Croesus Mine Site

A.k.a. Croesus Mill Site, Croesus Extension, Croesus Extension Lode, Croesus MS Extension, Croesus L&M Patented Mining Claim

Preliminary Assessment Report

Blaine County
State of Idaho

Department of Environmental Quality

October 2008

Submitted to:
U. S. Environmental Protection Agency
Region 10
1200 Sixth Avenue, #900
Seattle, WA 98101

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

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

October 20, 2008

Margaux Edwards Crockett
Executor Franklin Edwards Estate
12840 Quail Run Lane
Caldwell, Idaho 83607

RE: Site Assessment of the Croesus Mine Site (a.k.a. Croesus Mill site, Croesus Extension, Croesus Extension Lode, Croesus MS Extension, Croesus L&M Patented Mining Claim)

Dear Ms. Edwards Crockett:

The Idaho Department of Environmental Quality (IDEQ) has completed a review of historical mining data and geological information at the above referenced sites. Subsequent to that review, IDEQ conducted a site visit of the Croesus Mine Site. During the site visit, mining facilities were mapped and sampled to complete the analysis necessary to complete a final Preliminary Assessment (PA) report.

Preliminary Assessments are conducted according to the Federal Comprehensive Environmental Response, Compensation and Liabilities Act. The reasons to complete a Preliminary Assessment include:

1) To identify those sites which are not CERCLIS caliber because they do not pose a threat to public health or the environment (No Remedial Action Planned (NRAP));

2) To determine if there is a need for removal actions or other programmatic management of sites;

3) To determine if a Site Investigation, which is a more detailed site characterization, is needed; and/or

4) To gather data to facilitate later evaluation of the release through the Hazard Ranking System (HRS)

IDEQ has also completed PAs under contract with the U.S. Environmental Protection Agency in order to identify risks to human health and the environment, and to make recommendations to land owners regarding how risks might be managed under current site conditions and in future use scenarios.

IDEQ has noted numerous physical hazards on the properties, specifically the caved Croesus Shaft and several adits. These are potential sites of subsidence and should be considered in future development plans. One partially open adit (#2) should be closed, which is beyond the scope of IDEQ's risk analysis. However, these openings are extremely dangerous and should be permanently closed or have access to them restricted. In addition, as there is evidence that a transient population uses the mine site for temporary encampments, you may want to consider risks and the potential for exposures to hanta virus at the open building located adjacent to the Croesus Adit #3 (see report for location).

The report identifies several areas at the site with potential human health and ecological risks. IDEQ suggests several steps you should consider as a land owner to manage these risks. First, there should be some well maintained site restrictions placed around the perimeter of this property. The cabin or "doll house" that is located on Croesus Creek is located in tailings containing high concentrations of heavy metals. Exposures at this location may be very hazardous to human health, and therefore IDEQ is strongly recommending removal of this structure and restricting public access to this area. There are other locations particularly the waste dump adjacent to Croesus Creek, and the Croesus Shaft waste dump where heavy metals concentrations indicate potential for human health risks. At the very least, access should be restricted in these areas. Furthermore, if this site is evaluated for future development (including residential) additional investigations of the waste sites should be conducted to determine the exact extent and character of the metals bearing wastes, and considerations for risk management should be incorporated in the development plans.

Attached is the final Preliminary Assessment (PA) Report of the properties and mine facilities. The report contains copies of historic mining reports, geologic information, data results, and maps of the properties.

IDEQ very much appreciates your cooperation and approval for our access, and looks forward to addressing any questions you may have regarding our findings.

Sincerely,

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

BAS:TE:tg

Attachment

cc: Ken Marcie – U.S. Environmental Protection Agency
Megan Stelma – Blaine County
file

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List of Acronyms

Acronym	Definition
303 (d)	Section of the Clean Water Act in Idaho
AMSL	Above mean sea level
ATV	All Terrain Vehicle (a.k.a. four-wheeler)
bgs	below ground surface
DEQ	Idaho Department of Environmental Quality
EPA	United States Environmental Protection Agency
gpm	gallons per minute
PA	Preliminary Assessment
ppm	parts per million
TDL	Target Distance Limit
TMDL	Total Maximum Daily Loads
USBM	United States Bureau of Mines
USFS	United States Forest Service
USGS	US Geological Survey

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Section 1. Introduction

This document presents the results of the Preliminary Assessment (PA) of the Croesus Mine site. The Department of Environmental Quality (DEQ) 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.

The DEQ 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, DEQ initiated a Preliminary Assessment Program to evaluate and prioritize assessment of such 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

1.1 Overview

The Mineral Hill Mining District is located in the south-central part of Blaine County, west of the Big Wood River Valley near the towns of Hailey and Bellevue. There are multiple historic mining sites within the district, although this preliminary assessment addresses only one site within the Croesus (Scorpion) Gulch sub-watershed.

The Croesus Mine site is situated along Croesus Creek, a tributary to the Big Wood River, at approximately 6,000 to 6,500 feet above mean sea level (AMSL). The Croesus Mine exists on patented land at latitude 43.4738º N and longitude 114.3472º W, in Sections 29 and 30 of Township 2N & Range 18E.

The general location of the mine site is identified in Figure 1. The closest town to the mining site is Hailey, which is approximately two miles by air and six miles by road. Figure 2 shows other mine areas around the site, the claim boundary lines do not match up when the Blaine County parcel shape file is plotted; two sets of lines are on each claim. This raises the question of where the boundaries actually exist. Therefore, DEQ does not warrant the specific location of the boundaries surveyed. Figure 3 presents a geologic overview of the Croesus Gulch. The former mines can be reached from Hailey by driving west along Croy Creek Road, then south along Croesus Gulch Road. The public has unrestricted access to the mine site on roads across U.S. Bureau of Land Management (BLM) lands, and there are no locked gates or posted signs in proximity to the mine site.

1.2 Historical Perspective

The Croesus Mine site; *extends to a depth of 860 feet and is the deepest mine in the region. It is distinct from all the others in that in the upper 600 feet it is a gold mine and in the lower 200 feet a lead-silver mine. The Croesus lode was discovered in 1881 but was not seriously exploited until about 1895. For the next four years the mine was worked most of the time, but the principal period of its development was during the following decade. Between March 29, 1899, and April 12, 1911, the records of the company show a return of $133,137.60 from ore shipments over and above freight and treatment charges. Of this amount about $23,000 has come from lead ore and the remainder from gold ore.*

Umpleby, et al, 1930, pp. 129-130

Discovery of the Minnie Moore mine in 1880 marked the beginning of the most prosperous era that the area enjoyed, but the years of greatest productivity came to an end within a decade…The discovery of more ore at the Minnie Moore in 1902 initiated another period of considerable productivity that lasted for several years. At the same time active work was carried on at the Croesus and other properties and this work continued for some years after the Minnie Moore had mined the last of its known ore.

Anderson, 1950, p. 9

Prior to 1908 a 10-stamp mill was operated on the lower grades of ore, but in that year a 100-ton mill equipped with rolls, Wilfley tables, jigs, and other machinery was erected. In 1923 plans were being made to reopen the mine, but nearly all of the workings were full of water and consequently inaccessible. Nothing further had been done in the mine in 1925. The developments comprise a vertical three-compartment shaft 800 feet deep, about 10,000 feet of openings on eight levels, and a 60-foot winze from the lowest level.

Umpleby, et al, 1930, p.130

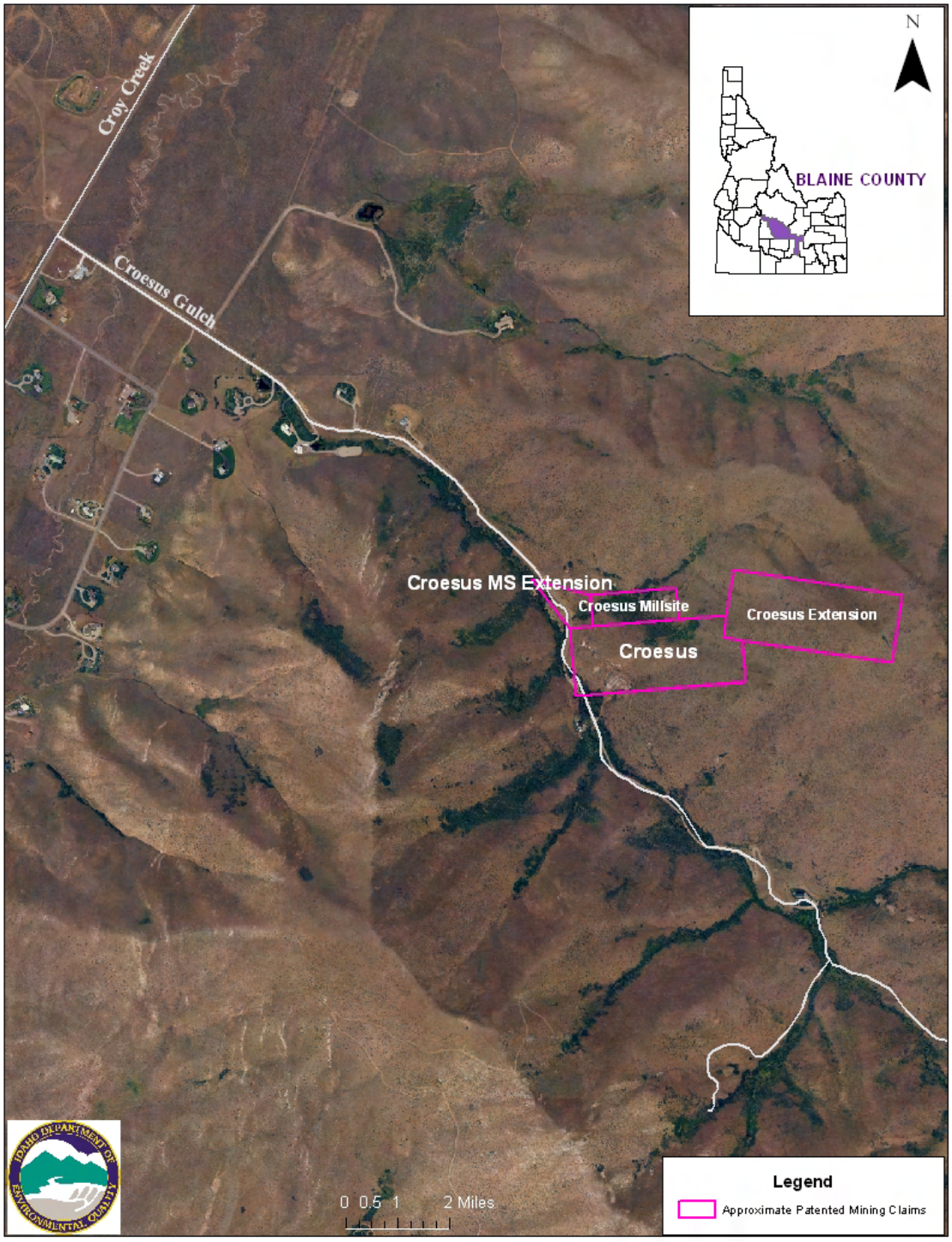


Figure 1. Aerial photograph of the Croesus Mine site.

Section 2. Site Description, Operational History, and Waste Characteristics

Physical characteristics of the Croesus Mine site are presented in the following pages, along with the mine's operational histories and characteristics of the wastes that remain.

2.1 Ownership

The Croesus Mine property currently comprises the Croesus, Croesus Mill site, Croesus Mill Site Extension, Croesus L&M Patented Mining Claim, and Croesus Extension Lode patents. Albert Comstock received a patent on the Croesus in 1889, which probably initiated mineral development in Croesus Gulch. Horace C. Lewis patented the Croesus Extension in 1898. According to the Blaine County Tax Assessor, the owner of record is Alexandra Edwards-Trust. The second owner is the Edwards Family Trust. Their mailing address is: 12840 Quail Run Lane, Caldwell, Idaho 83607.

2.2 History, Ore and Production

Anderson (pp. 26-27) describes the early history of the mine:

> *Ore was discovered in 1881 but little work was done until 1895, and thereafter was carried on intermittently until about 1940... The mine is of more than ordinary interest, because for the first 600 feet it was a gold mine and for the remaining 200 feet a lead-silver mine. This was possible because of the presence of two mineralogically different veins, one of the gold type and the other of the lead-silver type. These veins are apparently similar in trend but they dip in opposite directions. As a consequence, the lead-silver vein passes through the gold vein between 500 and 600 levels. These veins and another parallel vein, the Hope, which lies a short distance to the south, are along east-west fracture zones in the diorite. The gold (Croesus) vein dips steeply north near the surface but reverses dip with depth and below the 200 level dips rather uniformly about 70º S. The lead-silver vein, which was first uncovered on the 800 level, dips about 65º N., and has been traced upward to the point where it intersects the gold vein.*
>
> *The ore bodies along the Croesus vein are reported to occur as lenses of varied size and shape with long axes generally inclined to the east. The largest bodies were on the second and third levels where the main ore shoot ranged from 100 to 187 feet long and from 4 to 5 feet wide. The gold ore consisted of quartz, pyrite, chalcopyrite, arsenopyrite, and pyrrhotite with a little siderite and galena.*

The direct shipping ore is said to have averaged $40 to $50 to the ton...

The lead silver vein is typical of lead-silver veins of the area. It contains galena, a little sphalerite, quartz, pyrite, chalcopyrite, and tetrahedrite in a siderite gangue. The ore is reported to have contained 5 to 20 per cent lead, with one ounce of silver for each per cent of lead and from 0.25 to 0.35 ounce of gold per ton.

Production from 1906-1914, 1931-1934, and 1947-1951 of several thousand tons yielded significant gold and copper from the gold (Croesus) vein and significant silver and lead from the lead (galena) vein. (Anderson and others 1950, Mitchell and others 1991, Umpleby and others 1930).

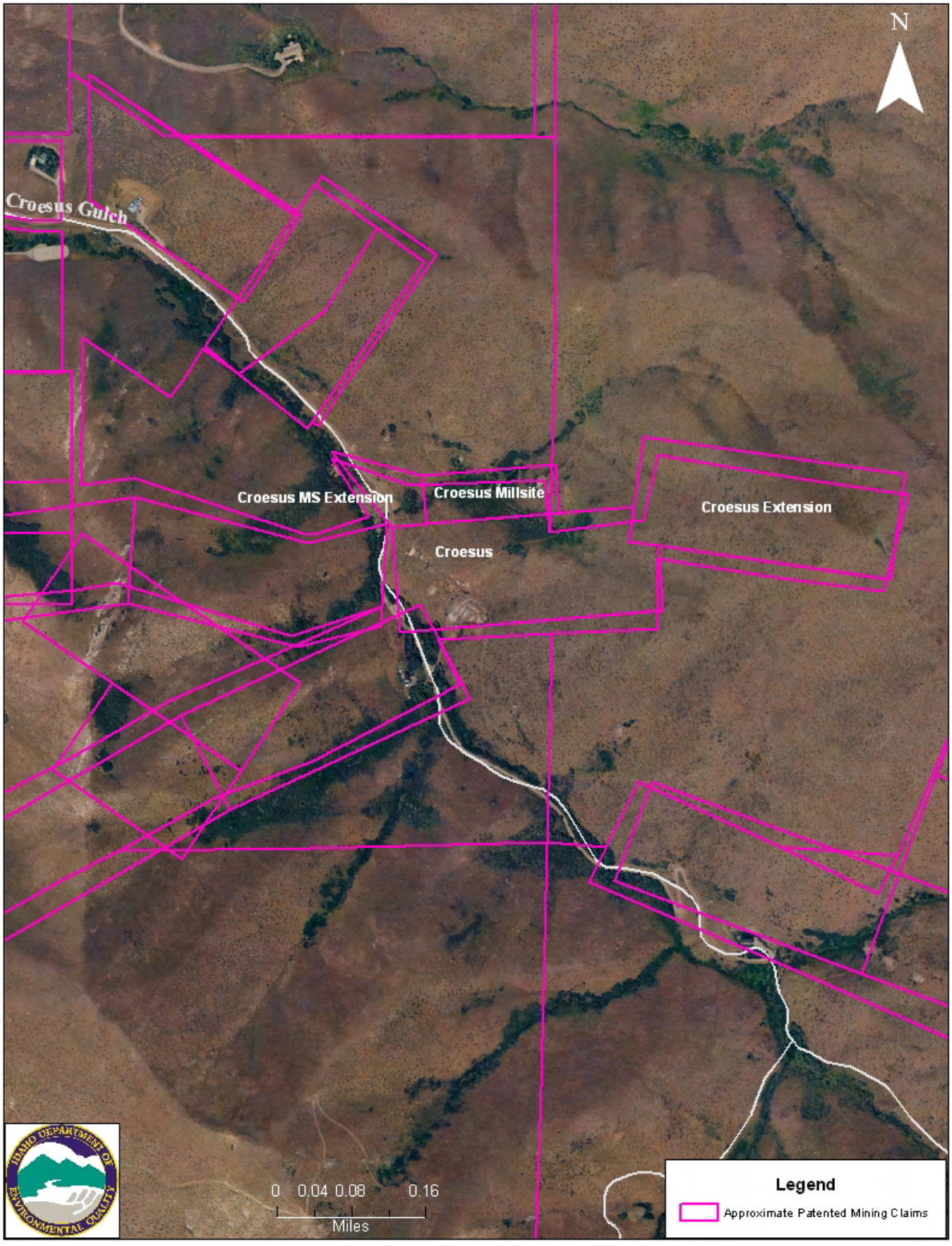


Figure 2. Aerial photograph of the Croesus Mine site and other mines in the surrounding area.

2.3 General Geology

Numerous 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).

The general geology of the area, depicted in Figure 3, was described by Kiilsgaard, et al., 2001, pp. 1-2) who described the geology of the site:

> *The Croesus stock is a northwest-trending body of quartz diorite grading to diorite that crops out in the hills west of Bellevue in the southeastern quarter of the quadrangle* (Worl and others, 1991).
>
> *The quartz diorite is dark gray, medium grained and equigranular and is characterized by subequal amounts of augite and vitreous biotite that together compose about 20 percent of the rock. Hypersthene is present in minor amounts, as is hornblende, which has replaced pyroxene. Andesine, the principle constituent, is euhedral, commonly aligned, and slightly zoned. Quartz is interstitial and composes less than 15 percent of the rock; potassium feldspar is present in sparse amounts.*

2.4 Stratigraphy and Lithology

Anderson (p. 7) noted the presence of the Milligen formation:

> *The Milligen formation is present on both sides of the Big Wood River Valley and on the southwest slope of the high ridge between Big Wood River Valley and Rock Creek. In many places it lies in normal contact with the Wood River formation, though in some places it is in fault contact with the Wood River formation…In the southwest side of Big Wood River it is along a zone of complicated faulting and extensive mineralization.*
>
> *The formation is comprised of an upper sequence of grayish calcareous shales with some purplish and buff shales and a few thin beds of impure limestone, while the lower sequence consists mainly of black carbonaceous shales and argillites with several discontinuous beds of dark gray and black limestone and locally thick lenses of light-colored sandstone and quartzite. The lower sequence of the Milligen formation is easily recognizable with its predominantly dark color and is the most important portion of the formation owing to its tendency to localize deformation and mineralization.*

The area around Croesus Gulch is underlain by the Devonian Milligen formation, the Dollarhide and Wood River formations of Pennsylvanian and Permian age, and by intrusive granitic rocks of Cretaceous age. The Milligen formation is characterized by black argillite and phyllite, dark-colored calcareous sandstone and siltstone, and carbonaceous calcareous limestone (Worl, et al, 1991).

Anderson assigned the black-shale host rocks as belonging to the Milligen formation of Mississippian age, whereas later authors (Warva and Hall) assigned the rocks to Middle Pennsylvanian and Lower Permian Dollarhide while Link and Worl assigned the same rocks to the Middle Devonian Milligen. Regardless of the stratigraphic nomenclature, the mineralization apparently concentrated near intrusive bodies, along shear and fault zones.

2.5 Structure

Anderson (1950, p. 7) noted the following in regards to the structure of the rocks:

> *The Milligen and Wood River formations have been deformed into a broad, much broken anticline with the crest closely coinciding with Big Wood River Valley. Beds on the northeast side of the anticline dip eastward at angles of 20º to 35º, exceptionally up to 70º, and beds on the southwest side dip generally westward at angles mostly between 20º and 40º. Extensive faulting on both sides of the valley has had the effect of dropping the crest of the anticlinal arch from 2,000 to 3,000 feet.*

According to Umpleby (1930, p. 130):

> *The vein crops out in quartz diorite at a point about half a mile from the nearest exposures of sedimentary beds. On the ridge west of the mine pegmatite dikes consisting of quartz, orthoclase, and muscovite are abundantly developed as lenticular masses. Younger than these dikes and also younger than the vein are lamprophyre dikes of about the composition of spessartite, although the specimens examined are so much altered that the determination is somewhat uncertain.*

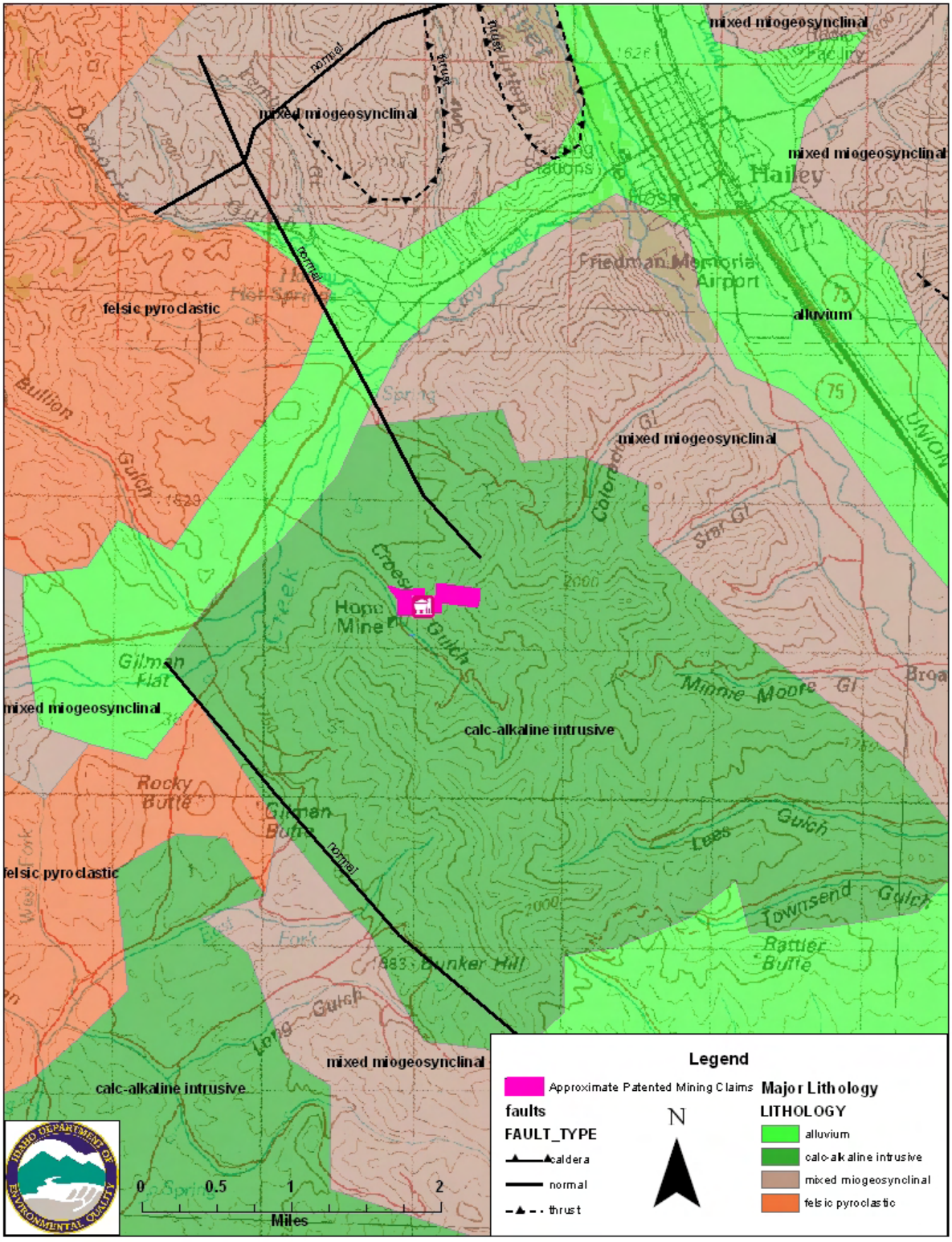


Figure 3. Geologic map of the Croesus Mine site.

Section 3. Current and Potential Future Land Uses

Current land uses in the area include biking, hiking, horseback riding and off-road vehicle touring. The land is on the market and there is a potential for residential development of the property. The Croesus Mine site is accessible from the Croesus Gulch road. A small cabin was observed a few feet away from Croesus Creek on the Croesus patented land.

3.1 Fish Species Observed

Fish presence/absence studies have not been conducted on Croesus Creek to confirm any fish species that may reside in this stream. Redband rainbow trout [*Oncorhynchhus mykiss* gairdneri], mountainwhitefish [Prosopium williamsoni], wood river sculpin [Cottus leiopomus], and brook trout [Salvelinus foninalis] are present within the Big Wood River (IDFG, 2000).

3.2 No Apparent Wetlands

Official wetland surveys for the area could not be found, but aerial photographs as well as direct observation seem to indicate that the Croesus Creek valley contains no significant wetland areas.

3.3 Future Land Use

Future land use could potentially include some year-round and/or seasonal homes on the private parcels of property in the sub-basin, owing to its close proximity to the Hailey and Bellevue communities.

Section 4. Individual Site Overview and Waste Characteristics

DEQ conducted a site visit on June 5, 2008, which included a visual inspection of the Croesus Mine site and collection of two water samples and four soil samples from the sampling locations shown in Figure 4. The samples were designated as shown.

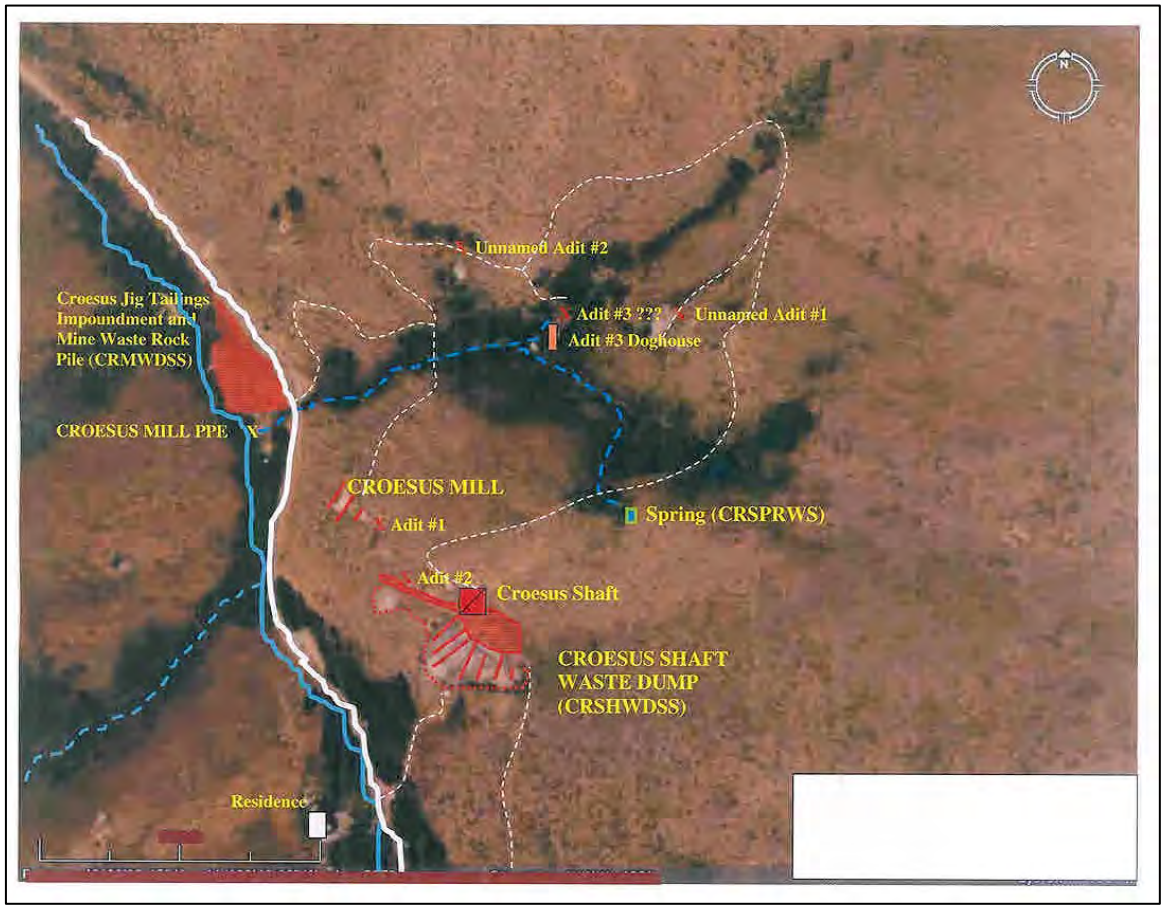


Figure 4. Small scale sketch of the Croesus Mine site area and environmental sampling locations.

4.1 Sampling Results

Table 1 and Table 2 present the results of the sampling. Boldface values in Table 1 are in excess of the Idaho Initial Default Target Levels (IDTLs) as described in the Idaho Risk Evaluation Manual (REM). IDTLs and EPA Region 6's HHSLs are being used for discussions because background soil and water samples were not at the Croesus. Background samples were not collected because access issues for areas above the mine had not been fully reconciled at the time of the site visit.

The water samples (CRSPRWS and CRAD3SW) were collected from a spring above the mining activity and from a seep in Adit #3. Sediment samples (CRPPESS, CRMWDSS, CRWD2SS, and CRWDSHSS) were collected at the same time the water samples were collected. Results from these samples can be seen in Table 1 and Table 2. The CRPPESS

soil sample location is down gradient of the mining activity and is considered to be the Probable Point of Entry (PPE).

Table 1. June 2008 total soils analysis for Croesus Mine site, Blaine County, Idaho.

Croesus Mine site Soil Samples

	IDTLs	EPA Region 6 HHSLs	Sample No.	Sample No.	Sample No.	Sample No.
Description	Units: Mg/Kg		CRPPESS	CRMWDSS	CRWD2SS	CRWDSHSS
Antimony	4.77	31	<2.0	**11.7**	<2.0	2.2
Arsenic	0.391	23	**33.7**	**836**	**3390**	**2570**
Cadmium	1.35	39	**13.3**	**13.6**	<0.20	<0.20
Copper	921	2900	515	485	**1140**	**1260**
Iron	5.76	55,000	**66,700**	**38,500**	**96,000**	**128,000**
Lead	49.6	400	**4420**	**5420**	**890**	**9160**
Magnesium	N/A	N/A	14,800	11,400	10,300	9170
Mercury	0.00509	23	**0.355**	**39.8**	**0.787**	**1.14**
Silver	0.189	390	**19.8**	**18.3**	**41.3**	**89.1**
Zinc	886	23,000	**926**	810	99.3	169

- **Boldface types indicates value exceeds Idaho Initial Default Target Levels (IDTLs)**

Table 2. June 2008 water sample results from the Croesus Mine site area.

Croesus Mine Water Samples

	IDTLs MCL by default, Risk Based (RB)	EPA Region 6 HHSLs Residential Water MCL	IDEQ Cold Water Biota Standard Acute	IDEQ Cold Water Biota Standard Chronic	Sample No.	Sample No.
Description	Units: Mg/L				CRAD3SW	CRSPRWS
Antimony	.006	.006	N/A	N/A	<0.020	<0.020
Arsenic	.01	.01	0.34	0.15	<0.025	<0.025
Cadmium	.005	.005	0.00052 (H)	0.00037 (H)	<0.0020	<0.0020
Copper	1.30	1.30	0.0046 (H)	0.0035 (H)	<0.010	<0.010
Iron	.001	N/A	N/A	N/A	<0.060	<0.060
Lead	.015	.015	0.014 (H)	0.00054 (H)	<0.0075	<0.0075
Magnesium	N/A	N/A	N/A	N/A	11.2	10.7
Mercury	.002	.002	0.0021	0.000012 (T)	<0.00020	<0.00020
Silver	.0521 (RB)	N/A	0.00032 (H)	N/A	<0.0050	<0.0050
Zinc	3.13 (RB)	N/A	0.036 (H)	0.036 (H)	<0.0100	<0.0100

Secondary MCL (T) – Standard in Total (H) – Hardness dependent @ 25 mg/L.

Table 1 shows that the soils collected from the waste dumps exceed the IDTLs for antimony (one dump, sample CRMWDSS), arsenic, cadmium (two dumps; CRPPESS,

CRMWDSS), iron, lead, mercury, zinc (one dump, CRPPESS), and silver. Table 2 shows the water collected from Croesus Creek meets Idaho Water Quality Standards. Exceedences of the IDTLs indicates that there are human health risks connected to unrestricted use of the site, specifically residential, at the location of those samples.

4.1.1 Waste Dumps

DEQ mapped the Croesus mine site (Figure 4) and identified two waste dumps of concern.

The first waste dump, "Croesus Mill Waste Dump" is located below the mine and mill remnants on west side of Croesus Gulch road. The coordinates for this site are: 43.4753ºN, 114.3500ºW. Sands on the upper surface of the dump (Sample CRMWDSS) appear to be jig tailings. There is approximately 200 cubic yards (cy) of this material present. The waste dump, (approximately 1,000 cy) is dominated by quartz diorite that was probably placed there during the more recent developments of the Unnamed Adits #1 and #2, and Croesus Adit #3. The "Lower Croesus Waste Dump" appears to be stable and has no indications of significant erosion from Croesus Creek, the unnamed tributary from the east or from localized precipitation.

If development is planned on this dump, consideration should be made in the development plans to thoroughly characterize the dump and ensure structural stability. Destabilization of the dump could result in unauthorized discharge to Croesus Creek. The waste dump is approximately 1500 cy.



Photo 1. Looking southwest at CRMWDSS. Croesus Creek is located below in the vegetative swath.

The second waste dump, "Croesus Shaft Waste Dump", is located on the southeast side directly below the shaft. The coordinates for this site are: 43.4740ºN, 114.3484ºW. IDEQ estimated that the Croesus Shaft Waste Dump may contain as much as 20,000 cy of waste rock. The waste dump is dominated by altered quartz diorite with very little or no sulfide mineralization present. However, a composite soil sample CRWDSHSS was collected from a small pile (<10 cy) of waste rock for analysis.



Photo 2. Northeast view of the Croesus Shaft waste dump (CRWDSHSS).

A total of five adits were observed in this PA, each one is discussed in detail below. There is also a spring located above the mill site.

4.1.2 Adit #1and Adit #2

Adit #1 is located on the southeastern section of the mine property directly above the mill foundation. Coordinates are: 43.4742ºN, 114.3484ºW. There is a residual dump between Adit #1 and the crusher which contains less than 100 cy of waste rock, including approximately 10 yards of ore.



Photo 3. Looking due north towards Croy Creek. Immediately above the Croesus Mill foundation and on level with the Croesus Shaft are two small unnamed adits, Adit #1 and Adit #2, respectively.

The Adits #1 and #2 do not appear to have been developed extensively; their adjoining waste dumps contain less than 100 cy of wastes. The waste materials are dominated by quartz diorite.

However, what must have been a 5 -10 cubic yard stockpile of coarse (+6") "run of the mine" ore is present between Adit #1 and the upper mill foundation. Adit #1 is completely caved. Adit #2 is open enough that a small animal or child might squeeze into it. Adit #2 may be considered **a physical hazard.** An alteration material on the waste dump of Adit #2 was sampled CRWD2SS**.** Coordinates for Adit #2 are: 43.4740ºN, 114.3482ºW.

4.1.3 The Croesus Shaft Collar

The Croesus Shaft, which is reported over 860' deep is caved shut. There are indications that the collar and underlying material may still be subsiding. Although, the shaft does not appear to be a significant physical hazard, its appearance may be deceptive. Coordinates for the shaft are: 43.4740ºN, 114.3479ºW.



Photo 4. Looking down into the Croesus Shaft.

4.1.4 Mill Foundations

Although there is some burned wood debris, it appears that the mill was dismantled for its equipment and building materials rather than burned down as indicated by the charred wood. There was no evidence of processing chemicals or containers. Less than 200 tons of ore were processed between 1895 and 1907. Coordinates for the Mill site are: 43.4738ºN, 114.3479ºW.



Photo 5. Looking south across the Croesus Mill foundation (remnants) towards the head of Croesus Gulch.



Photo 6. Looking southwest at the floor of the Croesus Mill.

The floor of the Croesus Mill has a small amount of detritus on it that at first appears as though they might be jig tailings. However, upon closer examination it appears to be groess from decomposing quartz diorite. Samples were not collected because the amount of this material is de minimis around the mill. In sum, there did not appear to be any soils contamination at or around the mill foundation that was worthy of note. However, if these foundations were developed for some residential purpose, IDEQ suggests that additional sampling of soils is conducted.

4.1.5 Spring

Approximately 600’ east north east of the Croesus Shaft is a very clear running spring. This was developed by construction of a plug and spring box, into presumably what had been a “dog hole” for developmental purposes. Sample CRSPRSW was collected from the spring, no field

measurements were collected, but flows were estimated at 5 – 10 gallons per minute. The area surrounding the spring has lush vegetation and there are no signs of waste dumps. Coordinates for the spring are: 43.4745ºN, 114.3465ºW.



Photo 7. Clear running spring flowing from pipe into concrete spring box.

4.1.6 Unnamed Adit #1 and #2

A caved unnamed adit (Unnamed Adit #1) is located very close to the boundary of the Croesus Mill site and BLM Lands. Although an accurate location of the adit may be warranted for determining responsibility for the physical hazards and an abandoned compressor (picture below) there is insufficient evidence that this adit or waste dump pose significant human health or ecological risks. The waste dump which contains less than 200 cy of waste is dominated by quartz diorite, and there are no indications of massive sulfides present. No sample was collected from this dump.



Photo 8. Caved in Unnamed Adit #1.



Photo 9. An abandoned compressor at Unnamed Adit #1



Photo 10. Southeast view of Unnamed Adit #2 and waste dump.

Unnamed Adit #2 which appears to be located on BLM administered lands and does not appear to have any drainage, but it is open and is a physical hazard. The waste dump adjoining Unnamed Adit #2 contains less than 100 cy of waste that is dominated by quartz diorite. Although there appears to be considerable iron staining, no visible sulfides were found.



Photo 11. Collapsed Unnamed Adit #2.

4.1.7 Adit #3

The Croesus Adit #3 and "dog house" are located on the Croesus Mill site claim. Although the underground workings are caved, approximately twenty-five feet of timbered adit remains open to public access. The adit is a source for mine drainage. The drainage appears clear and has no indication of metals precipitates. It was sampled (CRAD3SW). Because of the lush overgrowth, an estimate of the volume of mine wastes present was not conclusive, but the waste dump appears to be dominated by quartz diorite, and has no indications of sulfides.



Photo 12. Croesus Adit #3.

The Adit #3 site contains a great deal of evidence that this site is used by a transient population as temporary living space. The adjoining "dog house" also has abundant evidence of domestic use, and rat infestation. It does not represent a physical hazard as much as it does a biological hazard. The biological hazard of concern is Hantavirus that may be present as a result of the rat and mice and/or rat feces that blanket the surfaces inside the building.



Photo 13. Croesus "dog house".

4.1.8 Croesus Mill PPE

Croesus Adits #1 and #2, the Shaft Collar and Mill foundations are located just above the Croesus Gulch Road, which travels parallel to and just above Croesus Creek. At first there were no indications on the road that wastes from the mine or mill facilities have been delivered to the road and thence to Croesus Creek. However, IDEQ did follow a potential pathway to Croesus Creek and found evidence of what appeared to be jig tailings near a PPE from the Lower Dump and Millsite. This PPE was sampled, and it was determined to contained significant levels of metals in the soils.



Photo 14. Croesus Gulch road.

Near what was determined to be the PPE, IDEQ found a recreational site (pictured below) . Although this appears to be used by the owners of the upstream residence, this cabin seems to be located on the Croesus Lode claim. Regardless of the legal location, this cabin and the scattering

of children's toys indicates that significant exposure to the mine and mill wastes at the PPE is occurring. The sediment, which resembles jig tailings, in this area was sampled (CRPPESS) to confirm whether or not significant human health risks exist at this location.

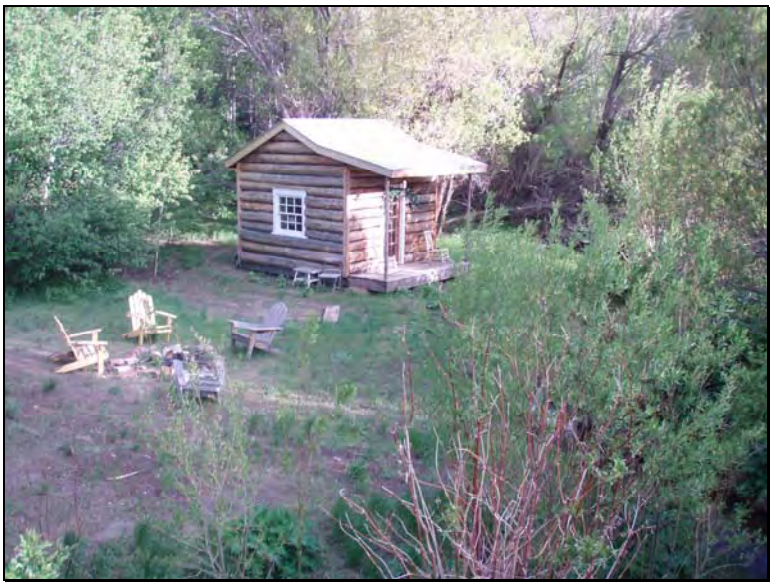


Photo 15. Cabin seems to be located on the Croesus Lode claim. Croesus Creek runs approximately 10 feet from the cabin.

Section 5. 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.

5.1 Groundwater

Ground water flow is expected to primarily follow faults and brecciated zones within the quartz diorite country rock and have surface features expressed as springs. In the Croesus Creek drainage, one spring was witnessed and one of the observed adits had water flowing from them. Densely vegetated portions of the hillsides indicate potential surface expressions (springs) of ground water.

Contributions to the aquifer in close proximity to the Croesus Mine will predominantly be as a direct result of precipitation or surface water. Croesus Creek is a perennial stream that flows into Croy Creek and then the Big Wood River. Annual precipitation for Hailey, Idaho, located approximately 6 miles (by road) to the northeast, 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 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. However, because the waste rock dumps have limited soil, and exist adjacent to Croesus Creek, a higher percentage of this rainfall would be expected to drain into the stream.

According to Idaho Department of Water Resources July 2002 records, 245 private drinking water wells are reported to be located within a 4-mile radius of the site. The majority of these wells are located across the Big Wood River and closer to the nearby towns of Hailey and Bellevue. Nine (9) public drinking water systems are located within a 4-mile radius of the site (Figure 7). The nearest downgradient well is located approximately 0.5 miles from the mine site, with a static water level of 22 feet below ground surface (bgs), measured on September 11, 2001. Based on historical monitoring data for the public water systems associated with the cities of Hailey and Bellevue, metal contamination does not appear to be concern in the aquifer that supplies these systems (DEQ, 2006).

Due to the location of the majority of the wells, however, it is unlikely that any impacts related to the mining activities will be detected in these wells (DEQ, 2006). The wells that are located downgradient of the mine site and are completed in the alluvial materials associated with the Big Wood River, drawing water from a separate aquifer than what is directly below the mine site. Ground water impacts associated with this mine site would be a greater concern if more shallow wells were located closer to the site. Due to the current location of the nearby domestic wells with respect to the mine location, it appears these wells are a sufficient distance from the mine site to avoid any ground water impacts associated with this mine site.

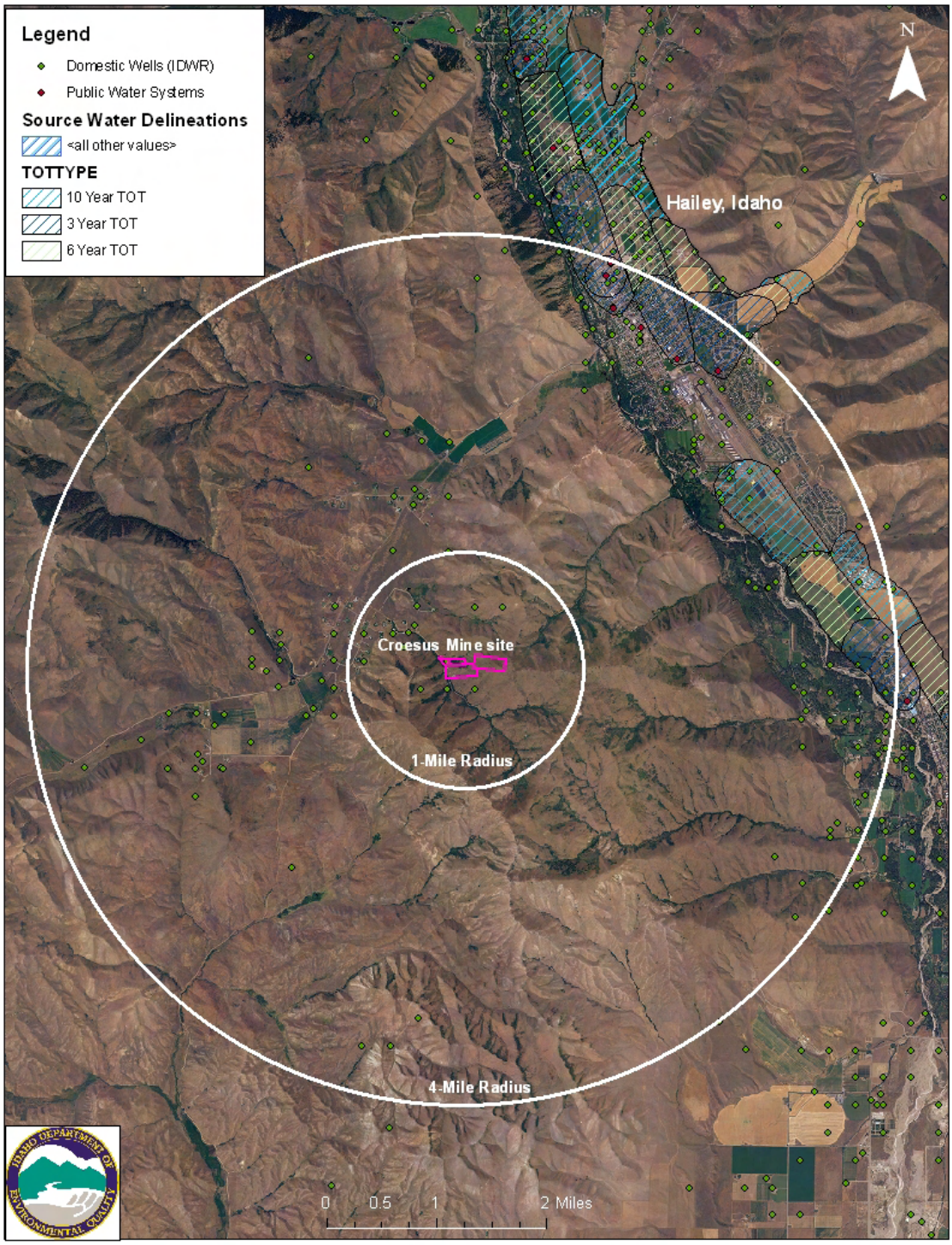


Figure 5. Domestic wells and Public Water System wells located with a four-mile radius of the Croesus Mine site. Time of Travel (TOT) for Source Water Delineations.

5.2 Surface Water

The area around the Croesus Mine drains westward into Croesus Creek which drains northward into Croy Creek which flows eastward towards the south-flowing Big Wood River. One potential PPE point exists at the Croesus Mill PPE sample site located at the convergence of the unnamed tributary into Croesus Creek. Overland flow across or in the vicinity of the waste dumps would flow directly into Croesus Creek. Croesus Creek is not currently listed on the EPA §303(d) list of impaired streams, but the Croy Creek and Big Wood River are currently listed for flow alteration, nutrients, suspended solids and siltation. Croesus Creek appears to be a perennial drain and live flow was observed.

Commercial or subsistence fishing does not occur within the 15-mile downstream distance, but sport fishing does. Most of the property is private along Croesus Creek, it is unlikely that the general public fishes in this stream. Redband rainbow trout [*Oncorhynchhus mykiss* gairdneri], mountainwhitefish [Prosopium williamsoni], wood river sculpin [Cottus leiopomus], and brook trout [Salvelinus foninalis] are present within the Big Wood River (IDFG, 2000).

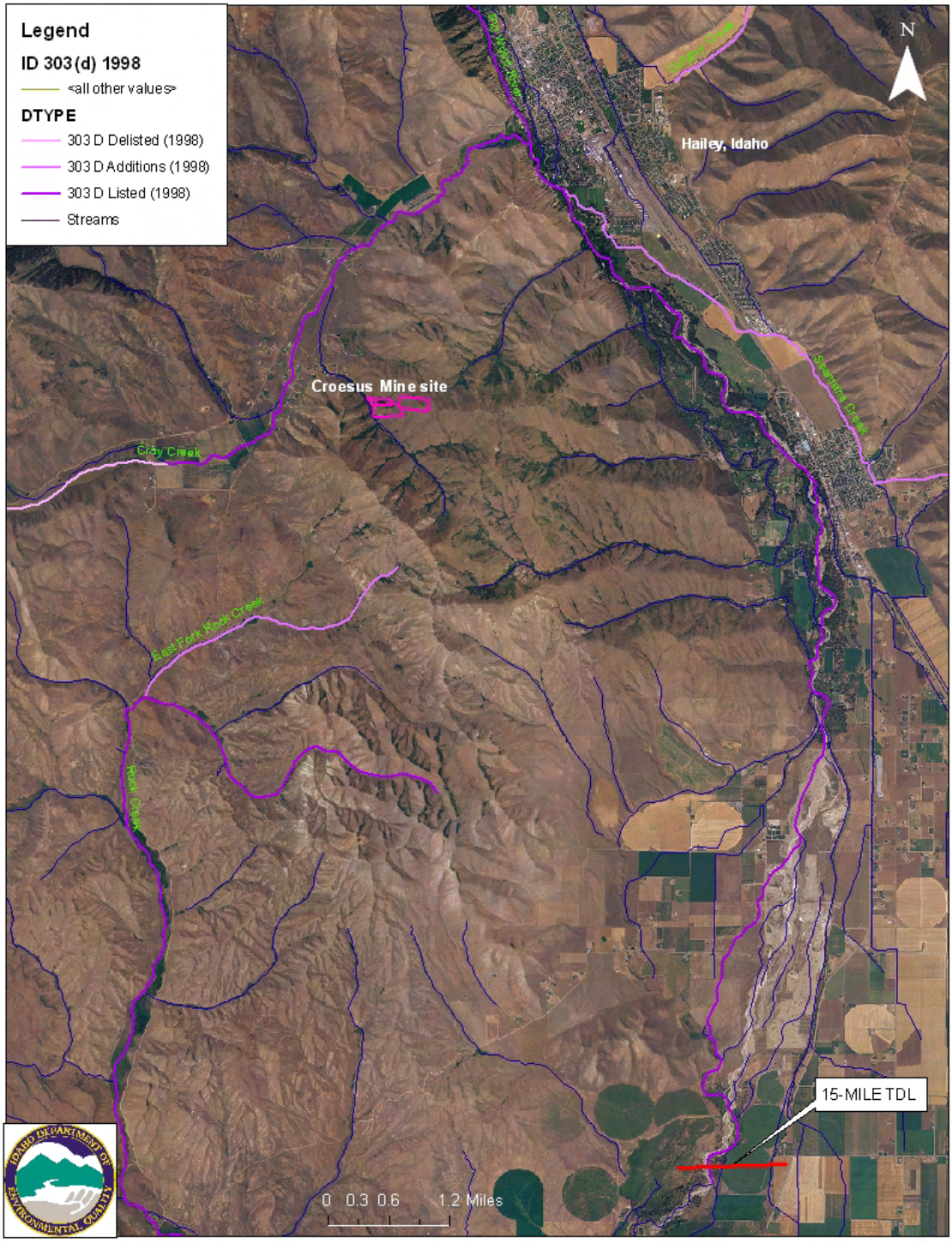


Figure 6. Depicts the drainage patterns of these water bodies as well as the 15-mile downstream Target Distance Limit (TDL) located on the Big Wood River.

5.3 Soil Exposure and Air

Access to the mine site is not restricted or posted, and there were numerous indications of public use of the site for recreation and temporary living quarters. An old overgrown road from the main access road on Croesus Gulch through the mine site allows public access to the site. Four-wheel drive vehicles can access the major workings. Signs posted discouraging the public from entering the Croesus site were not well maintained.

5.3.1 Potential Receptors

Potential receptors include local residents, hunters, sheep herders, cattlemen, trail riders (motorized and non-motorized), campers, and rarely, tourists. Sheep and cattle do not appear to spend significant amounts of time grazing on the mine site. Residents and outdoor enthusiasts are principal receptors of concern, as they reside nearby or use surrounding land for recreational activities.

The land within a two (2) mile radius of the site is primarily BLM land, but minor amounts of private land (patented mining properties) exist. The parcels of land occupied by the mines and waste dumps are leased or owned by private parties.

5.3.2 Schools, Day-Care Facilities, Private Residences

There are no schools, day-care facilities, or private residences within 200 feet of the site, but BLM or Forest Service workers, in addition to the outdoor recreation enthusiasts, may occasionally be within 200 feet of the site.

5.3.3 Plant Species of Concern

Bugleg goldenweed was the only plant species of concern (F&G, 2002) within a 4-mile radius of the mining site (Figure 6). Animal species listed as a species of concern that are located within a 4-mile radius of the site include Gray Wolf, North American Wolverine, Western Toad, and Canadian Lynx (F&G, 2002).

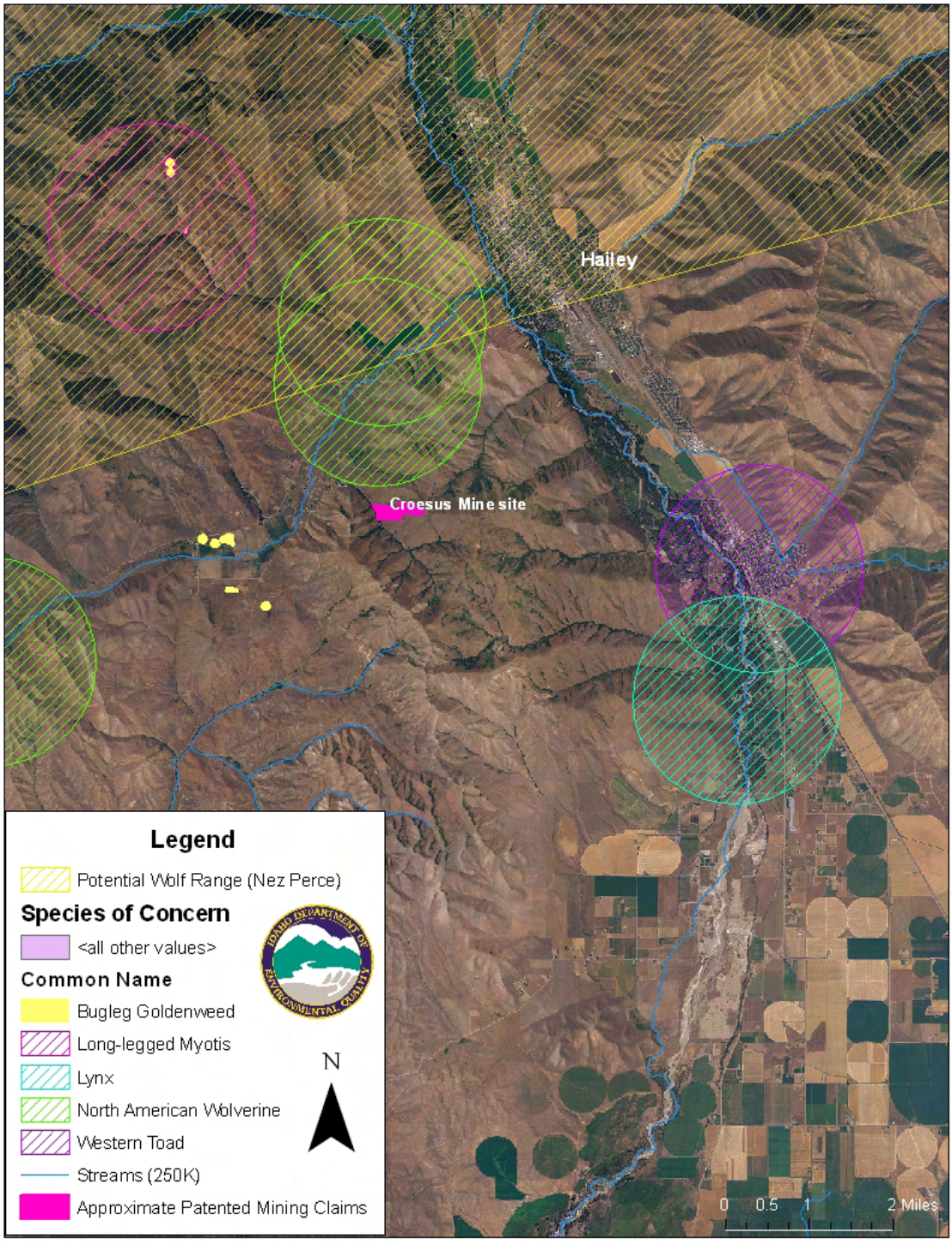


Figure 7. Sensitive species identified in the vicinity of the Preliminary Assessment Site.

5.3.4 Soil Sample Concentrations

Soil samples contained total antimony concentrations ranging from <2.0 to 11.7 mg/kg. Arsenic concentrations ranged from 33.7 to 3390 mg/kg. Cadmium concentrations from soil samples ranged from <0.20 to 13.6 mg/kg. Copper concentrations ranged from 485 to 1260 mg/kg. Iron concentrations ranged from 38,500 to 128,000 mg/kg. Lead concentrations ranged from 890 to 9160 mg/kg. Mercury concentrations ranged from 0.355 to 39.8 mg/kg. Silver concentrations ranged from 18.3 to 89.1 mg/kg. Zinc concentrations ranged from 99.3 to 926 mg/kg. Analytical results can be seen in Table 1.

Background samples were not collected during this investigation, so it is difficult to analyze the elevated concentrations reported to a background level to determine the amount of impacts this mine has had on the surficial soils.

Relative to the Idaho *Initial Default Target Levels* (IDTLs) soil exposure at the mines is expected to be elevated for all receptors, due to the high concentrations measured in the soil samples. These IDTLs are risk-based target levels for certain chemicals that have been developed by DEQ using conservative input parameters, a target acceptable risk of 10^{-6}, and a *Hazard Quotient* of 1. These values are designed to aid in the development of clean-up and remediation goals that would allow the closure of a site based on the risks associated with various receptors for specific media to be less than 10^{-6}. The levels are also used to guide risk management designs, where unrestricted use of a site, such as residential development, is anticipated or desirable.

If the IDTL is exceeded for any constituents, two options are available:

1. Adopt the IDTLs as the cleanup levels and develop a *Risk Management Plan* (RMP)
2. Perform a more detailed, site-specific evaluation, which includes developing site-specific background concentrations for comparative purposes.

Section 6. Summary and Conclusions

Most structures relating to mining activity have fallen, burned or been covered. Waste rock dumps, remnants of historic structures, and the remains of a few collapsed adits can be seen in the area. Two adits remain open and human activity in the area appears to be limited. Soil samples taken from the waste dumps at the Croesus Mine site contained elevated concentrations of metals. Two water samples collected in this drainage showed no significant signs of overall water quality degradation.

6.1 Presence of Wetlands

Based on official wetland surveys and aerial photographs of the area, no significant wetlands exist near the site or within the 15-mile TDL. Therefore, potential impacts to wetland areas associated with this mine site can be neglected.

6.2 Impacts on Water Quality

Surface water samples were not collected from the Big Wood River downstream of the confluence with Croy Creek to determine the impacts (if any) that could occur in the Big Wood River. The receptors of greatest concern are game fish, as they are exposed to the water that showed elevated metal concentrations and may later be consumed by humans.

Ground water impacts related to the mine site are currently unknown. However, monitoring data associated with the public water systems located near the cities of Hailey and Bellevue indicates no metal contamination exists within the producing aquifers for each system. The location and distribution of private domestic wells with respect to the mine site suggest impacts related to the mine site may be insignificant, but this suggestion cannot be verified due to a lack of analytical data.

6.3 Potential Exposure for Wildlife and Vegetation

Potential exposure of wildlife and vegetation to waste rock dumps from the site is present. The high salinity of the waste dumps may entice local wildlife to consume it due to the high salt content. In addition, the native plant species may bio-accumulate high concentrations of metals that may be consumed by the local wildlife. The wildlife that may be exposed to elevated concentrations of metal (via water, soil, or plant material) may be harvested and consumed by humans.

6.4 Potential Exposure for Humans

Human activity around the mine site is relatively low for the general public, but high for a neighbor who resides adjacent to the property. There was a child playing on the hillside west of the mine site across Croesus Creek and the people who live above the mine site in the Croesus Gulch drainage have used the mine site, and have been exposed to high

concentrations of arsenic, cadmium, copper, lead, silver and zinc. Currently there is interest in selling/purchasing the property for residential development. High concentrations of metals in the waste dumps indicate that if residential development is a desirable future use, additional site characterization and risk management should be done. However, under the current conditions and uses exposure for humans to the elevated metal concentrations on the mine dumps is low. Fugitive dust and direct contact with the waste dumps are the two main mechanisms through which humans could be exposed to the metal concentrations at the site.

6.5 Recommendations

Overall, the soil samples collected from the site show elevated metal concentrations with respect to Idaho's Initial Default Target Levels. The samples that indicated high metal concentrations were collected in areas that are accessible to humans. The area of most concern involves the recreational cabin located a few feet away from the PPE next to Croesus Creek. If the waste dumps are disturbed there will be a significant risk to humans inhabiting the cabin and surrounding area.

There are numerous potential physical and biological hazards at the site. The caved shaft and adits are potential sites of subsidence and should be considered in future development plans. One partially open adit (#2) should be closed. Adjacent to the site on lands administered by BLM are mining structures that may be attractive nuisances and hazards to resident children. Mouse and rat feces located in abandoned buildings are most certainly disconcerting.

Initially, there should be some well maintained site restrictions placed at this property. This specifically, should prevent recreational use and exposure at the PPE on Croesus Creek below the mill site where the cabin has been placed, on the mine waste dump on Croesus Creek, and around the Shaft and Shaft Waste Dump.

Other risk management tools should be employed if development of property for residential purposes is planned. These tools may include things such as top soil caps and covers, hot spot removals and more aggressive site restrictions such as fencing.

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