

State Lands Mill Site Preliminary Assessment Report

Blaine County
State of Idaho



Department of Environmental Quality

March 2007

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

State Lands Mill Site
Preliminary Assessment Report
March 2007

Table of Contents

List of Acronyms	v
Section 1. Introduction	7
1.1 Overview	7
1.2 Historical Perspective	8
Section 2. Site Description, Operational History, and Waste Characteristics	12
2.1 Site Description	12
2.2 Operational History	12
2.3 General Geology	13
2.3.1 Previous Studies	14
2.3.2 Stratigraphy and Lithology.....	14
2.3.3 Structure.....	15
Section 3. Current and Potential Future Land Uses	17
3.1 Fish Species Observed	17
3.2 Apparent Wetlands	17
3.3 Future Land Use.....	17
Section 4. Individual Site Overview and Waste Characteristics	18
4.1 Sampling Results	19
4.2 Inspection Findings	21
4.2.1 Waste Pile	23
Section 5. Pathway and Environmental Hazard Assessment	25
5.1 Groundwater.....	25
5.2 Surface Water	28
5.3 Soil Exposure and Air	30
5.3.1 Potential Receptors	30
5.3.2 Schools, Day-Care Facilities, Private Residences	30
5.3.3 Plant Species of Concern	30
5.3.4 Soil Sample Concentrations	30
Section 6. Summary and Conclusions	32
6.1 Presence of Wetlands	32
6.2 Impacts on Water Quality	32
6.3 Potential Exposure for Wildlife, Livestock, and Vegetation	33
6.4 Potential Exposure for Humans.....	33
6.5 Recommendations	33
References	35
Report Index	37

List of Figures

Figure 1. Location of the State Lands Mill Site within the State of Idaho.....	9
Figure 2. Topographic overview of the State Lands Mill Site Area.....	10
Figure 3. Aerial photograph of the State Lands Mill Site Area.....	11
Figure 4. Aerial photograph of the State Lands Mill Site.....	13
Figure 5. Geologic map of the State Lands Mill site area.....	16
Figure 6. Small-scale sketch of the State Lands Mill site and environmental sampling locations.....	18
Figure 7. Domestic wells and Public Water System wells located with a 4-mile radius of the State Lands Mill Site.....	27
Figure 8. Surface water 15-mile Target Distance Limit from the Preliminary Assessment Site.....	29
Figure 9. Sensitive species identified in the vicinity of the Preliminary Assessment Site.....	31

List of Photographs

Photo 1. View looking east at the State Lands Mill Site.....	22
Photo 2. View looking east on the State Lands Mill Site.....	23
Photo 3. View looking east across Elk Creek at the sampling location for samples RESWBG1 and RESDBG1. This location is upgradient of the site.....	24

List of Tables

Table 1. July and September 2006 total soils analysis data from the State Lands Mill Site, Blaine County, Idaho.....	19
Table 2. Sediment Sample Results from the site.....	20
Table 3. Surface Water Sample Results from Elk Creek.....	21

List of Acronyms

Acronym	Definition
DEQ	Idaho Department of Environmental Quality
EPA	United States Environmental Protection Agency
gpm	gallons per minute
PA	Preliminary Assessment
TDL	Target Distance Limit
USGS	US Geological Survey

State Lands Mill Site
Preliminary Assessment Report
March 2007

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Section 1. Introduction

This document presents the results of the preliminary assessment (PA) of the State Lands Mill 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.

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 towns of Hailey and Bellevue. There are multiple historic mining sites within the district, although this preliminary assessment addresses only one site within the Elk Creek sub-watershed: the State Lands Mill site.

The State Lands Mill site (Mill) and tailings are located in the lower reaches of Red Elephant Gulch, along Elk Creek, and downgradient from the workings of the Red Elephant Mine. The closest workings, the Lipman Tunnel, lie approximately one mile to the north. The Mill resides on state of Idaho land, immediately upstream from the Central patent mill site claim.

The general location of the State Lands Mill is identified in Figure 1. The Mill exists on state land at latitude 43.48067 N and longitude 114.4316497 W, within Sections 28 of Township 2N & Range 17E. The closest town to the Mill is the city of Hailey, approximately 6.5 miles by air and road.

Figure 2 shows the topography around the site, and Figure 3 provides an aerial view. The mine facilities can be reached from Hailey by driving east along the Croy Creek Road, then north along the Red Elephant Gulch Road. No locked gates on the small road leading to the site are present to control public access; however, *no trespassing* signs are posted along the roadway through the entire site to limit the amount of human activity that may occur on the site. Throughout Red Elephant Gulch, numerous indications of

frequent public access are evident, including fire rings, signs of ATV vehicle use, and signs of recreational hiking.

1.2 Historical Perspective

Available sources provide the history of the Mill and adjacent mine:

Ore was first discovered in 1864, and the boom days of the region were in 1880 to 1887. The total production has amounted to more than \$25,000,000, most of which came from lead-silver ore, with minor amounts from gold, copper and zinc ore.

Umpleby, et al, 1930, p. X

The deposit (Red Elephant Mine) was worked during the early period of mining activity in the region but made its principal production between 1890 and 1898; more recently it has been worked by lessees but with only moderate success, and in 1923 it had been shut down for several years. The mine reopened in 1926.

Umpleby, et al, 1930, p. 146

State Lands Mill Site
Preliminary Assessment Report
March 2007

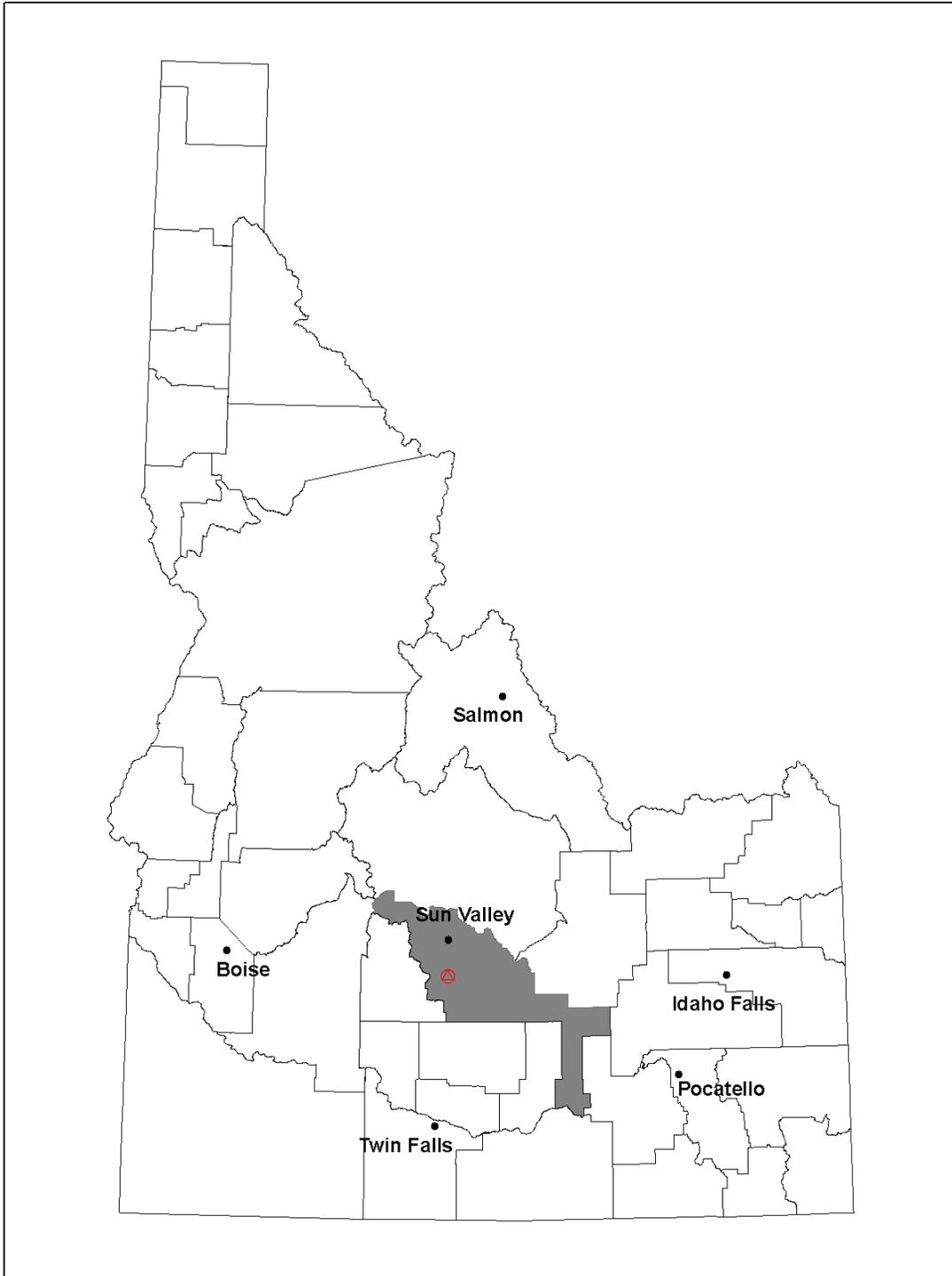


Figure 1. Location of the State Lands Mill Site within the State of Idaho.

State Lands Mill Site
Preliminary Assessment Report
March 2007

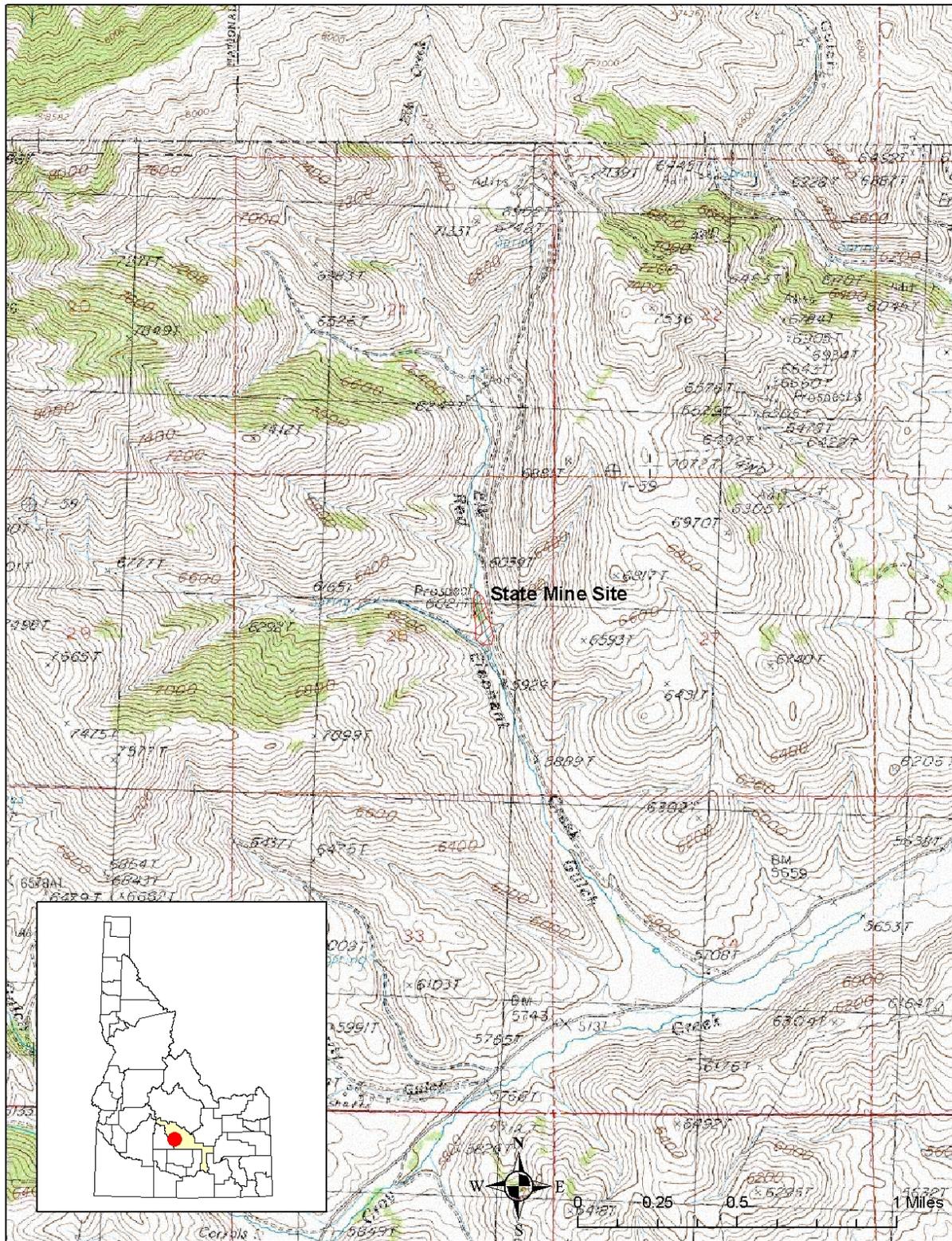


Figure 2. Topographic overview of the State Lands Mill Site Area.

State Lands Mill Site
Preliminary Assessment Report
March 2007



Figure 3. Aerial photograph of the State Lands Mill Site Area.

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

Physical characteristics of the State Lands Mill site are presented in the following, along with the operational histories and characteristics of the wastes that remain.

2.1 Site Description

The State Lands Mill is located in the lower reaches of Elk Creek in Red Elephant Gulch (Figure 4), about one mile above the confluence of Elk Creek and Croy Creek. The Mill consists of fine-grained tailings, the wooden remains of a small structure and ore bin. The Mill area, which flanks Elk Creek, is heavily vegetated and measures approximately 75 feet long by 50 feet wide.

2.2 Operational History

Information relating to the mill's construction, equipment or dates of operation could not be determined. Sparse operational data is presented below.

Production records, obtained from E. Daft and the Ketchum smelter, during the period 1882–1900: 8,231 tons of ore yielded 9.44 ounces of gold; 834,601 ounces of silver; 8,655,493 pounds of lead; and 781,433 pounds of copper. Subsequent records, obtained from the U.S. Geological Survey (USGS), during the period 1904-1918: 6,410 tons of milled ore and 537 tons of crude ore yielded 42.56 ounces of gold; 125,099 ounces of silver; 853,409 pounds of lead; 170,615 pounds of zinc; and 7,425 pounds of copper.

Umpleby and Ross, 1930, p. 147

It is reported that C.W. Davis mined high-grade pillars in the Lipman tunnel in 1937-1939 reputedly producing about \$25,000 worth of shipping ore.

Fryklund, 1950, p. 63

Based upon the estimated age of mill remains and the lack of production or operational history, this writer presumes that the State Lands Mill was possibly operated during 1937-39, to accommodate the ore from the Lipman tunnel, rather than from earlier Red Elephant Mine production.



Figure 4. Aerial photograph of the State Lands Mill Site.

2.3 General Geology

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.

Anderson, 1950, p. 2

Anderson (p 7) went on to note that, “The folding within the area is comparatively simple and consequently faulting constitutes the outstanding feature.”

2.3.1 Previous Studies

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; Kiisgaard 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 (Mitchell and Gillerman, 2005; IDEQ, 2002 & 2006; IDEQ & USEPA, 2006 & 2007).

2.3.2 Stratigraphy and Lithology

Link and Worl (2001) reviewed previous geologic and historic information relating to stratigraphy and mineralization relationships in the Mineral Hill district, including Red Elephant Gulch.

The Bullion mineralized area...is underlain by the lower and middle members of the Pennsylvanian and Permian Dollarhide Formation, which are folded into upright and west-overtained map scale folds....The lower member of the Dollarhide Formation hosts most of the mineralized rock (Skipp and others, 1994). Fryklund (1950), following Umpleby and others (1930), labeled these rocks as Wood River Formation, though he notes, "it is possible that Milligen formation is also present" (p. 64). An unpublished map (circa 1970) of W.E. Hall labels the dark-colored rocks in the Bullion area as Milligen Formation. Hall (1985) showed the rocks as Dollarhide Formation, and Wavra and Hall (1989) showed them as upper member, Dollarhide Formation.

The lower member of the Dollarhide Formation in the Bullion area contains fine- to medium-grained sandstone, black siltite and black limestone or marble. A distinctive lithology in the lower member is channelized disorganized conglomerate that contains mainly intrabasinal soft-sediment clasts of siltstone and sandstone. The lower member occupies both sides of Bullion Gulch and the central part of Red Elephant Gulch. The rocks east of Bullion Gulch are mapped as being stratigraphically high in lower member Dollarhide Formation, because the middle member quartzite is not present. They are intruded on the east by the Deer Creek stock.

In the Bullion area the middle member of the Dollarhide Formation (regionally about 300 m [984 ft] thick) contains silicified sandstone that crops out as light-gray to brown quartzite that forms the high ridge between Red Elephant and Bullion Gulches. These rocks were shown as Wood River Formation on the map of Hall (1985). The mineralized veins of the Bullion area do not extend southward into the middle member Dollarhide Formation. The middle member, much less silicified, is also present in west-dipping beds on the ridge of Kelly Mountains.

Link and Worl, 2001, pp. 12 & 14

2.3.3 Structure

Fryklund (1950, pp. 65-66) noted the following in regards to the structure of the rocks:

The most obvious and significant structural features of the area are the major faults or fault zones which divide the area into a number of distinct blocks...The age of the oldest faults are to be placed as pre-intrusive and possibly all the major faulting is pre-intrusive...All of the major faults are probably pre-mineral as well as pre-intrusive.

Umpleby, et al (1930, p. 217) noted a broad anticline southwest of the river:

Southwest of the river the beds dip generally westward at inclinations that largely range from 20° to 40°. It's thus clear that the sediments form a broad anticline, of which the crest almost coincides with the Big Wood River Valley...The underlying Milligen formations shows a wide range in local dip and strike...

State Lands Mill Site
 Preliminary Assessment Report
 March 2007

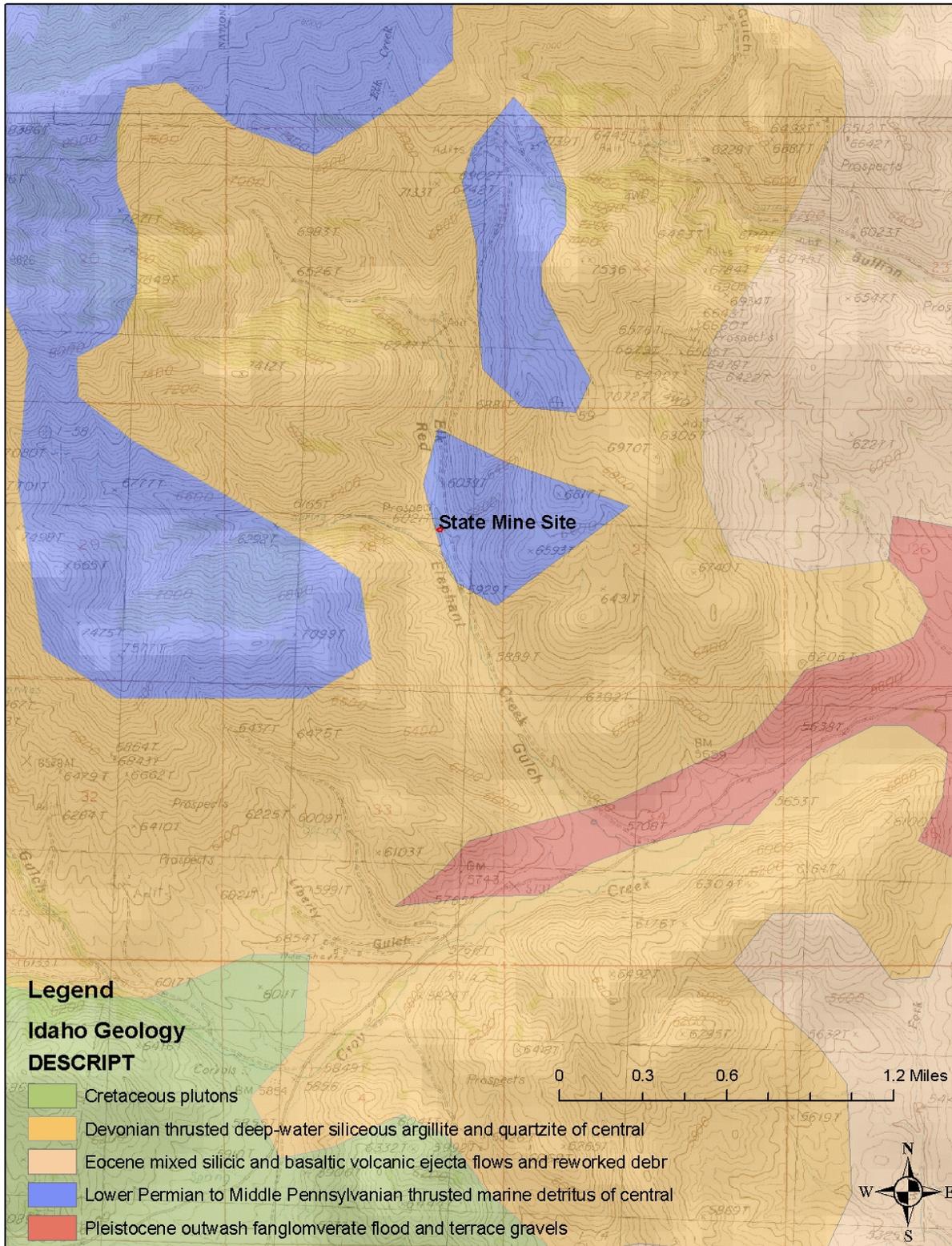


Figure 5. Geologic map of the State Lands Mill site area.

Section 3. Current and Potential Future Land Uses

Current land uses in the area include biking, hiking, hunting, horseback riding and off-road vehicle touring. Though the State Lands Mill site lies in a copse of scrub and pine trees on the west bank of Elk Creek, an old road and trails provide ready access from the Red Elephant Gulch road. During the course of the field work conducted, the DEQ site investigators observed hikers and mountain bikers traversing the Red Elephant Gulch road.

3.1 Fish Species Observed

Fish presence/absence studies have not been conducted on Elk Creek to confirm any fish species that may reside in this stream. Visual observations confirm the presence of brook trout (*Salvelinus foninalis*) in a small stock water pond near the bottom of Red Elephant Gulch. Redband rainbow trout (*Oncorhynchus mykiss gairdneri*), mountain whitefish (*Prosopium williamsoni*), wood river sculpin (*Cottus leiopomus*), and brook trout (*Salvelinus foninalis*) are present within the Big Wood River (IDFG, 2000).

3.2 Apparent Wetlands

Official wetland surveys for the site were reviewed (USFWS, 2007) along with aerial photographs, and direct observation indicate that the site contains wetland areas that are approximately 0.5 acres in size.

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 Hailey.

Section 4. Individual Site Overview and Waste Characteristics

As a result of an interview with the site owner regarding potential remediation efforts, DEQ conducted a site investigation on July 10, 2006 and September 14, 2006, which included a visual inspection of the State Lands Mill site and collection of three (3) water samples and six (6) soil and sediment samples (Figure 6).

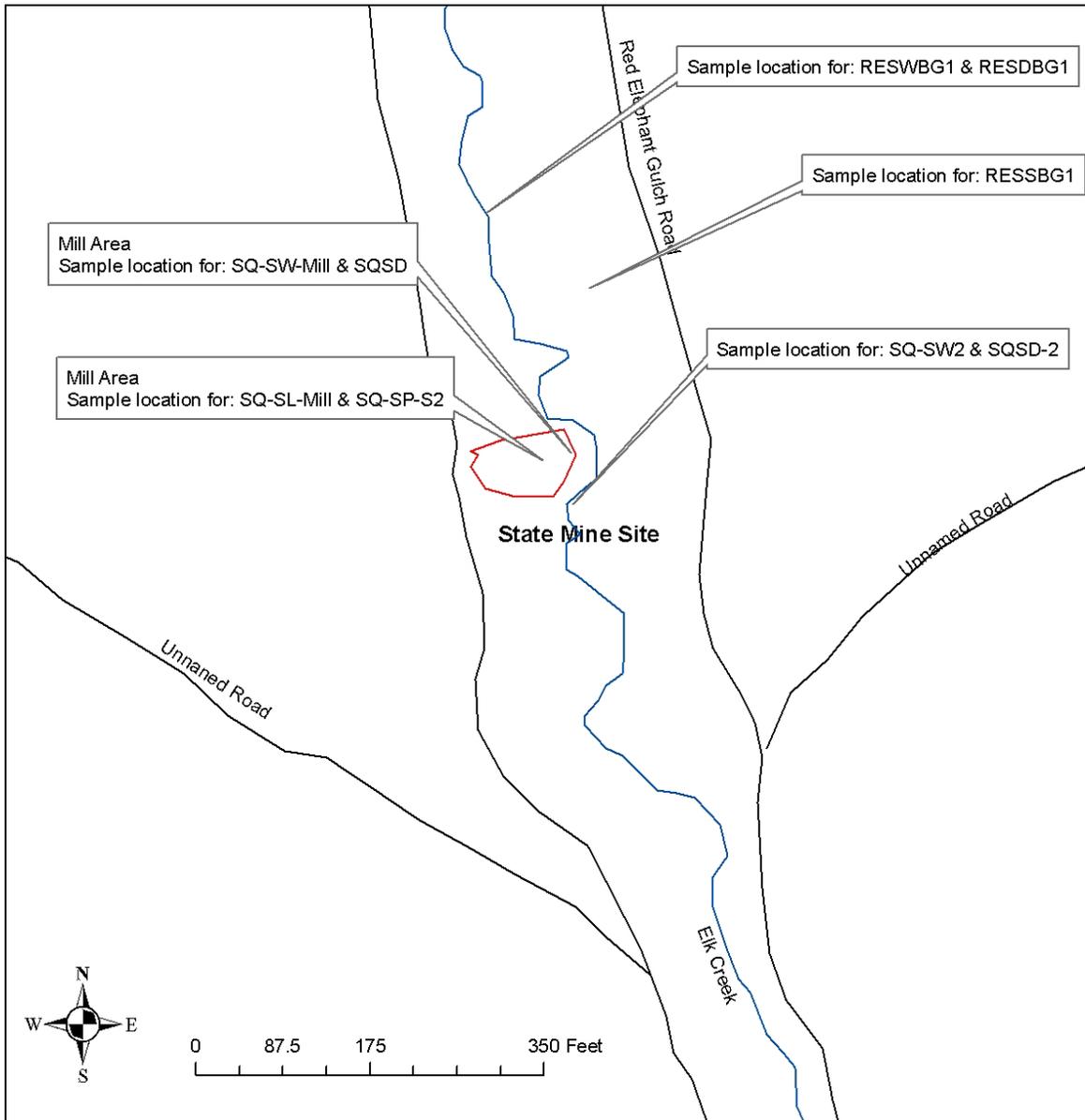


Figure 6. Small-scale sketch of the State Lands Mill site and environmental sampling locations.

4.1 Sampling Results

Table 1, Table 2, and Table 3 present the results of the sampling. Background samples were collected for sediment, surface water, and soils. If a sample concentration exceeded the background concentration by more than a factor of three, then that constituent was considered elevated. **Boldface** values in the tables indicate the elevated constituents for the site.

A potential *Probable Point of Entry* (PPE) exists at the site where the toe of waste pile contacts Elk Creek.

Table 1. July and September 2006 total soils analysis data from the State Lands Mill Site, Blaine County, Idaho.

Analyte	Soil Sample SQ-SL-Mill (mg/kg)	Soil Sample SQ-SP-S2 (mg/kg)	Background Sample RESSBG1 (mg/kg)	Idaho Initial Default Target Levels under REM (mg/kg)
Arsenic	2460	5.1	50.6	0.391
Barium	6.2	227	218	896
Cadmium	418	2.26	5.03	1.35
Chromium	57.3	128	30.1	2130
Lead	152000	95.5	470	49.6
Mercury	5.5	0.012	0.112	0.00509
Selenium	32.1	<0.5	1.9	2.03
Silver	1350	1.3	4.9	0.189

Boldface values are considered elevated with respect to background concentrations.

Soil samples were collected from the site and analyzed for metals (samples SQ-SL-Mill, SQ-SP-S2, and RESSBG1). Sample SQ-SL-Mill was collected near the foundation area at the site. SQ-SP-S2 was collected from the remains of what appears to be an ore stockpile. RESSBG1 was collected from the hillslope upstream of the mine site as a background sample. Analytical results from these three samples indicate arsenic, cadmium, chromium, lead, mercury, selenium, and silver are elevated constituents in the soils at the site.

State Lands Mill Site
Preliminary Assessment Report
March 2007

Table 2. Sediment Sample Results from the site.

Constituent of Concern	Mill Sediment Sample SQSD (mg/kg)	Site sediments SQ-SD2 (mg/kg)	Sediment Sample RESDBG1 BACKGROUND (mg/kg)
Arsenic	187	208	26.2
Barium	98	89	93.1
Cadmium	14.9	8.68	0.59
Chromium	44.9	56.8	16.8
Lead	3540	11500	124
Mercury	0.357	0.691	0.078
Selenium	3.5	5.6	1.1
Silver	29	99.9	0.6
Field Parameters			
pH	9.05 std. units		
Specific Conductance	276 μ siemen/cm		
Temperature	10.1 $^{\circ}$ C		
Dissolved Oxygen	11.14 mg/L		
Turbidity	250 NTU		

Boldface values are considered elevated with respect to background concentrations.

Sediment samples were collected from the mill site as well as Elk Creek and analyzed for metals. Sediment sample (SQSD) was collected from the saturated area that existed within the site. Sediment sample SQ-SD2 was collected as a composite soil sample across the site. Sample RESDBG1 was collected approximately 300 yards upstream from the upper portions of the site. This sample was collected as a background sample.

As shown in Table 2, elevated concentrations of arsenic, cadmium, chromium, lead, mercury, selenium, and silver were measured at the downgradient sample location. These parameters are considered elevated with respect to the background concentrations as defined earlier in this section.

Table 3. Surface Water Sample Results from Elk Creek.

Constituent of Concern	Surface Water Sample SQSW Mill (mg/L)	Surface Water Sample SQ-SW2 (mg/L)	Background Elk Creek Results RESWBG1 (mg/L)
Arsenic	0.013	0.01	0.03
Barium	0.02	0.01	0.01
Cadmium	0.0024	<0.0005	<0.0005
Chromium	0.005	<0.002	<0.002
Lead	0.02	0.002	<0.002
Mercury	<0.002	<0.002	<0.002
Selenium	0.008	0.003	<0.005
Silver	0.004	<0.002	<0.002
Field Parameters			
pH	9.07 std units		
Specific Conductance	284 μ siemen/cm		
Temperature	10.2 °C		
Dissolved Oxygen	10.99 mg/L		

4.2 Inspection Findings

During DEQ's July 2006 visit, the volume of the mine waste piles associated with the State Lands Mill site were mapped at approximately 500 cubic feet. The area that the waste rock currently occupies is approximately 1 acre. The State Lands Mill site waste piles are located along Elk Creek, on the western side of Red Elephant Gulch Road, which allowed DEQ personnel the ability to make good observations and assessments (Photo 1).

Associated with the mill site is one minor waste pile and scattered rubble that defines the boundaries of the site. The waste pile is located above the stream channel of Elk Creek. All former structures at the site have been reduced to scattered rubble or removed.

The State Lands Mill site has one significant waste pile that was inspected during the DEQ site visit. The remainder of the site is covered with vegetation, wood debris, a concrete foundation, and metal debris.

State Lands Mill Site
Preliminary Assessment Report
March 2007



Photo 1. View looking east at the State Lands Mill Site.



Photo 2. View looking east on the State Lands Mill Site.

4.2.1 Waste Pile

The waste pile at the site is located on the east side of the drainage, above the flood plain for the north-south flowing Elk Creek. The dimensions and structure of the waste pile vary, as the material appears to be remains of a pre-existing milling operation. Generally, the waste pile was approximately 175 feet long, 50 feet wide, and 5 feet thick. Elk Creek currently flows near the waste pile, and runoff across the contaminated soils is evident.

The composition of the waste pile consisted of silt to coarse gravels, varying from light gray to dark brown in color. Less than 10% organic material was observed in the samples. No distinct segregation of the composition of the waste pile was observed as it appears the tailings have been partially re-worked during the milling operations.

One area of the waste material appeared to be ore grade material and was considered the remains of the stock pile used at the mill. The remainder of the site appeared to have multiple colored sediments, wood debris, metal debris, and the remainder of a concrete foundation.

Vegetation has slightly been re-established on the impacted soils. Small trees, grasses, and other shrubs have begun to cover the tailings pile (Photo 3). During the site visit, surface water was existing at the site above Elk Creek.



Photo 3. View looking east across Elk Creek at the sampling location for samples RESWBG1 and RESDBG1. This location is upgradient of the site.

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 be controlled structurally within faults and brecciated zones in the country rock and be expressed at the surface as springs. In the Elk Creek drainage, no springs were witnessed. Densely vegetated portions of the hillsides indicate potential ground water discharge areas, but due to the timing of the site visit, no distinct springs could be mapped.

Shallow ground water may also be encountered within the alluvial deposits of the major tributaries to the Big Wood River. This aquifer system provides drinking water to multiple sources along the Croy Creek drainage (Figure 7). The interaction between the shallow alluvial aquifer systems with the deeper country rock aquifer is not known.

Contributions to the aquifers in close proximity to the State Lands Mill site will predominantly be as a direct result of precipitation or surface water. Elk Creek is a perennial stream that flows into Croy Creek. 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 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 pile exists adjacent to Elk 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, 93 private drinking water wells are reported to be located within a 4-mile radius of the site. The majority of these wells are located within the Croy Creek drainage, closer to the nearby towns of Hailey and Bellevue (Figure 7). The closest domestic well to the site was located at the bottom of Red Elephant Gulch, directly downgradient from the site. The well was sampled, and preliminary results from a related report indicate the water quality from this well has not been impacted from upgradient sources (START, 2007).

No public drinking water systems are located within a 4-mile radius of the site. The closest public water systems are located near the towns of Hailey and Bellevue, over five miles away. 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 a concern in the aquifer that supplies these systems (DEQ, 2006).

State Lands Mill Site
Preliminary Assessment Report
March 2007

Due to the location of the majority of the wells, it is unlikely that any impacts related to the mining activities will be detected (DEQ, 2006). The wells that are located downgradient of the mine site, however, are of greatest concern. These wells are completed in the alluvial materials associated with the Elk Creek alluvial deposits, drawing water from a shallow aquifer directly below the site. Ground water impacts associated with this site would be a greater concern if more shallow wells were located closer to the site. Based on the analytical data collected from the closest well, and due to the current location of the other nearby domestic wells with respect to the site location, it appears these wells are a sufficient distance from the site to avoid any ground water impacts associated with this site.

Ten (10) irrigation wells were identified within a four-mile radius of the site, and the site is not located within a wellhead protection area (DEQ, 2003).

State Lands Mill Site
Preliminary Assessment Report
March 2007

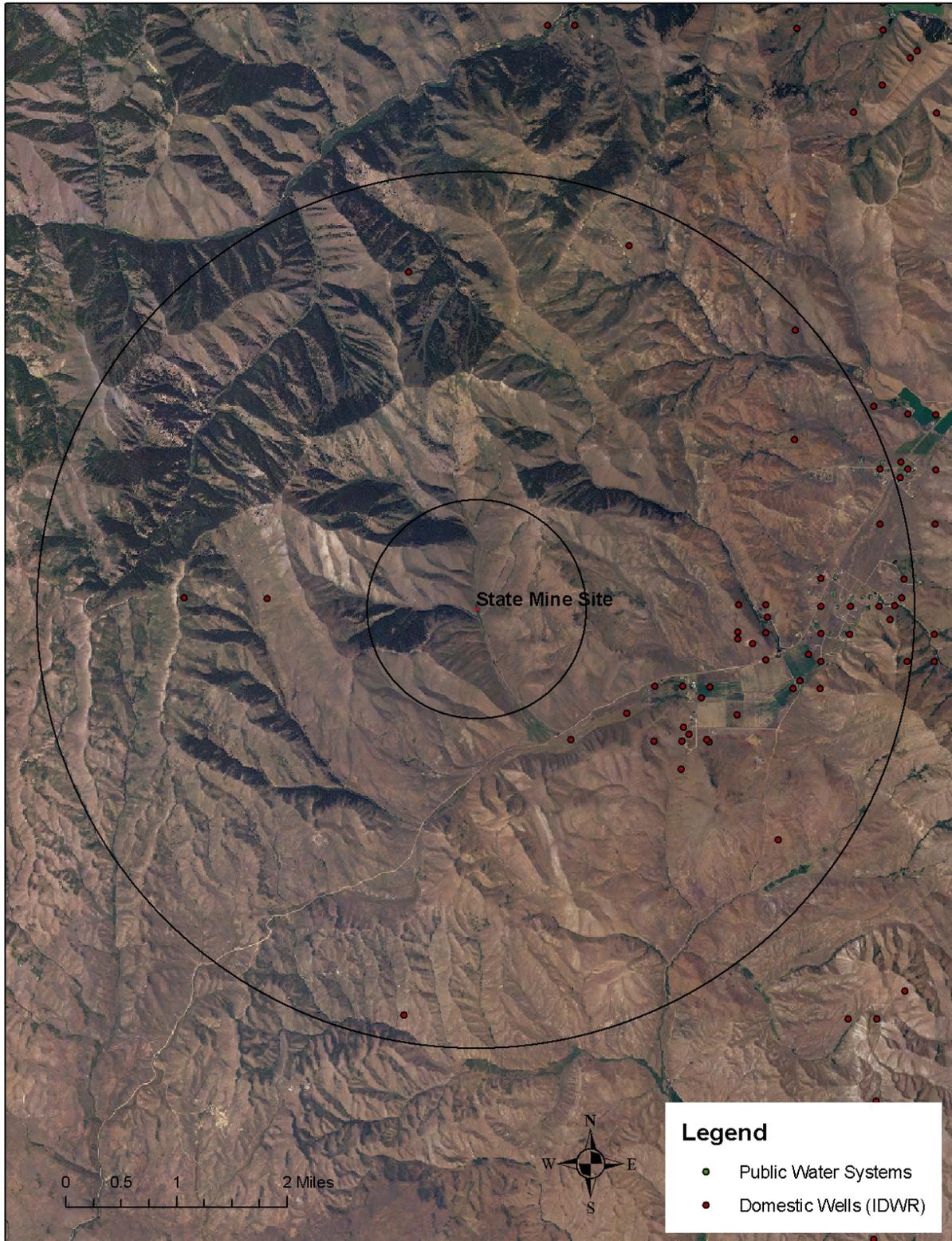


Figure 7. Domestic wells and Public Water System wells located with a 4-mile radius of the State Lands Mill Site.

5.2 Surface Water

The State Lands Mill site area drains southward towards the east-flowing Croy Creek. Overland flow across or in the vicinity of the waste pile would flow directly into Elk Creek. Elk Creek is not currently listed on the EPA §303(d) list of impaired streams, but Croy Creek is currently listed for flow alteration, nutrients, and siltation.

Elk Creek, a tributary to Croy Creek, is the most immediate stream the Preliminary Assessment site could potentially impact. The majority of the mining activity in Red Elephant Gulch occurred in the northern portions of the drainage.

Flowing water was observed in Elk Creek adjacent to the waste pile. During the site visit, the flow rate of Elk Creek was approximately 50 gallons per minute (gpm) near the site. It is unknown how much flow Elk Creek receives during the spring runoff.

Commercial or subsistence fishing does not occur within the 15-mile downstream distance, but sport fishing does. Although camping may occur in places along Elk Creek, it is expected that fishing does not occur in this tributary. Redband rainbow trout (*Oncorhynchus mykiss gairdneri*), mountainwhitefish (*Prosopium williamsoni*), wood river sculpin (*Cottus leiopomus*), and brook trout (*Salvelinus foninalis*) are, however, present within the Big Wood River (IDFG, 2000).

Figure 8 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.

There are no surface water intakes for drinking water or any type of industry within the 15-mile TDL. Multiple drinking water wells are located within the 4-mile radius of the State Lands Mill site and are discussed further in the Groundwater section.

State Lands Mill Site
Preliminary Assessment Report
March 2007

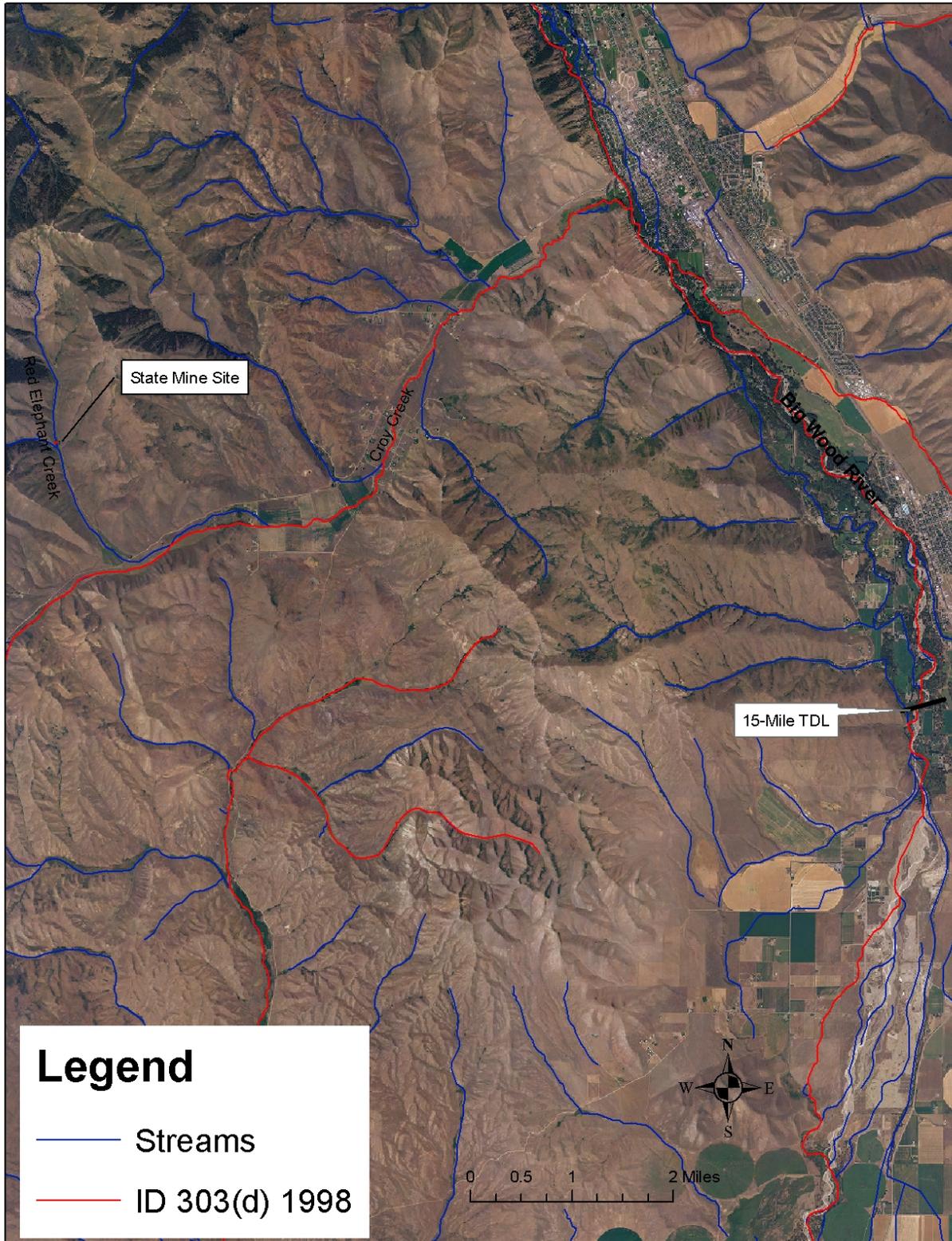


Figure 8. Surface water 15-mile Target Distance Limit from the Preliminary Assessment Site.

5.3 Soil Exposure and Air

Access to the mill site is restricted by *no trespassing* signs posted along the Red Elephant Gulch Road. The main access road to Red Elephant Gulch allows public access to the site. The site is located on private property and surrounded by public lands on all sides.

5.3.1 Potential Receptors

Potential receptors include local residents, hunters, anglers, cattlemen, trail riders (motorized and non-motorized), campers, and rarely, tourists. Cattle graze the surrounding area, but their presence within the mine site is minimal. Residents and outdoor enthusiasts remain the highest percentage of potential receptors, 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; however minor amounts of private land exist. The parcel of land occupied by the waste pile is 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, however, 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 in the area listed as a species of concern (F&G, 2002) within a 4-mile radius of the mining site (Figure 9). 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, and Long-legged Myotis (F&G, 2002).

5.3.4 Soil Sample Concentrations

Relative to the background concentrations, soil exposure at the site is expected to be elevated for all receptors, due to the high lead concentrations measured in the soil samples.

Soil samples contained total arsenic concentrations up to 2,460 mg/kg, barium concentrations up to 98 mg/kg, cadmium concentrations up to 418 mg/kg, chromium concentrations up to 128 mg/kg, lead concentrations up to 15,200 mg/kg, mercury concentrations up to 5.5 mg/kg, selenium concentrations up to 32.1 mg/kg, and silver concentrations up to 1,350 mg/kg. Analytical results can be seen in Table 1.

Background samples were also collected at the site. Based on the concentrations of the samples when compared to three times the background concentrations, all constituents appear to be elevated with the exception of barium.

Based on the concentrations measured in the soils at the site, it appears remedial action will need to occur to control the exposure and potential transport of the elevated metal soils at the site.

State Lands Mill Site
Preliminary Assessment Report
March 2007

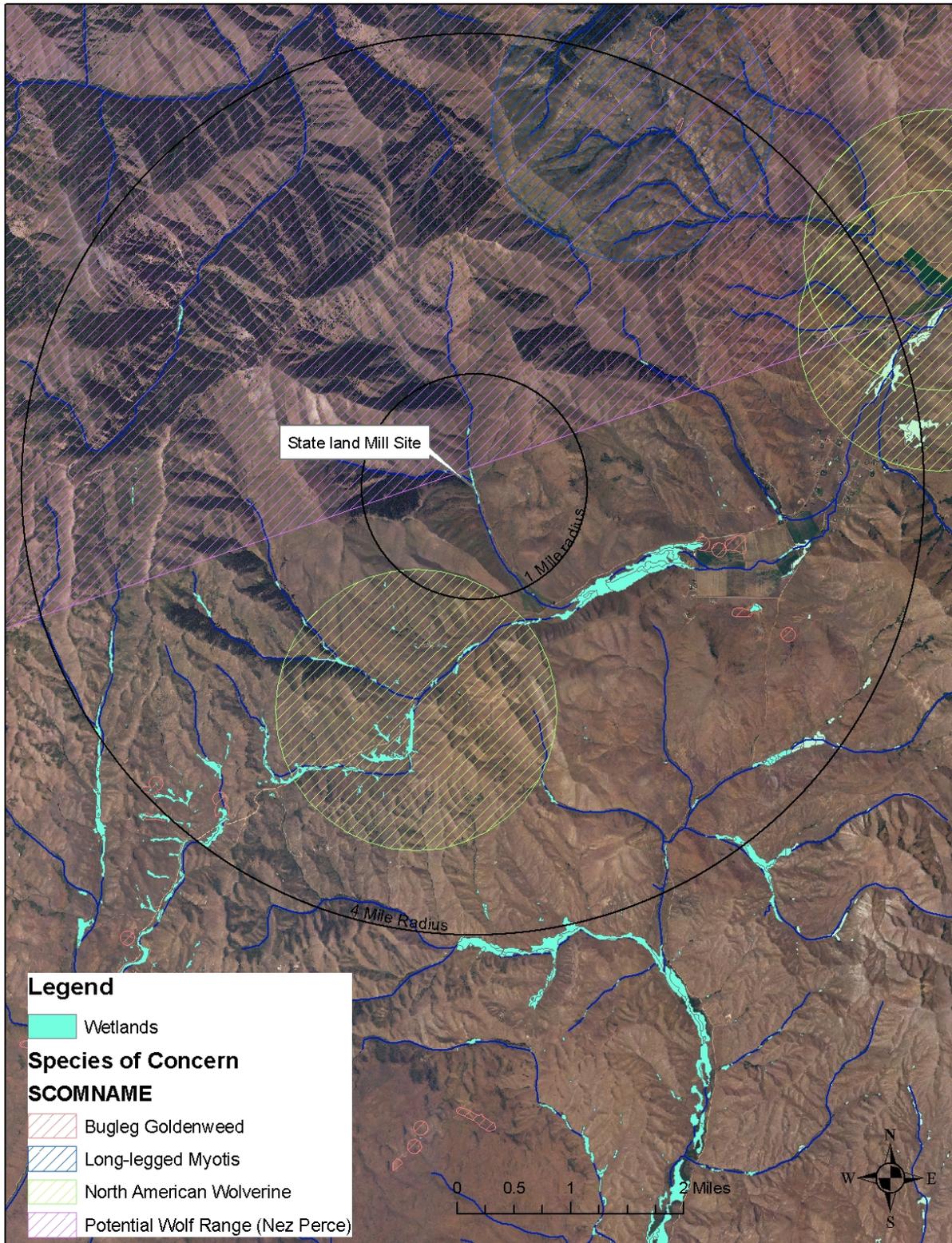


Figure 9. Sensitive species identified in the vicinity of the Preliminary Assessment Site.

Section 6. Summary and Conclusions

The Red Elephant mine produced primarily silver and lead, though minor zinc, copper and gold values were also realized. The State Lands Mill probably operated intermittently between 1904 and 1917. Earlier production (1882-1900) records of the adjacent Red Elephant mine suggest crude ore was shipped directly to the Ketchum smelter for processing. Though the exact nature of early milling processes is unknown, it was reported that the Quincy Junior Mining Co. operated an electrostatic zinc process, at least partly during its history.

The associated mill tailings exhibit the inadequacy of early milling technologies, with resultant elevated metal concentrations. Based on the concentrations measured in the soils at the site, it appears remedial action will need to occur to control the exposure and potential transport of the lead-elevated tailings at the site.

6.1 Presence of Wetlands

Based on official wetland surveys and aerial photographs of the area, wetlands exist on the site. Samples were not collected from the wetlands on this site to evaluate any impacts. The wetland area (approximately 3.5 acres), exists both upgradient and downgradient of the site as well as at the site.

6.2 Impacts on Water Quality

The surface water sample collected from the site indicated elevated lead concentrations (0.02 mg/L) when compared to three times the background concentration (<0.002 mg/L). Cadmium was also elevated (0.0024 mg/L) in the surface water sample collected at the site with respect to the background concentration (< 0.0005 mg/L). Surface water samples collected from Elk Creek just downgradient from the site did not show any elevated constituents.

Sediment samples collected from Elk Creek indicate that elevated concentrations of arsenic, cadmium, chromium, lead, mercury, selenium, and silver were measured at the downgradient sample location. These elevated constituents may have negative impacts on the biological receptors within Elk Creek.

Ground water impacts related to the mine site are currently unknown. However, analytical data collected from the nearest well, a shallow well located at the bottom of Red Elephant Gulch, indicate the ground water sampled has not been impacted from the upgradient activities. Analytical 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 site suggest impacts related to the mine site may be insignificant but cannot be verified due to a lack of analytical data. As future development encroaches

closer to the site, new wells drilled within Red Elephant Gulch would be more susceptible to potential ground water contamination associated with the site.

6.3 Potential Exposure for Wildlife, Livestock, and Vegetation

Potential exposure of the tailings pile to wildlife and vegetation from the site is present. In addition, livestock may use the area to graze if future development warrants such activities. The native plant species may bio-accumulate high concentrations of metals that may be consumed by the local wildlife or livestock. The particular plant species that readily bio-accumulate metals should be investigated in greater detail as elevated lead concentrations exist in the tailings pile. Depending on the plant species and livestock exposed to the site, the lead concentrations may be toxic to certain receptors. 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 site is low, due to *no trespassing* signs that are posted along the Red Elephant Gulch road near the site. However, due to the site location near the main Red Elephant Gulch Road, this area may be frequently used by mountain bikers, hikers, hunters, snowmobile operators, off-road four wheeling, and various other outdoor recreation enthusiasts who frequent the area via the main access road.

Elevated metal concentrations were measured in the soil at the site, and exposure for humans to the elevated metals is high. Fugitive dust or direct contact with the waste piles appears to be the most significant route of exposure to humans for elevated constituents. Considering the site access is not limited, these exposure levels are a significant factor to address.

Increased risks to humans would exist if human activity was higher at the site. If exposure to the site increases, the risk associated with that exposure will increase accordingly. If the site is ever developed as a residential area, the level of exposure/risk would increase significantly.

The analytical data indicate that the ground water sampled at the closest domestic well was not elevated with metal concentrations. This fact also needs to be considered in terms of exposure associated to humans. Currently, the risk to humans is low; however, if new ground water wells are completed closer to the site, the risk would need to be re-evaluated as the exposure would increase.

6.5 Recommendations

Overall, the soil and sediment samples collected from the site show elevated metal concentrations with respect to background concentrations. The samples that indicated high metal concentrations in the soils were collected in areas that are accessible to the public. Recreation enthusiasts and wildlife exposed to the elevated metal concentrations in the soil are the main concern with the contaminated soils.

Surface water samples collected from Elk Creek indicate metal concentrations are not elevated when compared to background concentrations. Elevated metals were measured at the surface water existing at the site. However, these concentrations were not present in the downgradient Elk Creek samples. Although the Elk Creek drainage has multiple sources of mining activity present, the metal concentrations do not appear impacted when comparing upgradient to downgradient samples.

Sediment samples collected from Elk Creek and the site show elevated concentrations of metals (arsenic, cadmium, chromium, lead, mercury, selenium, and silver). The samples that showed the elevated metal concentrations were collected at the downgradient side of the site. Based on a comparison to the sediment samples collected upgradient of the site, it appears the site is a source of the elevated metals detected in the sediments of Elk Creek.

Based on the analytical data showing elevated metal concentrations in the soils and measured in the sediments below the site, a remediation plan should be developed to help stabilize the elevated soils. If the soils could be removed or re-vegetated, a significant decrease in the contribution to the surface water and sediment contamination would be expected.

In addition, any future activity at the site should consider the data presented in this report. The risks associated with the site are based on current conditions of the site. If conditions at the site are modified in the future, additional environmental risk analyses should be conducted accordingly.

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State Lands Mill Site
Preliminary Assessment Report
March 2007

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Report Index

	irrigation wells, 26	
A		K
Anderson, 13, 14, 35		
anglers, 30	Kiisgaard, 14, 35	
anticline, 15		L
arsenic, 19, 20, 30, 32, 34		
B	lead, 8, 12, 19, 20, 30, 32, 33, 34	
barium, 30	Lindgren, 14	
Batchelder, 14	Link and Worl, 14	
brook trout, 17, 28	Lipman tunnel, 12	
C		M
cadmium, 19, 20, 30, 32, 34	mercury, 19, 20, 30, 32, 34	
campers, 30	Milligen Formation, 13	
cattlemen, 30	Mineral Hill Mining District, 7	
chromium, 19, 20, 30, 32, 34	Mitchell, 14, 35	
copper, 8, 12, 32	mountainwhitefish, 17	
Croy Creek, 7, 12, 25, 28		P
Croy Creek Road, 7		
D	precipitation, 25	
drinking water wells, 25, 28	preliminary assessment (PA), 7	
	public drinking water systems, 25	
E		R
E. Daft, 12		
F	rainbow trout, 17	
fishing, 28	rainfall, 25	
Fryklund, 12, 14, 15, 35	receptors, 30, 32, 33	
G	risk, 33, 34	
Gillerman, 14, 35		S
gold, 8, 12, 32	selenium, 19, 20, 30, 32, 34	
ground water impacts, 26	silver, 8, 12, 19, 20, 30, 32, 34	
H	snowfall, 25	
Hailey, 7, 17, 25, 32, 35	snowmobile, 33	
Hailey-Bellevue mineral best, 13	species of concern, 30	
Hall, 14		T
hunters, 30, 33	tourists, 30	
I	trail riders, 30	
Idaho Initial Default Target Levels (IDTLs), 25		U
Idaho Water Quality Standards, 25	Umpleby, 8, 12, 14, 15, 35	
		W
	Wagner, 14	

State Lands Mill Site
Preliminary Assessment Report
March 2007

Wavra, 14
wetland, 17, 32
Wood River Formation, 13
wood river sculpin, 17
Worl and Johnson, 14
Worl and Lewis, 14

zinc, 8, 12, 32

Z