Magdalena Mine
Preliminary Assessment Report

Blaine County
State of Idaho

Department of Environmental Quality

December 2006

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

Table of Contents

List of Figures

List of Photographs

List of Tables

List of Acronyms

Acronym	Definition
AMSL	Above mean sea level
bgs	below ground surface
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

This page intentionally left blank for correct double-sided printing

Section 1. Introduction

This document presents the results of the preliminary assessment (PA) of the Magdalena Mine. 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

Although ownership research conducted on the Magdalena Mine determined that the site was located on U.S. Bureau of Land Management (BLM)-administered Public lands, an obvious expression of acid mine drainage discharging to surface waters was noted *duri*ng a drive by (Photo 3, page 16). At that time, DEQ's Project Manager determined there was sufficient reason for DEQ to investigate the site more closely and evaluate potential risks to human health and the environment. The results of that investigation are contained in the following report.

1.1 Overview

The Magdalena Mine consists of numerous mine adits and dumps existing on public land within the mountainous Mineral Hill Mining District approximately two miles southwest of Hailey in Blaine County, Idaho. The Magdalena Mine is situated along Colorado Creek, a tributary to the Big Wood River, at approximately 6,000 to 6,500 feet above mean sea level (AMSL).

The general location of the Magdalena mine facilities are identified in Figure 1. The Magdalena Mine exists on BLM-managed public land at latitude 43.48264055º N and longitude 114.32775770º W, within Section 21 of Township 2N & Range 18E. The closest town to the Magdalena is the city of Hailey, approximately 6 two miles by air and four miles by 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 south along the Colorado Gulch Road. No locked gates or posted signs on the small

road leading to the mine site are present to control public access—numerous indications of frequent public access include fire rings, broken beer bottles and various beverage cans.

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 Colorado Gulch sub-watershed.

1.2 Historical Perspective

Available sources provide the history of the 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

> 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.
>
> Anderson, 1950, p. 9

Only sporadic exploration, development and production activities have occurred since this historic mining period. The Magdalena Mine was operational again from 1985 to 1987 (Worl and Lewis, 2001).

> Ore mined in the early days was very rich. Much of it was reported to have averaged 40 to 60 per cent of lead and 40 to 120 ounces of silver to the ton, and numerous shipments were of far higher grade. Small lots containing as much as 2,000 ounces of silver to the ton were mined…Zinc is present in nearly all the ore. In most of the ore it is an abundant accessory…Gold is present in nearly all of the lead ore in amounts ranging from a few cents up to rarely $5 to the ton…Little attention appears to be given to copper by mining men in the Big Wood River region, but much of the lead-silver ore contains more or less of this metal.
>
> Umpleby, et al, 1930, pp. 87-88

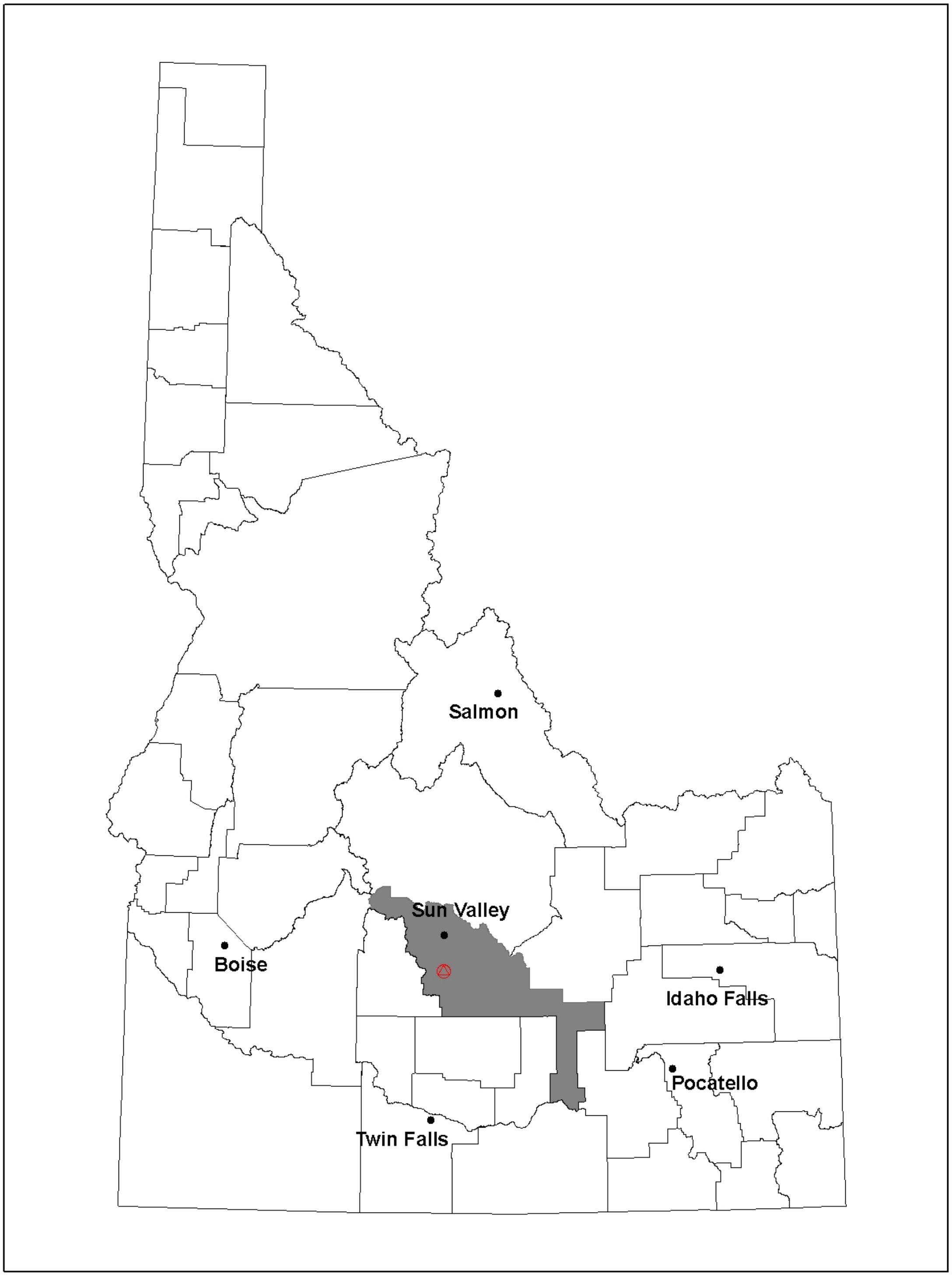

Figure 1. Location of the Magdalena Mine within the State of Idaho.

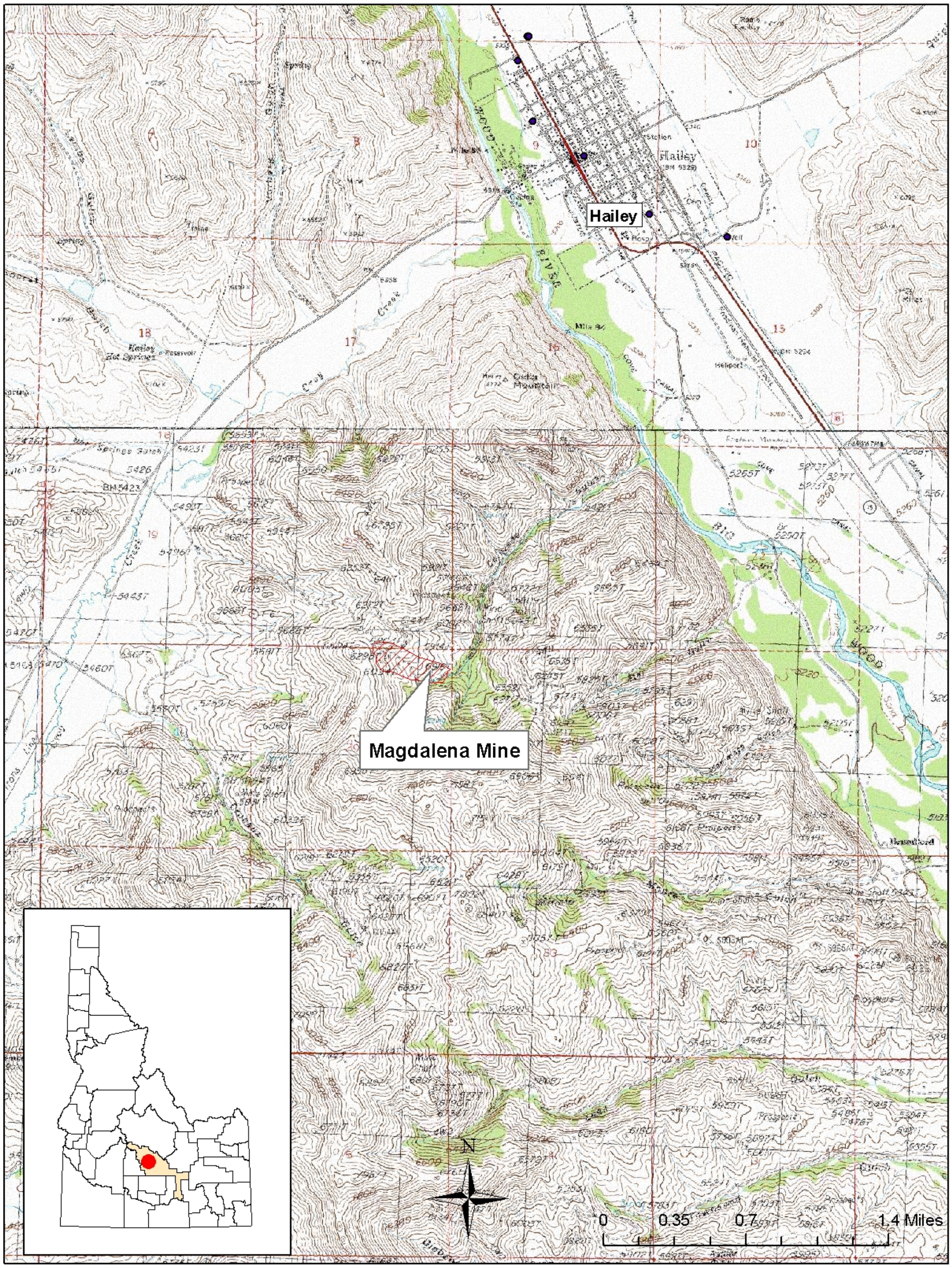

Figure 2. Topographic overview of the Magdalena Mine Area.

Figure 3. Aerial photograph of the Magdalena Mine Area.

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

Physical characteristics of the Magdalena Mine site is presented in the following, along with the mines' operational histories and characteristics of the wastes that remain.

2.1 Site Description

The Magdalena Mine is located in the upper reaches of Colorado Creek (Figure 4), about a half-mile above the Snoose Mine. A description of the mine is provided by Anderson (1950, p. 24)

> The property has three open tunnels, several open cuts and two-three caved tunnels. The lowest tunnel consists of a crosscut and drift about 225 feet long; the second, a crosscut and short drift about 200 feet ling; and the third (upper), an 80-foot crosscut which connects with a drift about 200 feet long.
>
> These tunnels and cuts are on a vein of exceptional persistence that may be traced for several thousand feet through the fractured and fissured diorite. Its trend is about N. 58º W. in the lower tunnel and about N. 45º W. in the upper tunnel. In both places the dip is 70º NE., but in a cut near the second tunnel the dip is 75º - 80º NE. The zone of fissured and fractured rock is as much as 6 feet wide but the vein within is much smaller and its thickness appears to vary considerably from place to place. In the upper tunnel the vein in places is about a foot wide; in the lower tunnel it is 10 to 24 inches wide; and in cuts near the middle tunnel, from 2 to 4 feet wide. The middle tunnel was turned on a minor, lightly mineralized fracture of N. 68º W. strike and 55º NE. dip about 188 feet from the portal and some tens of feet short of the vein exposed in the cuts and other workings. Vein filling is chiefly white quartz with some coarsely crystalline pyrite and arsenopyrite and in places a little chalcopyrite. The main values are reported in gold.

Actual production records were not located.

The mineralized diorite zone identified by Anderson was later determined by Kiislgaard and others (2001) to correlate with the Croesus stock. The age of the diorite in the Magdalena Mine was calculated at "85.6±0.6" million years. (p. 2).

2.2 Operational History

Records detailing operations at the Magdalena are scant, but Anderson (1950) noted that several mines in this area were worked in "the early days with little attention thereafter" (p. 23). Worl and Lewis (2001) noted that the Magdalena was operational from 1985 to 1987, but no additional information was provided.

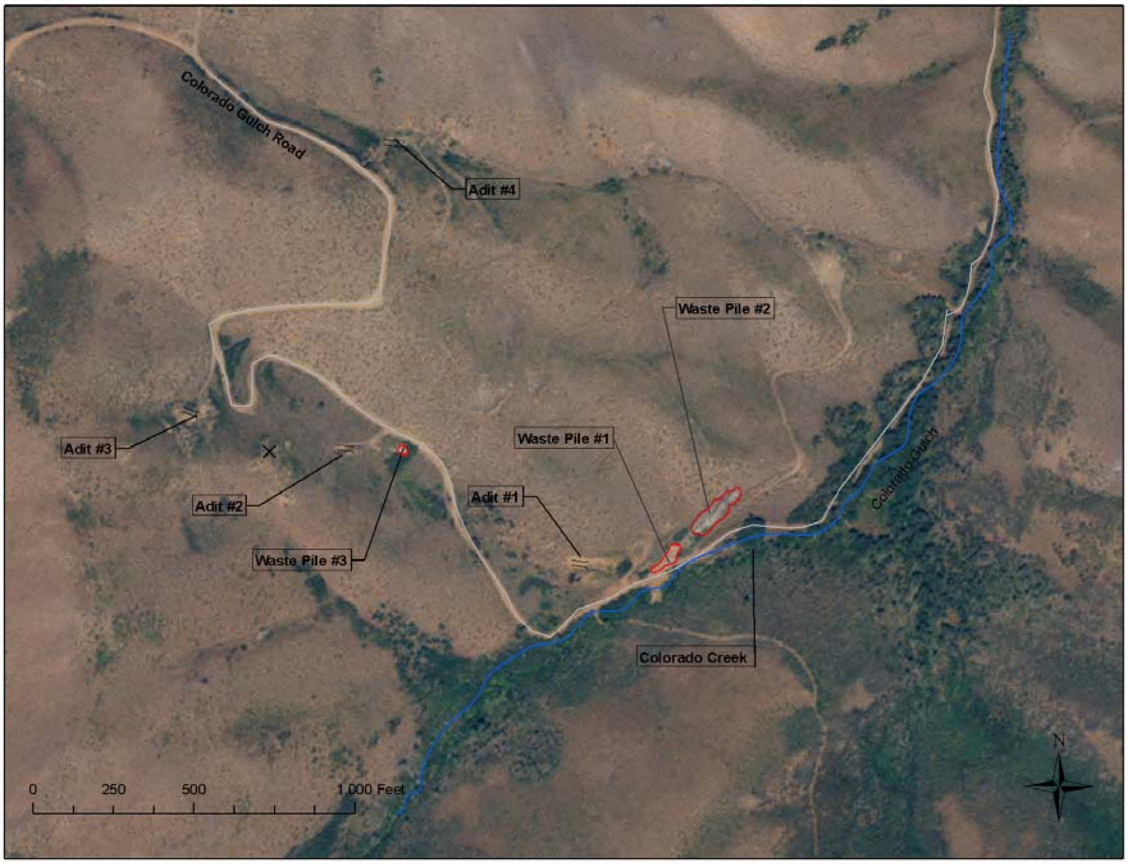

Figure 4. Aerial photograph of the Magdalena Mine.

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 5, was described by Anderson (1950, p2) who described the geology of the site:

The Hailey-Bellevue mineral best 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 (p 7) went on to note that, "The folding within the area is comparatively simple and consequently faulting constitutes the outstanding feature."

2.4 Stratigraphy and Lithology

Anderson (ibid) 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 Colorado 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).

> The area of granite and diorite west of Bellevue contains many dikes, and the near-by sedimentary rocks contain a few sills…The dikes show a wide range in color and mineral composition. The rocks that resemble the diorite in composition are found in two sill-like bodies-one 500 feet north of the Magdalena shaft…
>
> Umpleby, et al, 1930, p. 214

Anderson assigned the black-shale host rocks 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. 2) noted the following in regards to the structure of the rocks:

> The various rocks exhibit complex structural relationships. The Milligen and Wood River formations have been folded and greatly faulted with some of the faulting preceding and

> accompanying the intrusion of the different igneous rocks and some of it coming after intrusion, in part long after.

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 20º to 40º. 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…At the mouth of Magdalena Gulch…these beds are locally crumpled or closely folded.

Link and Worl (2001, p. 12) mapped areas nearby the Minnie Moore mine in Colorado and Magdalena Gulches. They noted the rocks of the Dollarhide Formation were located:

> . . . on the west (upper) ends of Colorado and Magdalena Gulches in a northward-widening band east of the Croesus stock. This is one of the few places where the Dollarhide and Milligen Formations are in contact. The exposed contact is sharp and linear, and beds are parallel across it. These features suggest that the contact is a sheared unconformity…A low-angle, shallow dipping, top-to-the-west normal fault cuts the upper parts of the Colorado Gulch. Between Colorado and Magdalena Gulches, this fault cuts the Snoose vein in its footwall. The fault also cuts the ridge to the north of Colorado Gulch….

Link and Worl (ibid, pp.18-19) also noted that ore occurs in fracture zones:

> In the Colorado and Magdalena Gulches, ore is hosted by high-angle fracture systems that trend northwest and dip mostly southwest…A major low-angle top-to-the-northwest normal fault terminates the mineralized veins north of Magdalena Gulch.

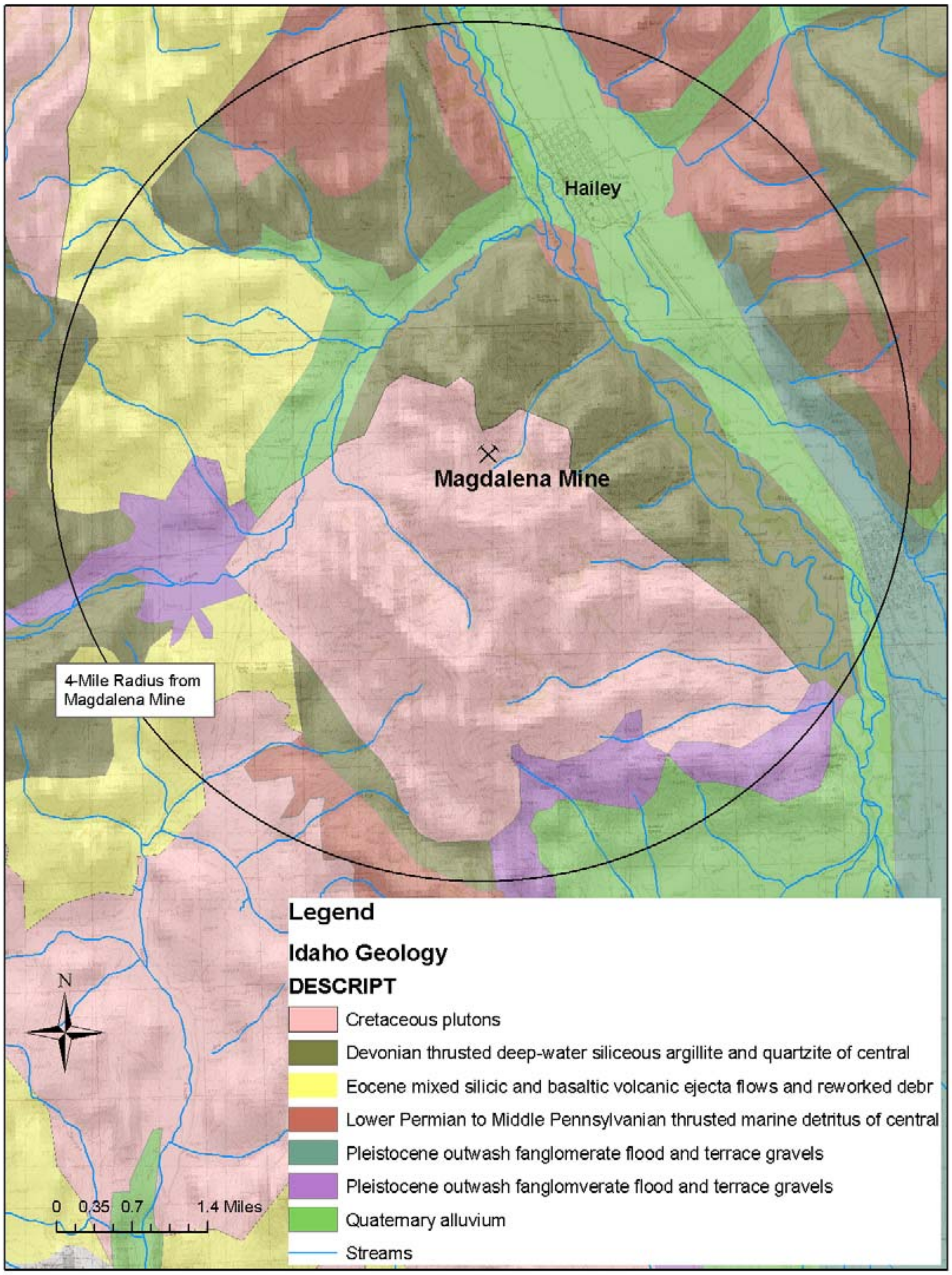

Figure 5. Geologic map of the Magdalena Mine area.

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 Magdalena Mine is accessible from the Colorado Gulch road. A pedestrian bridge spanning the Big Wood River provides easy access to the Colorado Gulch road from the Hailey area. During the course of the field work conducted, the DEQ site investigators observed hikers and mountain bikers traversing the Colorado Gulch road.

3.1 Fish Species Observed

Fish presence/absence studies have not been conducted on Colorado 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 however, aerial photographs as well as direct observation seem to indicate that the Colorado Creek valley contains no 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 Hailey.

Section 4. Individual Site Overview and Waste Characteristics

As a result of observing clear indications of acid mine drainage from the lower Magdalena mine workings (Adit #1, see Figure 6), DEQ conducted a site investigation on July 11, 2006, which included a visual inspection of the Magdalena Mine and collection of two (2) water samples and three (3) soil and sediment samples.

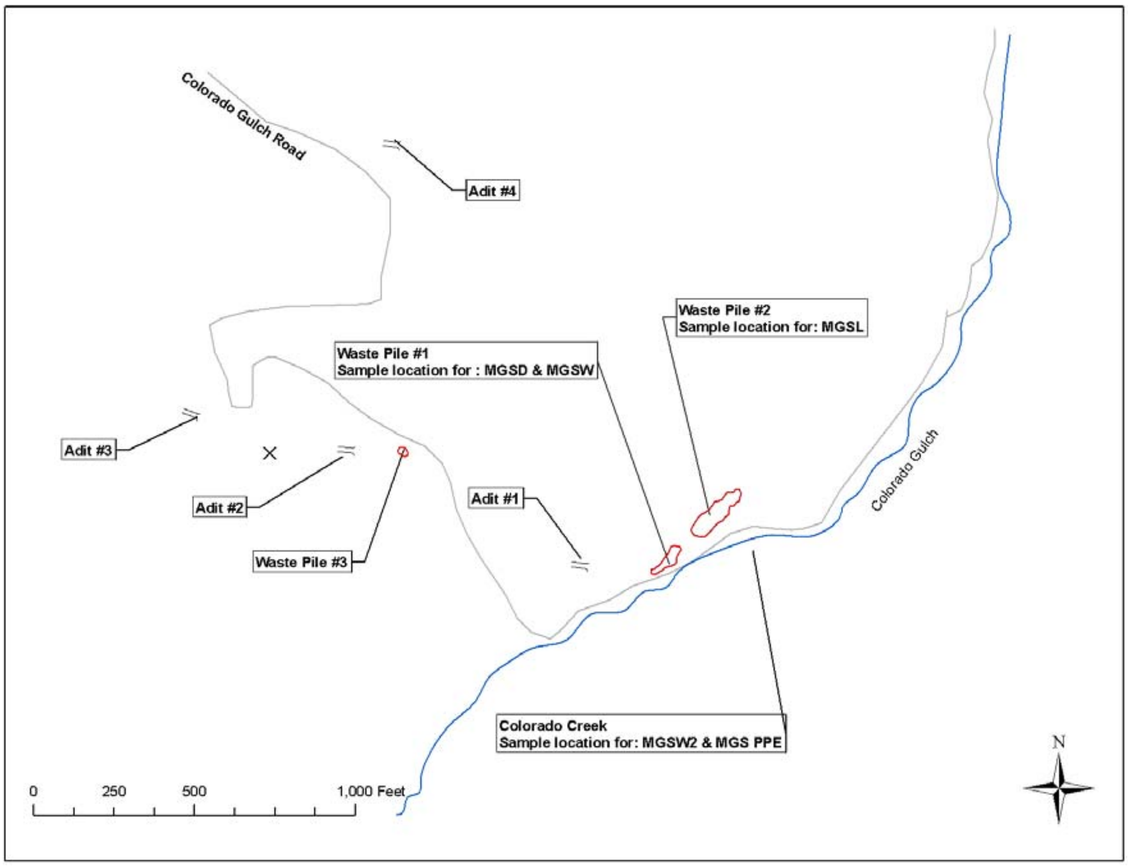

Figure 6. Small-scale sketch of the Magdalena Mine and environmental sampling locations.

4.1 Sampling Results

Table 1, Table 2, and Table 3 present the results of the sampling. **Boldface** values in are in excess of the Idaho Initial Default Target Levels (IDTLs) as described in the Idaho Risk Evaluation Manual (REM).

Multiple potential *Probable Points of Entry* (PPE) exist at the waste piles located at the Magdalena Mine site.

Table 1. July 2006 total soils analysis data from the Magdalena Mine, Blaine County, Idaho.

Analyte	Soil Sample MGSL (mg/kg)	Idaho Initial Default Target Levels under REM (mg/kg)
Arsenic	**40,000**	0.391
Barium	189	896
Cadmium	**1.5**	1.35
Chromium	52.7	2130
Lead	**132**	49.6
Mercury	<0.004	0.00509
Selenium	**6.9**	2.03
Silver	**9.1**	0.189

Boldface values exceed Idaho Initial Default Target Levels (IDTLs)

Samples (water and sediment) were collected from the toe of the waste dump and analyzed for metals (samples MGSD and MGSW). Additional water and sediment samples (MGSD-PPE and MGSW-PPE) were collected from Colorado Creek, directly downgradient from the point in which the adit water entered the stream (Photo 4). This was considered the PPE sample for this media.

Table 2. Surface Water Sample Results from Adit #1 discharge.

Constituent of Concern	Adit #1 Discharge Water Result (mg/L)	Idaho Water Quality Standards for cold water biota[1] (mg/L)	Adit #1 Sediments Results (mg/kg)
Arsenic	**20**[2]	0.36	1110
Barium	1.29	NA	158
Cadmium	**0.0228**[2]	0.0037	1.41
Chromium	0.361	0.550	94.5
Lead	**0.126**[2]	.065	28.5
Mercury	0.0004	.0021	0.006
Selenium	**0.188**[2]	.0020	4.8
Silver	**.071**[2]	.0034	0.7
Field Parameters			
pH	9.0 std. units		
Specific Conductance	470 µsiemen/cm		
Temperature	15.0 ºC		
Dissolved Oxygen	10.70 mg/L		
Turbidity	290 NTU		

1 Standards are based on a total hardness of 100 mg/L.

2 Exceeds Idaho Water Quality Standards for cold water biota.

Although the analytical results of the adit discharge (Table 2) exceeds Idaho Water Quality Standards for cold water biota, the analytical results (Table 3) show that the water collected from Colorado Creek meets the criteria. Due to the location of the samples collected, the sample results are considered a good indication of the potential impacts to nearby surface water bodies.

Table 3. Surface Water Sample Results from Colorado Creek.

Constituent of Concern	Colorado Creek Surface Water Result (mg/L)	Idaho Water Quality Standards for cold water biota[1] (mg/L)	Colorado Creek Sediment Results (mg/kg)
Arsenic	0.043	0.36	305
Barium	0.04	NA	71
Cadmium	<0.0005	0.0037	0.66
Chromium	0.003	0.550	57.3
Lead	<0.002	.065	3.3
Mercury	<0.0002	.0021	<0.005
Selenium	<0.005	.0020	3
Silver	<0.002	.0034	<0.3

Field Parameters

pH	8.4 std units
Specific Conductance	270 µsiemen/cm
Temperature	12.0 ºC
Dissolved Oxygen	11.1 mg/L
Turbidity	82 NTU

4.2 Inspection Findings

During DEQ's July 2006 visit, the volume of the mine waste piles associated with the Magdalena Mine were mapped at approximately 98,500 cubic feet. The Magdalena Mine waste piles are located on the north side of Colorado Creek, where the mine operated, on mostly open south-facing slopes, which allowed DEQ personnel the ability to make good observations and assessments (Photo 1).

Associated with the mine are three waste piles and four adits that can be seen throughout the upper portions of the drainage. All former structures at the site have been reduced to scattered rubble or removed.

The Magdalena Mine has three significant waste piles that were inspected during the DEQ site visit. The waste piles were arbitrarily named Waste Pile #1 through Waste Pile #3 (Figure 6). The three waste piles exist on gradual slopes of approximately 10 percent (Photo 2).

Photo 1. View looking north at the Magdalena Mine Site.

Photo 2. View looking northwest at the lower waste dumps and the collapsed Adit #1.

4.2.1 Waste Pile #1

Waste Pile #1 is located near the Adit #1 at the mine site (Figure 6). This waste pile was approximately 100 feet long, 30 feet wide, and 15 feet thick. Waste debris has slumped off the pile and built up along the toe of the pile. The pile lies along the northern edge of the Colorado Gulch road, and an old mining road crosscuts up onto the waste pile.

Vegetation (small trees, grasses, and sagebrush) have been re-established on this dump with a high percentage of vegetative cover on the pile, which lies approximately 100 feet to the east of the adit. A small trench runs from the collapsed adit location down to the western edge of the waste pile.

Acid mine drainage was observed surfacing from the toe of this waste pile along the edge of the Colorado Gulch road. This drainage exhibited classic discoloration and has staining of the underlying soils (Photo 3). Based on the location of the expression of this water with respect to the collapsed adit and trench, it is assumed that this water is adit drainage that happens to surface at the toe of this dump. Flows observed during the site visit were low (approximately 0.5 gallons per minute [gpm]) and traversed the Colorado Gulch road into Colorado Creek.

Photo 3. View looking east down the Colorado Gulch road. Waste Pile #2 is located in the center of the photo. The acid mine drainage can be seen flowing along the road on the left side of the photo.

4.2.2 Waste Pile #2

Waste Pile #2 was the largest waste pile mapped that was associated with this mine site. Approximately 230 feet long, 15 feet wide, and 20 feet thick, the pile was situated along the Colorado Gulch Road, approximately 50 feet east of Waste Pile #1.

The pile was composed of crushed rock of various size and composition (Photo 3). The color of the material in this pile varied from a light grey to a reddish brown. No water was observed that was associated with this pile.

Sample MGSL was collected as a composite sample of the top two inches of the pile surface material. Analytical results from this sample can be seen in Table 1.

Photo 4. PPE water sample from Colorado Creek, directly downgradient from the lower mine activity.

4.2.3 Waste Pile #3

Waste Pile #3 is located mid-slope of the mine on the western side of the Colorado Gulch road, due east of adit #2 (Figure 6). Adit #2 was partially collapsed approximately 150 feet up the hill from the waste pile. This pile is relatively small, measuring approximately 30 feet long, 30 feet wide, and 15 feet deep (approximately 500 cubic yards). No samples were collected from this pile, and no water was observed that was associated with this pile.

Adit #3 was mapped at the top of the hillslope on the western side of the Colorado Gulch road (Figure 6). This adit has remained open and human activity appears to occur near the

entrance to this adit by the evidence of litter scattered around the area (Photo 5). A waste pile associated with this adit was not observed, and no water was present. No samples were collected from this location.

Photo 5. View of Magdalena Adit #3. This adit was open and access to the public is not restricted.

Adit #4 is located on the top of the ridgeline of the basin on the east side of the Colorado Gulch road (Figure 6). This adit was not mapped during the site visit and information regarding this adit is based on previous investigations and aerial photographs (Photo 6).

Photo 6. Looking north at Adit #4, located directly below the road in the center of the photo.

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 Colorado Creek drainage, no springs were witnessed but one caved adit (Adit #1) was assumed to be discharging mine drainage. 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.

Contributions to the aquifer in close proximity to the Magdalena Mine will predominantly be as a direct result of precipitation or surface water. Colorado Creek is a perennial stream that flows into the Big Wood River. Annual precipitation for Hailey, Idaho, located approximately two miles 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 piles have limited soil and exist adjacent to Colorado 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, 444 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 (Figure 7).

Nine (9) public drinking water systems are located within a 4-mile radius of the site. The nearest well is located approximately 1.0 miles west of the mine site, with a static water level of 10 feet below ground surface (bgs), measured on November 20, 1977. 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 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 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.

Sixty (60) 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). There is no monitoring data associated with these wells to confirm any impacts related to the mining operations.

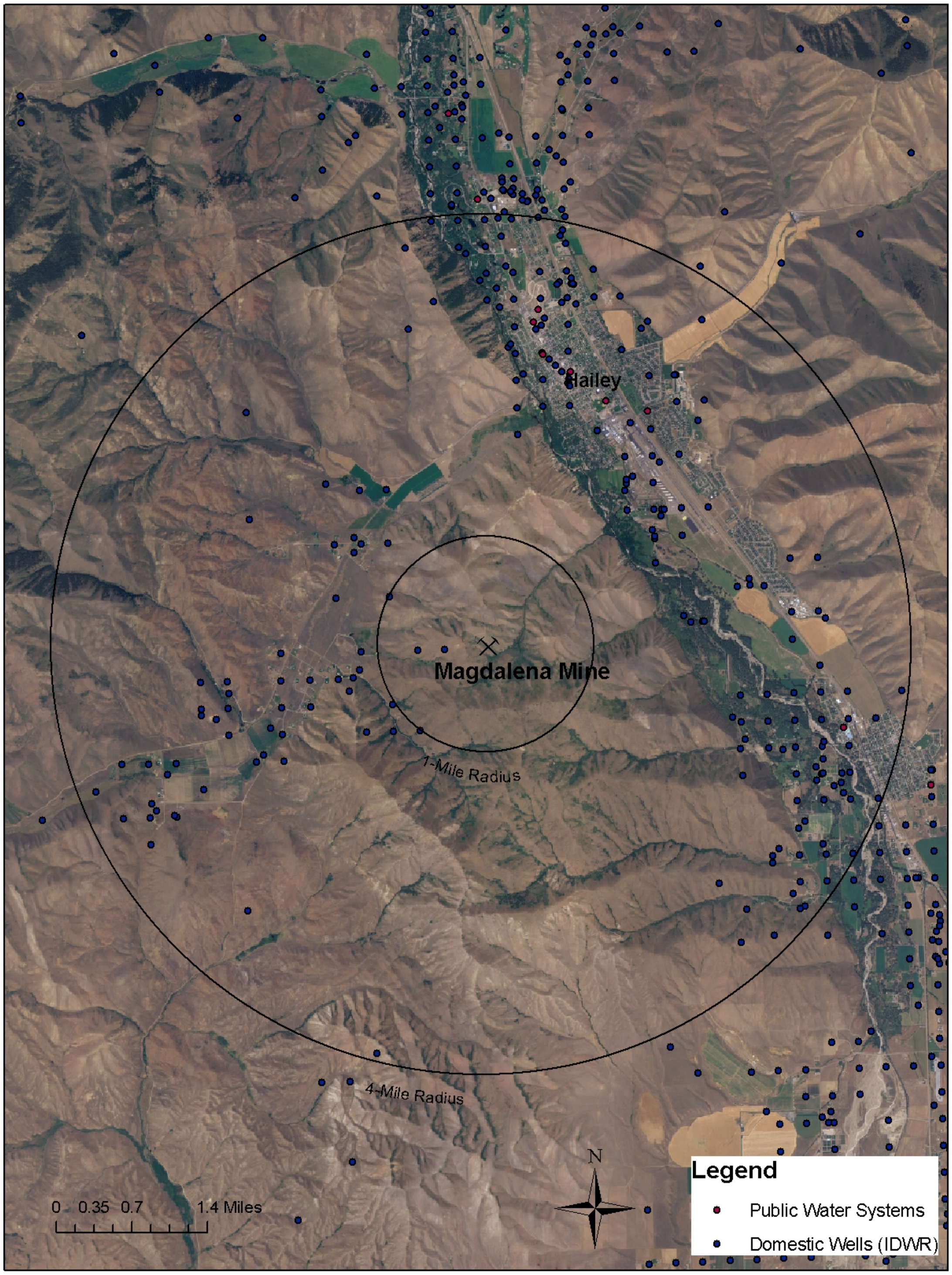

Figure 7. Domestic wells and Public Water System wells located with a 4-mile radius of the Magdalena Mine.

5.2 Surface Water

The Magdalena Mine area drains eastward towards the south flowing Big Wood River. Overland flow across or in the vicinity of the waste piles would flow directly into Colorado Creek. Colorado Creek is not currently listed on the EPA §303(d) list of impaired streams, but the Big Wood River is currently listed for flow alteration, nutrients, and siltation.

Colorado Creek, a tributary of the Big Wood River, is the most immediate stream the Preliminary Assessment site could potentially impact. The majority of the mining activity in Colorado Gulch occurred on the north side of the drainage.

Flowing water was observed in Colorado Creek adjacent to the lower two waste piles. During the site visit, the flow rate of Colorado Creek was approximately 50 gpm near the site. It is unknown as to how much flow Colorado Creek receives water 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 Colorado Creek, it is expected that fishing does not occur in this tributary. Redband rainbow trout [*Oncorhynchhus 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 Magdalena Mine and are discussed further in the Groundwater Pathway section.

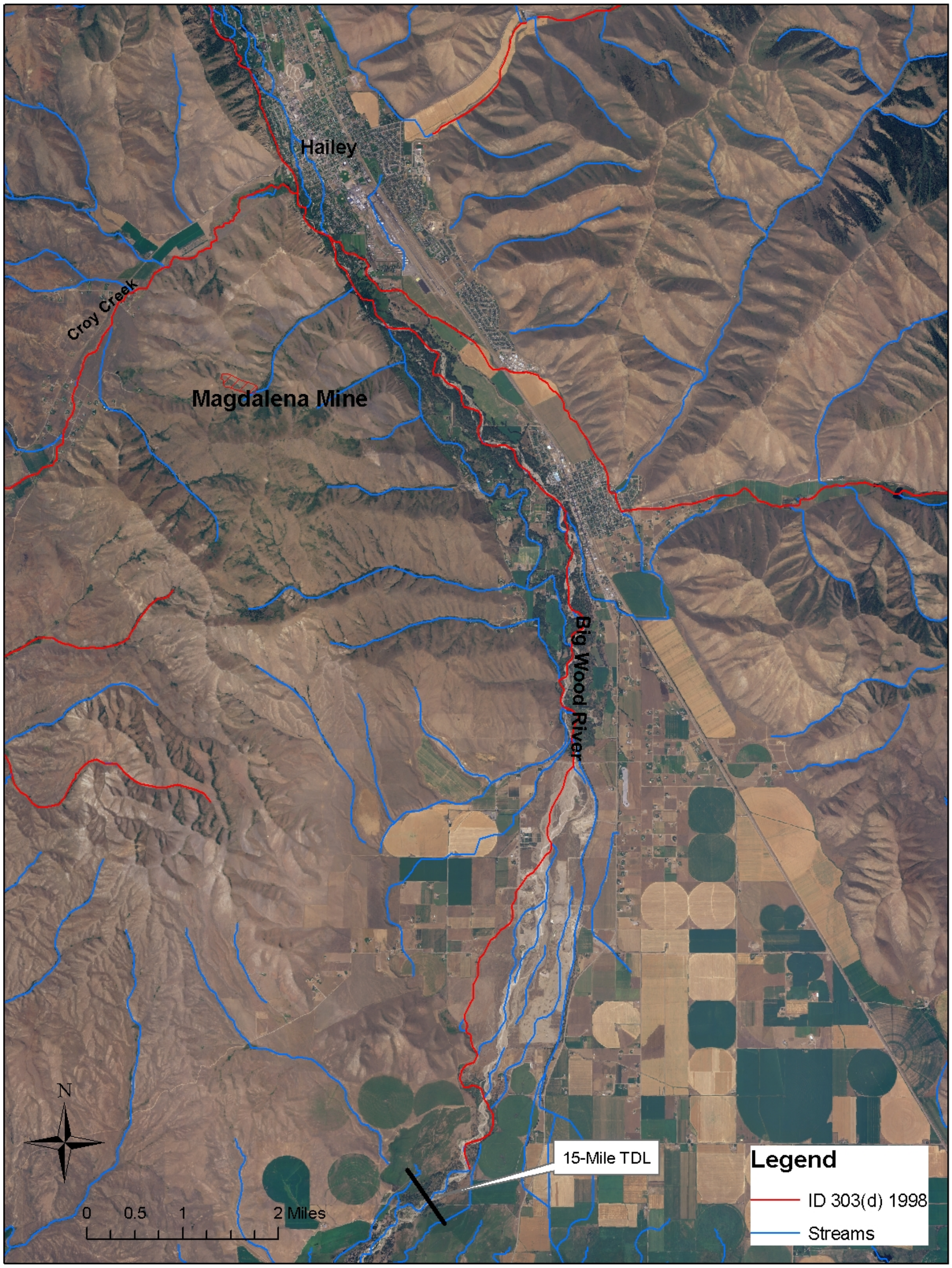

Figure 8. Surface water 15-mile Target Distance Limit from the Preliminary Assessment Site.

5.3 Soil Exposure and Air

Access to the mine site is not restricted or posted. The main access road to Colorado Gulch allows public access to the site. A pedestrian bridge spanning the Big Wood River,

near its confluence with Colorado Creek provides ready access to the Colorado Gulch road and adjacent mining properties. Some signage indicating that private land is present and other signage warning of potential mining activity exists, but only in select locations. All of the private land access points surrounding the mine are generally posted with trespass information.

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 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, however, BLM or Forest Service workers, in addition to the outdoor recreation enthusiasts, may occasionally be within 200 feet of the site.

Soil samples contained total arsenic concentrations at 40,000 mg/kg, barium concentrations at 189 mg/kg, cadmium concentrations at 1.5 mg/kg, chromium concentrations at 52.7 mg/kg, lead concentrations at 132 mg/kg, mercury concentrations at <0.004 mg/kg, selenium concentrations at 6.9 mg/kg, and silver concentrations at 9.1 mg/kg. Analytical results can be seen in Table 1. Because several of the mine working are located at the ridgeline background samples were not collected during this investigation; therefore, 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. However, soil and sediment samples do exceed Idaho's Initial Default Target Levels

5.3.3 Plant Species of Concern

Bugleg goldenweed was the only plant species in the area were 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, Western Toad, and Canadian Lynx (F&G, 2002).

5.3.4 Soil Sample Concentrations

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}.

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.

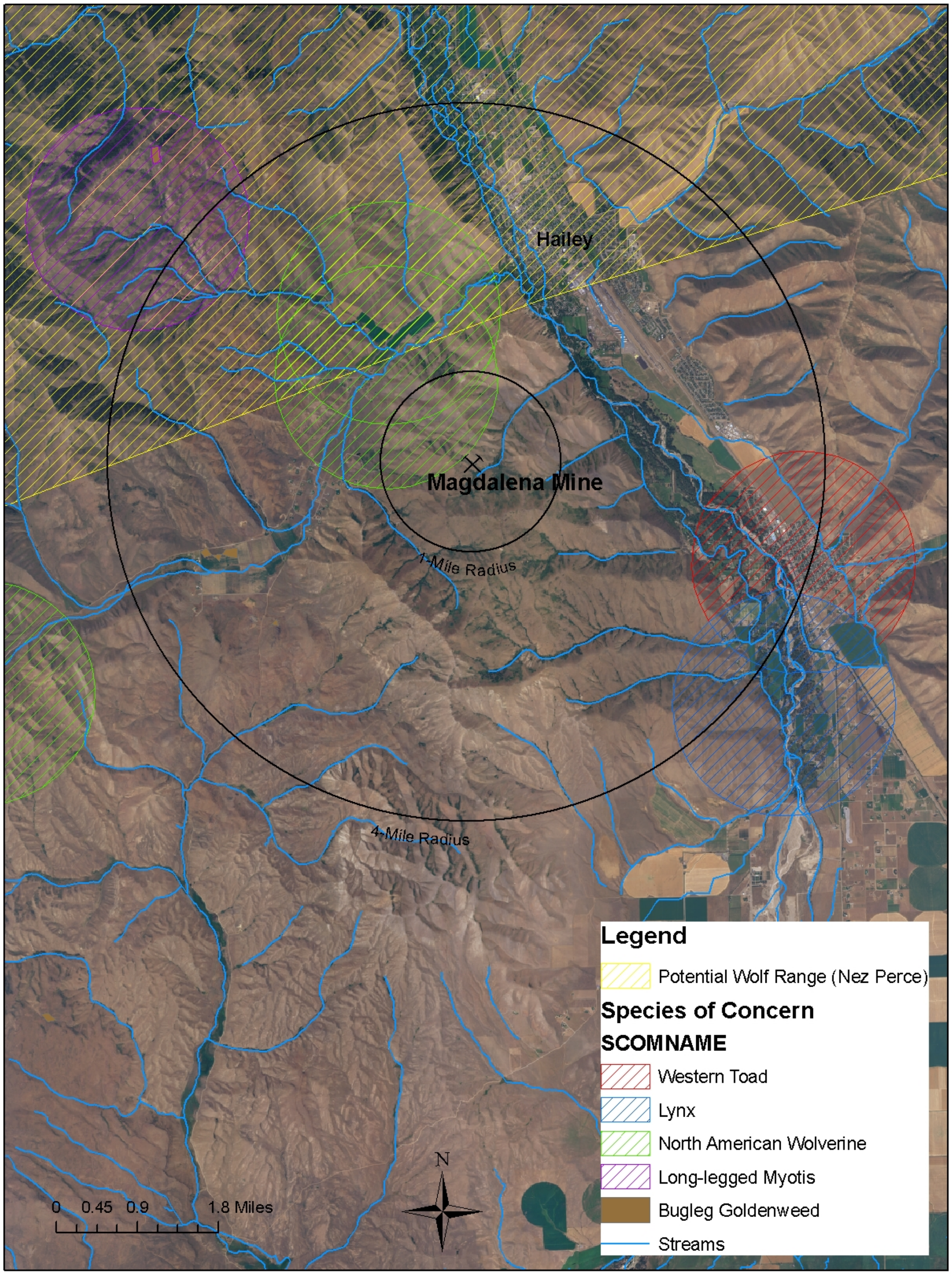

Figure 9. Sensitive species identified in the vicinity of the Preliminary Assessment Site.

Section 6. Summary and Conclusions

The Magdalena Mine probably operated in the late 1800s, when the mining in the district was most active. The mine was reopened and briefly worked from 1985 until 1987, though development and production records were not located.

The mine was chiefly known for its gold values. A gold and silver vein at the Snoose Mine, which lays approximately a half-mile below the Magdalena in Colorado Gulch, was thought to have been an easterly extension of a Croesus mine vein. Perhaps the gold values obtained at the Magdalena were attributable to a similar structure.

Most structures relating to mining activity have fallen, burned, or been covered. Waste rock piles, remnants of historic structures, and the remains of a few collapsed adits can be seen in the area. Adits remain open, and human activity in the area appears to be non-restricted. Soil samples taken from the waste piles at the Magdalena Mine contained elevated concentrations of metals. A water sample collected from the mine drainage showed significant signs of overall water quality degradation.

6.1 Presence of Wetlands

Based on official wetland surveys and aerial photographs of the area, no 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

The surface water sample collected from the adit discharge indicated elevated metal concentrations when compared to the Idaho Water Quality Standards for cold water biota. However, the surface water sample (SGSW) collected in Colorado Creek directly below the confluence of the creek and the adit discharge water show that the water quality within Colorado Creek appears to be within the Idaho Water Quality Standards for cold water biota.

Surface water samples were not collected from the Big Wood River downstream of the confluence with Colorado Creek to determine the impacts (if any) that could occur in the Big Wood River. The receptors of greatest concern are game fish, which 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 cannot be verified due to a lack of analytical data.

6.3 Potential Exposure for Wildlife and Vegetation

Potential exposure of waste rock piles to wildlife and vegetation from the site is present. The high salinity of the acid mine drainage water may entice local wildlife to consume it. 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 high, based on the observations during the site visit. Recent litter surrounding an open adit (Adit #3) suggest this area may be frequently used as an area to host outdoor parties. Mountain bikers and hikers were also witnessed during the site visit. Hunters, snowmobile operators, off-road four wheeling enthusiasts, and various other outdoor recreation enthusiasts may also frequent the area as access is not restricted.

Due to the high metal concentrations in the adit discharge water and surrounding waste piles, exposure for humans to the elevated metal concentrations is high. Fugitive dust, direct contact with the adit discharge water, and direct contact with the waste piles elevate the potential risks to humans and their pets at this site. In addition, open adits are accessible to the public and are considered a significant hazard.

6.5 Recommendations

Overall, the soil and sediment 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 easily accessible to human activity. Therefore, with respect to the elevated metal concentrations in the soil and water collected, additional work is warranted.

Accordingly, Option 2 from Section 8.4 of the Idaho Risk Evaluation Manual is recommended: performing a more detailed, site-specific evaluation. This evaluation would include additional site-specific sampling, including the collection of background samples to determine the impact mining activity has had on the area.

Water quality within Colorado Creek appears to be within the criteria for the Idaho Water Quality Standards for cold water biota. Assuming no additional impacts related to this mine site exist below the PPE sample location, no additional work is warranted based on the water quality data presented.

The existing open adits and high metal concentrations measured in soil and water that are easily accessible to humans may be a trigger for remedial actions at this site. As a result, it may be important to further discuss these issues with the BLM.

References

Bureau of Land Management, 2006, *Land Patent Details* – BLM GLO Records. http://www.glorecords.blm.gov/PatentSearch/Detail.asp?Accession=IDIDAA+046037&Index=1&QryID=41620.75&DetailTab=1

Idaho Department of Water Resources (IDWR), 2006. http://www.idwr.idaho.gov/water/well/search.htm

Anderson, A.L., Kiislgaard, T.H., and Fryklund, V.C., Jr., 1950, *Detailed geology of certain areas in the Mineral Hill and Warms Springs mining districts, Blaine County, Idaho;* Idaho Bureau of Mines and Geology, Pamphlet No. 90, 37 p.

Blaine County, 2006, Blaine County Treasurer-Tax Collections, Hailey, Idaho

Bureau of Land Management, 2006, *Land Patent Details* – BLM GLO Records. http://www.glorecords.blm.gov/PatentSearch/Detail.asp?Accession=IDIDAA+046037&Index=1&QryID=41620.75&DetailTab=1

Environmental Protection Agency (EPA), 2002. Preliminary Remediation Goals. http://www.epa.gov/region9/waste/sfund/prg/index.htm

Idaho Department of Fish and Game (IDF&G), 2002. http://www2.state.id.us/fishgame/info/cdc/plants/vasc_plants&status_n-r.htm

Idaho Department of Fish and Game (IDF&G), 2000. Redband Trout Distribution.

Idaho Department of Environmental Quality (DEQ), 2006. Safe Drinking Water Information System (SDWIS).

Idaho Department of Environmental Quality (DEQ), 2000. 1998 303(d) list.

Idaho Department of Water Resources (IDWR), 1997. COVERAGE IDOWN -- Idaho Surface Ownership.

IDWR[2], 2002. GIS shapefile of well database.

Kiislgaard, T.H., Lewis, R.S., and Bennett, E.H., 2001, *Plutonic and Hypabyssal Rocks of the Hailey 1ºx2º Quadrangle, Idaho*, USGS Bulletin 2064-U, 18 p.

Link, P.K. and Worl, R.G., 2001, *Geology and Mineral Deposits of the Minnie Moore and Bullion Mineralized Areas, Blaine County, Idaho*, USGS Bulletin 2064-Y, 22 p.

Umpleby, J.B., Westgate, L.G., and Ross, C.P., 1930, *Geology and ore deposits of the Wood River region, Idaho, with a description of the Minnie Moore and nearby mines by Hewett,* USGS Bulletin 814, 250 p.

United States Geological Survey (USGS), 1991. Digital map file of major land uses in the United States.

Western Regional Climate Center (WRCC), 2006. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?idhail

Worl, R.G. and Lewis, R.S., 2001, Vein Deposits Hosted By Plutonic Rocks in the Croesus Stock and Hailey Gold Belt Mineralized Areas, Blaine County, Idaho, USGS Bulletin 2064-X, 19 p.

This page intentionally left blank for correct double-sided printing.

Report Index