.8 – 27.6 mg/kg), cadmium (1.42 – 4.52 mg/kg), Copper (14.2 – 42.3 mg/kg), Iron (21,500 – 29,400mg/kg), Lead, and Zinc (91-368 mg/kg) were all below EPA Region 6's Human Health Screening Criteria.

Analysis of samples from mine wastes and tailings indicates that total metals concentrations for antimony, arsenic, cadmium, iron, lead, mercury, silver and zinc exceed Idaho's Initial Default Target Levels (IDTLs). These IDTLs are risk-based target levels for certain chemicals that have been developed by IDEQ using conservative input parameters, a target acceptable risk of 10-6, and a Hazard Quotient of 1. An exceedence of the IDTLs indicates that if pathways are complete, and receptors can get a prolonged exposure to contaminants from the site, then additional site assessment work may be necessary to qualify true risk under current site conditions.

The highest metal concentrations were found in samples from the Minnie Moore shaft's waste dump and from the jig mill. These are: antimony (388 mg/kg), arsenic (6,150 mg/kg), cadmium (230 mg/kg), iron (191,000 mg/kg), lead (22,100 mg/kg), mercury (4.57 mg/kg), silver (256 mg/kg), and zinc (23, 500 mg/kg); which far exceeds IDTLs, EPA Region Six's Human Health Screening levels and background conditions.

Sample RFWDSS-01 was a composite sample collected from waste rock material from the east portion of the Relief Shaft Waste Dump. Concentrations of total Antimony (16.8 mg/kg) Arsenic (2490 mg/kg), Cadmium (578 mg/kg), Iron (78,400 mg/kg), Lead (8350 mg/kg), Mercury (2.0 mg/kg), Selenium (7.1 mg/kg), Silver (38.3 mg/kg) and Zinc (1400 mg/kg) exceed background soils concentration by greater than 3 times, and the IDTLs. The concentrations for total Arsenic, and Lead also exceed EPA Region 6 Human Health Screening Criteria by 100 times and 20 times respectively.

Sample ALWDSS-1 was a composite sample collected from waste rock material from the Allen Shaft Waste Dump. Concentrations of total Arsenic (104 mg/kg), Cadmium (8.37 mg/kg), Copper (8.37 mg/kg), Iron (25,600, Lead (103 mg/kg), Mercury (0.0593 mg/kg), Selenium (<4 mg/kg), Silver (0.76 mg/kg) and Zinc (573 mg/kg). Total Arsenic, Cadmium, Lead, Mercury and Silver the IDTLs.

Soils analysis of the material from the two “Unknown” waste dumps indicates that arsenic (96.3 mg/kg) and selenium (8.3 mg/kg) exceeds IDTLs, EPA Region Six’s Human Health Screening levels and background conditions. Interestingly, selenium results from samples collected at only the Unknown waste dumps and the Relief shaft waste dump exceeded the MDL of 4.0 mg/kg.

Table 1: IDEQ Soils Samples Total Recoverable Metals Analysis (mg/kg)

Description	IDEQ Initial Default Threshold Level (IDTL) values	EPA Region 6 Human Health Screening Criteria	Minnie Moore Waste Dump #1 MMWDSS-01	Minnie Moore Jig Tailings MMWDSS-02	Allen Shaft Waste Dump #1 ALWDSS-01	Relief Shaft Waste Dump #1 RFWDSS-01	Michigan Shaft Waste Dump #1 MSWDSS-01	Unknown Waste Dump #1 UKWD1SS-01	Unknown Waste Dump #2 UKWD2SS-01
Antimony	4.77	**31**	**79.2***	**388***	<2.0	16.8*	9.9	<2.0	3.8
Arsenic	0.391	**23**	**6150***	**3600***	**104***	**2490***	**773***	28.5	96.3
Cadmium	1.35	**39**	**230***	**116***	8.37*	13.3*	11.9*	10.7	3.87
Copper	921	**2900**	76.1	643*	49.0*	578*	33.8	69.6	82.8
Iron		**55000**	191000*	113000*	25600*	78400*	54800*	18500	36600
Lead	49.6	**400**	**4200***	**22100***	103*	**8350***	**575***	31.1	77.7
Mercury	0.00509	**23**	**2.38***	**4.57***	0.593*	2.0*	0.607*	0.088*	0.345*
Selenium	2.03	**390**	<4	<4	<4	7.1*	<4	6.1	8.3
Silver	0.189	**390**	**19.4***	**256***	0.76*	38.3*	2.52*	0.59*	0.80
Zinc	886	**23000**	**23500***	**13700***	573*	1400*	951*	842*	183
	At or Exceeds IDTLs								
*	At or Exceeds Background Levels x3								
	At or exceeds EPA region 6 HHSLs								

Note: MDL for Se exceeds IDTL value

Table 2: IDEQ Background Soils Samples - Total Recoverable Metals Analysis (mg/kg)

	IDEQ Initial Default Threshold Level (IDTL) values	EPA Region 6 Human Health Screening Criteria	Minnie Moore Shaft Background Soil Sample	Allen Shaft Background Soil Sample	Relief Shaft Background Soil Sample	Michigan Shaft Background Soil Sample	Unknown Background Soil Sample Above Grey Copper
Description			MMBGSS-01	ALBGSS-01	RFBGSS-01	MSBGSS-01	UKBGSS-01
Antimony	4.77	**31**	<2.0	<2.0	<2.0	<2.0	<2.0
Arsenic	0.391	**23**	27.6	5.8	11.8	21.9	23.8
Cadmium	1.35	**39**	3.03	1.42	1.79	4.52	2.13
Copper	921	**2900**	36.5	14.2	16.6	42.3	21.7
Iron	5.76	**55000**	21500	25200	26900	22700	29400
Lead	49.6	**400**	62.6	19.9	42.4	25.1	20.6
Mercury	0.00509	**23**	0.037	<0.033	0.035	<0.033	<0.033
Selenium	2.03	**390**	<4	<4	<4	<4	<4
Silver	0.189	**390**	<0.50	<0.50	<0.50	<0.50	<0.50
Zinc	886	**23000**	266	82.9	101	368	91
	At or Exceeds IDTLs						
	At or exceeds EPA region 6 HHSLs						

Note: MDL for Ag, Hg & Se exceeds IDTL value

Section 10 Risk Analysis

The heavy metal concentrations exhibited in Minnie Moore Gulch may present an unacceptable health risk for receptors visiting and/or working at the site. To evaluate risks to human health from exposure to soils in Minnie Moore gulch, DEQ used the DEQ 2004 Risk Evaluation Manual (REM). This analysis is based on exposure to surface soils, and it utilized the following sample data from the jig tailings and Minnie Moore shaft waste dump.

It is assumed that recreational visitors have the potential to contact contaminants at the site while hiking, hunting, and riding mountain bikes or ATVs. However, due to current quarrying activities, it is also assumed that most visitors may access the site specifically for mineral exploration and development. Therefore, the exposure routes, in decreasing order of significance, are incidental soil ingestion, inhalation of particulates, and dermal contact.

Although the following is a very brief synopsis of the risk evaluation, the detailed analysis and tables containing the results of the calculations may be found in Appendix A.

Exposure Duration and Frequency

The age-adjusted receptor represents an individual who visits the site over 30 years, six times as a child, nine times as an adolescent, and fifteen times as an adult. For non-residential receptor the exposure duration is 6.6 years. The exposure duration of a construction worker is 30 days; this is assumed to be a conservative estimate owing to the duration of most construction projects.

For exposure routes involving direct contact with soil, including soil ingestion and dermal exposure, it is assumed that receptors have contact with soil primarily in warmer months, when the ground is not frozen or snow covered. For this reason, an exposure frequency of 270 days per year is used for these exposure routes for both residential and nonresidential scenarios. The direct contact exposure frequency for construction workers is 30 days per year (REM, Appendix E, p. E-2).

Discussion

IDEQ ran the Risk Evaluation Model (REM) for each of the areas where soils sample analysis demonstrated metals concentrations higher than Idaho's Initial Default Threshold Limits (IDTL's). Potential for cancer risk and non-cancer hazards analysis were driven by arsenic, cadmium and mercury concentration levels. The tables of *Summary(s) of Cumulative Risk and hazard Index(s), Representative Concentrations for Residential Receptors, Representative Concentrations for Non-Residential Receptors, Representative Concentrations for Construction Workers, Risk/Hazard Quotient for Residential Receptors, Risk/Hazard Quotient for Residential Receptors, Risk/Hazard Quotient for Non-Residential Receptors, and Risk/Hazard Quotient for Construction Workers, a*re contained in Appendix A. No REM analysis has been completed for ecological receptors.

Under the current uses for the site the most realistic receptor for the site is the construction worker. Although there are no residences in Minnie Moore Gulch, and public access is well

restricted, there is a fairly good potential that Minnie Moore Gulch may be considered for residential development. Therefore residential (child and age-adjusted) and non-residential scenarios have been included for consideration and recommendations regarding risk management needs for that future use. Most of the receptors are expected to be construction workers actively working the mineral claims or adjacent ground. Considering the climate, the elevation and slope aspect of the workings, May through October might represent the typical mining season. The frequency and duration of the construction worker seems to be appropriate to the type of mining activities which were observed within Minnie Moore Gulch. These risk factor assumptions would significantly change if residences are developed in proximity to the mine waste and jig tailings piles.

Generally speaking at all of the mine dumps and waste sites there are significant cancer and non-cancer risks due top exposure to arsenic, lead and mercury. The cancer risk for potential residential receptors and construction workers is greater than the acceptable levels. The non-cancer hazard is also greater than the acceptable level (Hazard Index = 1) for the residential receptors and the construction worker receptors. Again, for specific and detailed analysis for each of the mines and waste sites, the reader is directed to Appendix A

Uncertainty

The risk estimates presented here are based on specific locations and may not be representative of the huge surface areas described by claims or large volumes of materials contained in waste dumps. **Furthermore, it is unlikely that under the "current uses" site receptors will realize the assumed exposure time.** However, if any of the claims are developed without incorporation of significant risk management for mine wastes and jig tailings, then risk factor assumptions, particularly for residents, would radically change.

The analysis presented here assumed that all of the arsenic is 100% bioavailable. It is likely that bioavailability varies in soils throughout this site; 60% arsenic bioavailability has often been assumed for arsenic in soils contaminated with mine waste.

Section 11 Pathway and Environmental Hazard Assessment

Pathway and environmental hazards were assessed for groundwater, surface water, and soil/air exposure. The findings from these assessments are presented in the following.

The information extrapolated from these reports is based on data that existed at the time of their writing, and the professional judgment of IDEQ staff. Although reasonable efforts were made to present accurate information, no guarantees, including expressed or implied warranties of any kind are made with respect to these reports or this Preliminary Assessment by the State of Idaho or any of its agents who also assume no legal responsibility for accuracy of presentation, comments or other information in these publications or this Preliminary Assessment report. The results should not be used as an absolute measure of risk, and they should not be used to undermine public confidence in public drinking water systems.

Ground Water

Ground water flow is expected to be controlled structurally within faults and brecciated zones in the country rock and be expressed at the surface as springs. The discharge from the Penobscot tunnel appears fairly minimal, perhaps owing to more pervasive conduits within the local strata. Other than this adit discharge, no additional springs were noted or mapped near the mines. The amount of recharge of regional aquifers by surface and ground water in the Minnie Moore Gulch area is unknown.

According to Idaho Department of Water Resources July 2002 records, 22 private drinking water wells are located within a 1-mile radius of the site. Drinking water wells are illustrated in Figure 9. The closest domestic well is located to the east at the Johnston's residence at the mouth of Minnie Moore gulch. No wells were sampled. There are no known persistent water quality problems in the area water supply wells.

During the cleanup activities of the nearby mines, such as Triumph and the adjacent Minnie Moore Mill site, the first concerns were related to potential human health risks as a result of contamination of public and private drinking water supplies. Generally speaking, contamination of drinking water systems was thought likely to occur from two types of sources (ore bodies and waste dumps) and along three pathways, as illustrated by the following three scenarios. First, heavy metals are leached from mine waste dumps, enter ephemeral or perennial drains and then contaminate the area's shallow ground water system. Second, heavy metals leach from the local ore bodies and are transported through the geologic structure to the shallow ground water. Third, heavy metals could leach out of the ore bodies, and be discharged from the underground workings as adit water, that is then conveyed through ephemeral and perennial drains to the shallow ground water systems.

For the purposes of completing Preliminary Assessments, Source Water Assessments (completed for local public drinking water supplies) were used to identify any known affects to those systems. Although IDEQ's Source Water Assessments were used to evaluate potential affects of this mine on public drinking water supplies no inferences can be made about the affects that this and adjoining mines have on local private wells.

Source water assessments provide information on the potential contaminant threats to public drinking water sources. In the Big Wood River Valley Idaho, most of those sources (>95%) are ground water (IDEQ 2000). Each source water assessment:

- Defines the zone of contribution, which is that portion of the watershed or subsurface area contributing water to the well or surface water intake (source area delineation).
- Identifies the significant potential sources of drinking water contamination in those areas (contaminant source inventory).
- Determines the likelihood that the water supply will become contaminated (susceptibility analysis**).**

Each assessment is summarized in a report that describes the above information and provides maps of the location of the public water system, the source area delineation, and the locations of potential contaminant sources. Idaho began developing source water assessments in 1999, and in May 2003 met its obligation under the amendments of the Safe Drinking Water Act by

completing delineations for all 2100+ public water systems that were active in Idaho as of August 1999 (IDEQ 2000). Source water assessments for new public drinking water systems are being developed as those systems come online. Each public water system is provided with two copies of its final assessment report. Four source water assessments for drinking water supplies have been used in this Preliminary Assessment Process to evaluate the potential impacts to both public and private drinking water supplies in and around Sun Valley, Ketchum, Hailey and Bellevue.

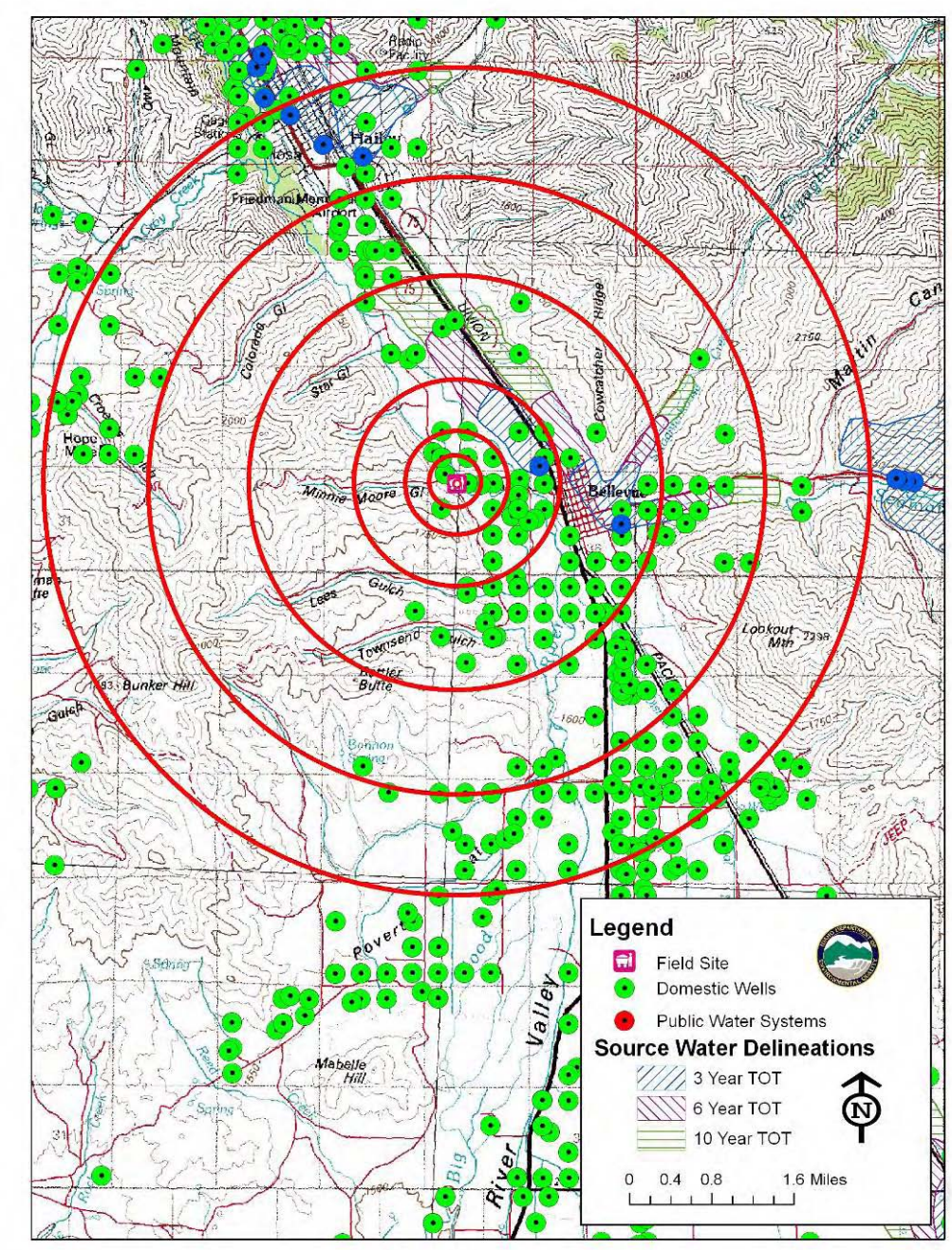


Figure 9 Drinking Water Well Locations and Source Water Delineations

The Source Area delineation process establishes the physical area around a well or surface water intake that becomes the focal point of the source water assessment. The process includes mapping the boundaries of the zone of contribution (the area contributing water to the well or to the surface water intake) into time of travel zones (TOT) indicating the number of years necessary for a particle of water to reach a well or surface water intake (IDEQ 2000). The size and shape of the source water assessment area depend on the delineation method used, local hydrogeology, and volume of water pumped from the well or surface water intake.

IDEQ used a refined computer model approved by EPA to determine the 3-year (Zone 1B), 6-year (Zone 2), and 10 year (Zone 3) time of travel associated with the Big Wood River Aquifer and its sources (IDEQ 2000). This information is illustrated in Figure 12.

This process involves collecting, recording, and mapping existing data and geographical information system (GIS) coverage to determine potential contaminant sources (e.g., gas stations) within the delineated source water assessment area. The potential contaminant source inventory is one of three factors used in the susceptibility analysis to evaluate the overall potential risk to the drinking water supply (IDEQ 2000). The inventory process goal is to locate and describe those facilities, land uses, and environmental conditions that are potential sources of ground water or surface water contamination.

This susceptibility analytical process determines the susceptibility of each public water system well or surface water intake to potential contamination within the delineated source water assessment area. It considers hydrogeologic characteristics, land use characteristics, potentially significant contaminant sources, and the physical integrity of the well or surface water intake. The outcome of the process is a relative ranking into one of three susceptibility categories: high, moderate, and low. The rankings can be used to set priorities for drinking water protection efforts (IDEQ 2000).

There are numerous public and private drinking water supplies in the Big Wood River Basin. The Sun Valley Water and Sewer District operates and maintains nine wells in two groupings (IDEQ 2000). The City of Ketchum drinking water system consists of seven wells in two groupings. The City of Hailey's drinking water system consists of six wells and a spring (IDEQ 2000).The City of Bellevue drinking water system consists of two wells and three springs (IDEQ 2000).

Generally speaking, public drinking water systems in the Big Wood River Valley are rated as moderate to high (IDEQ 2000). Multiple factors affect the likelihood of movement of contaminants from the sources to the aquifer, which led to this moderate to high score. Soils in the area are poorly to moderately drained. The vadose zone is predominantly gravel, which increases the score. On the valley floors the average depth to ground water is twenty to fifty feet.

To date, routine water quality monitoring of public drinking water indicates that there are no significant volumes of heavy metals migrating through the regional or localized ground water systems. There is no current, long term or recurring water chemistry problems in the City of Ketchum's drinking water sources. Arsenic, nickel, antimony, barium, selenium, chromium, cyanide and nitrate have been detected in Ketchum's wells, but all were well below MCLs (IDEQ 2000). There is no long term or recurring water chemistry problems in the City of Hailey's drinking water sources. Manganese, zinc, chromium, and mercury have been detected in Hailey's wells, but all were well below MCLs (IDEQ 2001). Currently, there are no data that

indicate that any metal concentrations have exceeded MCLs in the Bellevue drinking water systems (IDEQ 2000).

Sensitive Species and Wetlands

Wetlands

Wetland surveys near the site were reviewed (USFWS, 2007) along with aerial photographs (see Figure 10). These indicate that the nearest wetlands are located in the Big Wood River valley. Minnie Moore Gulch is an ephemeral drainage. Shallow springs support pocket stands of aspen trees above the Minnie Moore, but any flow from these waters readily infiltrates the substrate.

Species of Concern

Redband rainbow trout [*Oncorhynchhus mykiss* gairdneri], mountain white fish [Prosopium williamsoni], wood river sculpin [Cottus leiopomus], and brook trout [Salvelinus foninalis] are present within the Big Wood River (IDFG, 2000). These are the closest official observations of fish to the mine site. Commercial or subsistence fishing does not occur within the 15-mile Target Distance Limit (TDL), but sport fishing does.

The Canadian Lynx (*Lynx* canadensis), a listed threatened specie, maintains a home range within a 4-mile radius of Minnie Moore gulch. Additionally, the bald eagle (Haliaeetus leucocephalus), the North American wolverine (Gulo gulo) and the Western toad (Bufo boreas) which are species of concern, reside within or closely nearby the gulch. Figure 12 illustrates these relationships.

In addition to the North American wolverine, Gray Wolves may also range in this area. Due to the much greater area of range for these animals compared to the size of the waste dumps, it is unlikely that individual animals would experience sufficient doses to be at risk.

Future Land Use

Future land use could include development of some year-round and/or seasonal homes.

It is likely that recreational use of the site will increase as the local populations and recreation industry expands. The site will also likely continue to provide grazing values to wildlife.

Surface Water

The mine discharge from the Penobscot tunnel was observed to infiltrate into the waste rock. The adit water was not observed to resurface, either along the toe of the dump or from the adjacent ground.

The ephemeral stream in Minnie Moore Gulch infiltrates the subsurface and does not appear to enjoin any waters of the Big Wood River. However, the theoretical 15-mile Target Distance Limit (TDL) lies within this river's drainage. The Big Wood River is an EPA CWA §303(d) listed stream.

Commercial or subsistence fishing does not occur within the 15-mile downstream distance, but sport fishing does. Redband rainbow trout [*Oncorhynchhus mykiss* gairdneri], mountain whitefish [Prosopium williamsoni], wood river sculpin [Cottus leiopomus], and brook trout [Salvelinus foninalis] are, however, present within the Big Wood River (IDFG, 2000).

Soil Exposure and Air

Access to the mine sites is restricted from the Broadford Road though access from Lees Gulch remains unrestricted to portions of the hill above Minnie Moore. Human and ecological receptors may be exposed to soils and mine waste by inhalation, dermal contact and ingestion. As with most of the mine sites in the Big Wood River area, strong winds on hot summer afternoons suspends fugitive dust in the air, which may be inhaled. Visitors may also have direct contact with heavy metals in wastes while exploring the site.

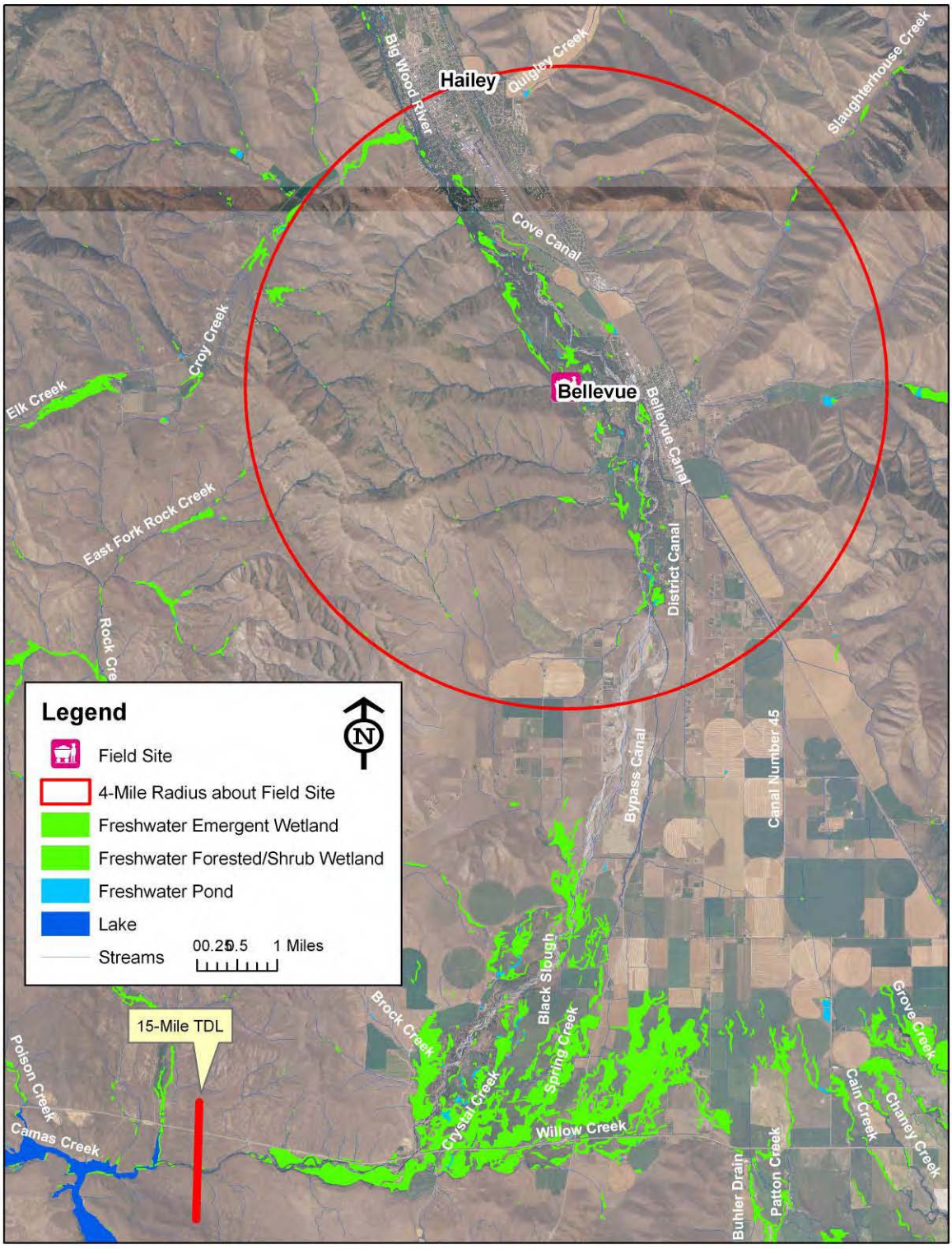


Figure 10 Wetlands

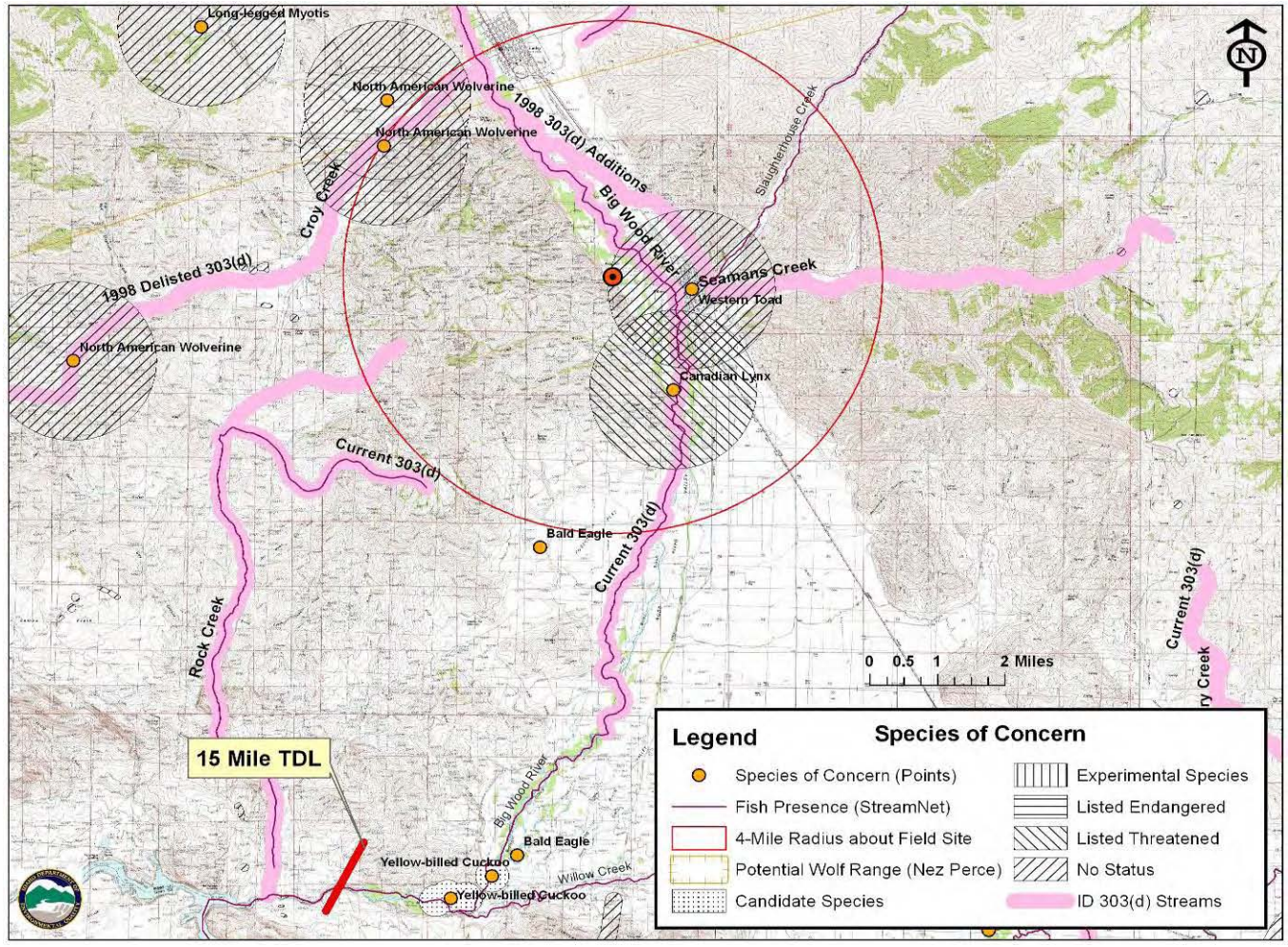


Figure 11 Species of Concern near Minnie Moore Gulch

Potential Receptors

Potential receptors include hikers, hunters, and trail riders (motorized and non-motorized). Cattle and/or sheep may graze the surrounding area, but their presence within the mine site appears minimal. Outdoor enthusiasts remain the highest percentage of human receptors, as they frequent the area for a number of recreational activities. The land within a two (2) mile radius of the site is primarily private, but public land administered by the BLM borders to the west and north.

Schools, Day-Care Facilities, Private Residences

There are no schools or day-care facilities, or private residences within 200 feet of the site, but the Johnston family resides at the mouth of the gulch and within 0.25 miles of the site. In addition, outdoor recreation enthusiasts may occasionally be within 200 feet of the site.

Section 12 Conclusions and Recommendations

Presence of Wetlands

According to the official wetland surveys and aerial photographs of the area, wetlands do not exist in Minnie Moore Gulch, but they do exist below it along the Big Wood River. Based observations and available wetlands data, existing wetlands along the Big Wood River could be adversely impacted by sources in Minnie Moore Gulch particularly the Riverview Millsite where EPA has completed a CERCLA 106 Removal Action.

Impacts on Water Quality

No overland connections were observed between seasonal runoff and nearby surface or ground water systems. Furthermore, source water assessments indicate that there are no adverse impacts to public or private drinking water supplies from mining in the area. If residences are developed on the mining claims, domestic wells might be drilled into a ground water system that is not suitable for domestic consumption. In this instance local community wells and public drinking water systems may be appropriate.

Potential Exposure for Wildlife, Livestock, and Vegetation

Although ecological risks were not evaluated closely, the potential exposure of ecological receptors on waste dumps is present. Native plant species may bio-accumulate high concentrations of metals that may be consumed by the local wildlife or livestock. Livestock and wildlife may be exposed to elevated arsenic, lead and possibly selenium soils concentrations, but relative to the extensive range of the livestock and wildlife, compared to the area of the dumps, it is unlikely that significant exposures to heavy metals occurs.

Potential Exposure for Humans

Human activity around the site is assumed minimal except for construction site workers. Minnie Moore Gulch is infrequently visited by mountain bikers, hikers, hunters, snowmobile operators, off-road four wheeling, or various other outdoor recreation enthusiasts. Access is restricted and maintained by the Johnston family. Exploration and development for industrial minerals is evident. Humans likely receive very small doses of heavy metals, especially arsenic, cadmium, lead, mercury, silver and zinc at the mine sites. Fugitive dust or direct contact with the waste piles appears to be the most significant route of exposure to humans for elevated constituents. Furthermore, aggregate and top soil is produced for commercial sales and distribution throughout the Big Wood River Valley. Contaminated soils may be being distributed across the valley. In order to evaluate whether or not contaminated soils are being distributed in the Big Wood River Valley additional and then routine sampling should be conducted of the topsoil sources and stockpiles. If there are significant human health risks due to exposures from these products, then a risk management plan should be developed and implemented.

The highest metal concentrations were found in samples from the Minnie Moore shaft's waste dump and from the jig mill on the Old Telegraph claim. These are: antimony (388 mg/kg), arsenic (6,150 mg/kg), cadmium (230 mg/kg), iron (191,000 mg/kg), lead (22,100 mg/kg), mercury (4.57 mg/kg), silver (256 mg/kg), and zinc (23, 500 mg/kg); which far exceeds IDTLs, EPA Region Six's Human Health Screening levels and background conditions.

The metals that resulted in the most significant cancer ad non-cancer health risks includes arsenic, lead and mercury. REM Modeling of mine wastes indicates cancer risk for of residential, non-residential and construction worker receptors are greater than the acceptable level of 1E-05. The non-cancer hazards related to these wastes is greater than the acceptable level (Hazard Index = 1) for all receptors. And, in soils around the Minnie Moore Shaft Cancer risk for residential receptors is greater than the acceptable level of 1E-5, However, non-cancer hazard is less than the acceptable level (Hazard Index = 1) for the age-adjusted residential, the non-residential and the construction worker receptors. **Based on these analyses, additional site assessment and risk management may be warranted. IDEQ recommends that a preliminary Hazard Ranking Score be calculated for the Minnie Moore, Old Telegraph and Grey Copper claims.**

Sample **RFWDSS-01** and **ALWDSS-1** were composite samples collected from waste rock material from Relief and Allen shaft waste dumps. Concentrations of total Antimony, Arsenic, Cadmium, Iron, Lead, Mercury, Selenium, Silver and Zinc exceed background soils concentration by greater than 3 times, and the IDTLs. The concentrations for total Arsenic and Lead also exceed EPA Region 6 Human Health Screening Criteria by 100 times and 20 times respectively. Furthermore, REM analysis indicates that cancer risk for residential, non-residential and construction worker receptors is greater than the acceptable level. The non-cancer hazard is greater than the acceptable level (Hazard Index = 1) for the age-adjusted residential, the non-residential and the construction worker receptors. **Based on these analyses, IDEQ is recommending that a Hazard Ranking Score be developed for the Relief claim property. Additional site assessment and/or risk management is warranted, particularly if this site is developed for residential purposes.**

Soils analysis of the material from the two "Unknown" waste dumps on the Alta and Con Virginia claims indicate that arsenic (28.5 and 96.3 mg/kg), mercury (0.088 and 0.345 mg/kg) and selenium (6.1 and 8.3 mg/kg) exceeds IDTLs, and three times background concentrations. These concentrations indicate that there may be both cancer and non-cancer risks associated with the waste if these claims are developed for "Unrestricted Uses" such as residential. If these claims are developed for residential uses, risk management plans should consider localized access restrictions, and soils caps/covers for contaminated areas. **IDEQ is recommending that a Hazard Ranking Score be calculated for these claims. However, pending additional information regarding future uses or an EPA HRS, IDEQ is recommending that these properties are designated as No Remedial Actions Planned. If residential development is planned for these claims, very specific risk management designs should be incorporated in the development plans.**

The Queen of the Hills mine/claim also know as the Silver Star-Queens Mine contains two main tunnels, the Moulton and the Lusk; two shafts, at least four minor adits or "dog holes" and a multiple buildings and foundations for a mill. All of the adits and Moulton tunnel were caved, while the Lusk's portal was mostly collapsed. IDEQ did not determined whether the Lusk tunnel remained open much beyond the portal. Both of the shafts are open and present serious safety issues to the unwary recreationist. The uppermost shaft is surrounded by a poorly maintained fence, which is an inadequate barrier. **Proper closure or fencing and signage are recommended to prevent accidents.** Although, samples were not collected in the mill site or on the mine waste dumps, it is likely that some heavy metals concentrations exist on this site. **IDEQ**

is therefore recommending that additional requests are made for access and that this site is assessed.

Physical Hazards

Although not a function of human health and ecological risk analysis, or the CERCLA site assessment protocols, IDEQ made observations about numerous mine openings. Based on those observations, IDEQ suggests that the mine and property owners consider these dangerous physical hazards, which should be activity managed or closed to restrict public access. Some of the more distinctive and most dangerous openings are shafts located on the Michigan, Minnie Moore, Relief, and Queens of the Hills patented claims. There are both recently opened adits and partially caved historic adits on the Con Virginia, Grey Copper, and Queen of the Hills patented claims.

The extent of underground workings throughout Minnie Moore Gulch may also present potential subsidence issues for future development particularly building foundations.

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The delineations can be divided into fixed radius and modeled delineations.

Fixed radius delineations (surface water and transient sources) were delineated by IDEQ staff using buffering tools. All transient systems were selected from the Public Water System dataset (PWS) and buffered at 1000 meters. Surface water systems were delineated at both 4- and 24-hour time of travel and buffered at 500 meters. To determine surface water time of travel, IDEQ staff utilized USGS annual average stream flow data to determine distance upstream from the source in 4- and 10-hours. The distance upstream was measured off of USGS 1:100000-scale hydrology datasets and the stream segments buffered.

Modeled delineations were delineated by either IDEQ staff, Washington Group International (WGI) contract staff, Barr Engineering Company staff or University of Idaho hydrology staff. Sources were modeled using WHAeM, a hydrologic modeling tool, and the 3-, 6-, &10-year time of travel paths were exported as AutoCAD dxf formatted files. ArcView was used to on-screen digitize a shapefile from the linear dxf files.

Both the fixed radius and modeled delineations attribute tables were formatted using an Avenue tool in ArcView. The corrected shapefiles were then used as an input layer in the Potential Contaminant Inventory (PCI) process.